ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

SUMMARY REPORT

CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

MAY 2023

PROJECT DESIGNATION: CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

PROMOTING ENTITY: Angola Roads Institute – Ministry of Public Works, Urbanism and Housing

EXECUTING ENTITY: QG Konstruktion GmbH

CONSULTANT ENTITY: RESURB Ambiente, Lda.

(Company registered with the Ministry of Environment, as an Environmental Consultant, with Certificate No. 20816908221, valid until 08/09/2023)

Luanda, May 25, 2023

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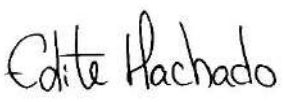
	
Edite Machado (Technical Coordination - RESURB)	Patrícia de Castro Gonçalves (Manager) Resurb Ambiente, Lda.

INDEX

ANNEXES

Annex I – Certificate of the consulting company – Resurb Ambiente Lda.;

Annex II – Stakeholder Engagement Plan;

Annex III – List of Equipment that will be used in the Construction Phase of the Project;

Annex IV – OP 02 Coexistence Rules_EN_Rev03;

Annex V - Environmental Monitoring Sheets – Water Resources;

Annex VI - Environmental Monitoring Sheets - Traffic Count;

Annex VII - Environmental Monitoring Sheets – Environmental Noise;

Annex VIII - Results of Environmental Monitoring - Characterization of the Environmental Noise;

Annex IX – Environmental Monitoring Sheets – Air Quality;

Annex X – Environmental Monitoring Sheets – Soils;

Annex XI – List of potential flora and fauna species in the Project's area of influence;

Annex XII – Photographic record of flora species identified in the Project's area of influence;

Annex XIII - Environmental and Social Impact Assessment Matrix;

Annex XIV - Record of the presence of the people auscultated in the scope of the Public Consultation process;

Annex XV - Brochure prepared for the presentation of the project in the scope of the process of auscultation, participation and public consultation of the project.

Anexo XVI - Project Management Policies;

Annex XVII - Approach to Ecosystem Services;

Annex XVIII – Register of existing aqueducts;

Annex XIX – Quarry Tests.

INDEX OF TABLES

INDEX OF FIGURES

EXECUTIVE SUMMARY

Resurb
Ambiente, Lda

H. Jackson Brown Jr.

The best preparation for tomorrow is doing your best today.

EXECUTIVE SUMMARY

The implementation of projects, regardless of their size, characteristics and duration, are liable to introduce changes in the environment in which they operate, causing impacts at different scales and in different directions.

In Nature, environmental changes occur daily, however, their repercussion depends on the regenerative capacity of the ecosystem where the impacts are registered. However, when referring to anthropogenic changes, the receiving environments do not always have the desired adaptability and regeneration capacity, thus giving rise to environmental impacts. The ecosystem's response capacity will be very dependent on the type of impacts, duration, nature and characteristics of the surroundings. It is, therefore, of paramount importance to ensure a correct assessment of the environmental and social impacts, in their biophysical and socioeconomic aspects, identifying for each of the phases of the project, throughout its life cycle, which includes the construction phase, operation and deactivation, the most relevant impacts and which will assume greater weight in the evaluation of the project itself.

In order to regulate issues related to environmental and social impacts, in particular their prevention and mitigation, the process of Environmental and Social Impact Assessment arises, which aims to provide an effective response to these aspects, with the aim of assessing the project comprehensively and globally, complying with applicable national legislation and also with international requirements, namely the Equator Principles and International Finance Corporation (IFC) Performance Standards once the Republic of Angola is a Non-Designated country.

This study focuses on the environmental and social impact assessment of the Rehabilitation Project for the EC192/EN250/EC254/EC385 Luau - Cazombo road. The project intends to comply with International Conventions and Good Practices, namely, the Human Rights Convention, the Convention of International Labor Organization (ILO), Environmental, Health and Safety Guidelines (EHS Guidelines) and Measures defined in the National Strategy for Adaptation to Climate change.

In view of the absence of publicly available analytical results for the region of interest for this ESIA, various monitoring activities were carried out in order to characterize some environmental descriptors, namely water quality, environmental noise, including traffic counts and air quality.

The environmental and social impact assessment shows that most of the potential impacts assessed with high magnitude are of a positive nature and refer to the operation/exploration

phase of the project, clearly highlighting the social benefits of the project, namely in terms of improvement in the quality of life, accessibility and road safety and socio-economic dynamism in the Province of Moxico and social inclusion.

The assessment of cumulative impacts allowed verifying that most of the identified impacts were assessed as cumulative, based on the fact that there is a cumulative effect of the impact inherent to the existence of other surrounding activities with a relevant impact on the characterized environmental and social descriptors. The assessment of the environmental and social impact of the zero hypothesis - non-implementation of the project, showed that this hypothesis would not mitigate or nullify some of the socio-environmental impacts identified, since it is based on the ongoing national strategy for the economic and social development of the Republic of Angola, the maintenance and/or aggravation of the identified potential impacts was foreseen.

Within the scope of the project, a Stakeholder Engagement Plan was also drawn up and implemented, which applies to all projects financed by the IFC. Stakeholder consultation is a fundamental part of the environmental and social assessment and project implementation process as it aims to establish a systematic stakeholder engagement strategy that will help the Proponent/Project Team to create and maintain a constructive relationship with stakeholders and, in particular, potentially project-affected parties by allowing their views to be considered in project design and environmental and social performance, as well as promoting and providing means for the effective and inclusive engagement of project-affected parties throughout its lifecycle on issues that could affect them, providing accessible and inclusive means of raising issues and grievances, including vulnerable and/or marginalized groups. The public consultations carried out, in the Project Preparation Phase, demonstrated some expectations of the stakeholders in relation to the implementation of the project, with emphasis on employability, rehabilitation of accessibility, socio-economic dynamism and improvement of living conditions, confirmed during the public consultation process the unanimity on the importance of implementing the project.

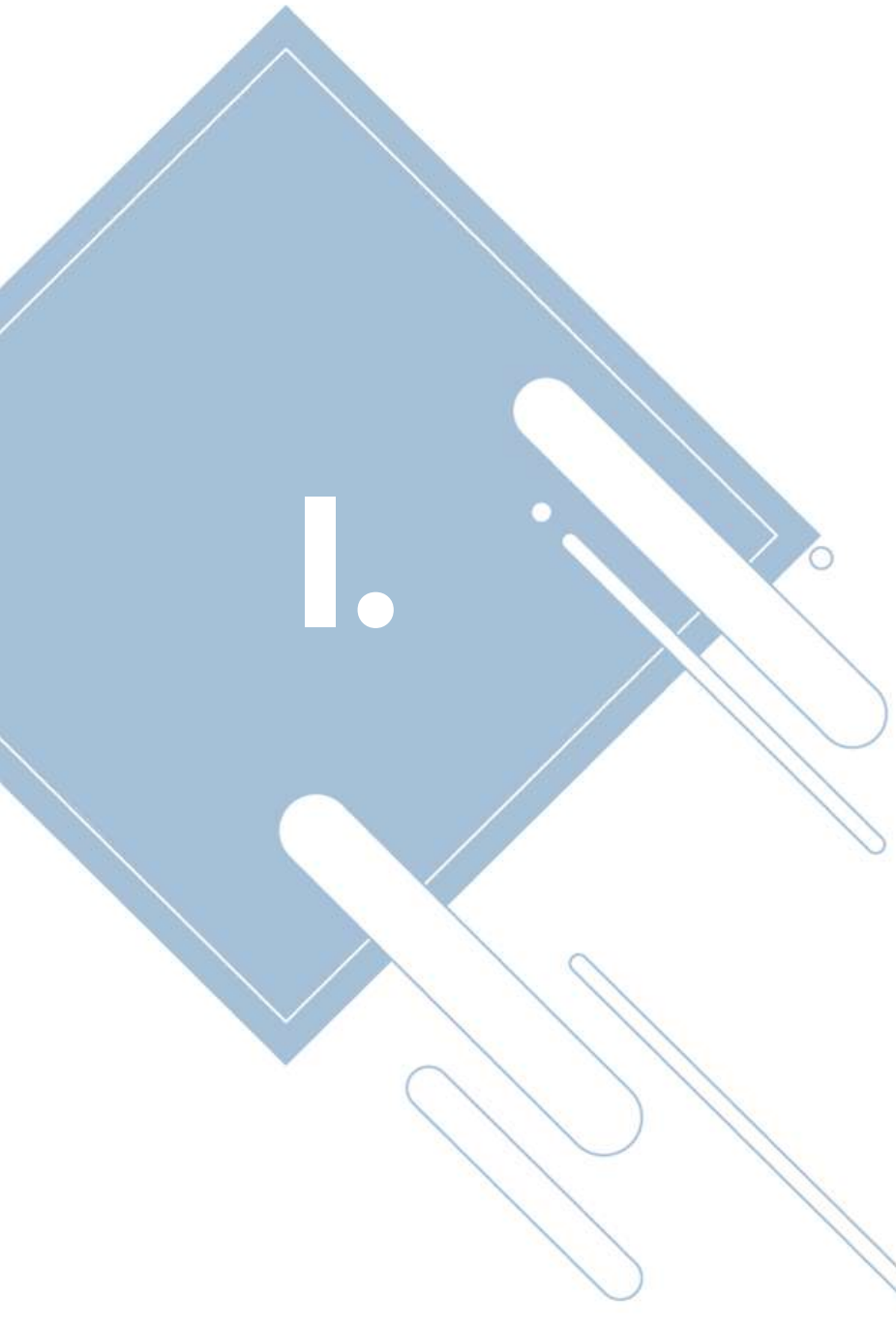
Following the activities carried out within the scope of this ESIA, no fatal issues were identified, that is, aspects that could make the implementation of the rehabilitation project of the road section between Luau-Cazombo-Lumbala Caquengue unfeasible. The analyzes that followed were aimed at defining measures to mitigate the identified impacts and the Environmental and Social Management Plan for project activities. Following the prediction of the main socio-environmental impacts that may arise from the recommended project actions, both in the

construction/deactivation phase and in the exploration phase, it is considered that the most important aspects and impacts are related to socio-economic aspects.

In the risk assessment process carried out, several socio-environmental risks identified for the project were identified, these are generally associated with emergency scenarios, accidents (human and/or technical failure), lack of registration of "interferences" from other public networks, lack of preventive and corrective maintenance of equipment and infrastructure, for which mitigating measures and programs provided for in the Environmental and Social Management Plan were defined.

In the Environmental and Social Management Plan and its Mitigation, Compensation and Socio-environmental Improvement other Programs were defined, in addition, namely, Stakeholder Engagement Plan, Health and Safety Plan, Water Monitoring Plan for Human Consumption, Waste Water Monitoring Plan, Soil Monitoring Plan, Air Quality Monitoring Plan, Environmental Noise Monitoring Plan, Occupational Noise Monitoring Plan, Waste Management Plan, Decommissioning Plan for Jobsites, Support Centers and Biophysical Recovery of Affected Areas by the Contract, with a view to ensuring continuous improvement in operational and environmental performance and social aspects of project implementation throughout its life cycle.

The environmental and social impact assessment carried out considers that the project has a favorable opinion for its implementation, considering the implementation of all mitigation and compensation measures for the defined environmental and social impacts.



I.

INTRODUCTION

Resurb
Ambiente, Lda

Aristoteles

In all things of nature there is something of the marvelous.

1. INTRODUCTION

1.1. Historical Context of Environmental and Social Impact Assessment

The constant change at a global level in the balances of the planet, with results such as the increase in the so-called “greenhouse effect”, the loss of biodiversity, soil erosion, the depletion of natural resources and the change in the view of the Earth as a living being, has increasingly given a planetary dimension to environmental issues. The interrelationship between these environmental problems makes their resolution increasingly complex, a situation denounced as early as 1972 at the Stockholm Conference, the First World Conference on Man and the Environment.

The experience accumulated in recent years, both internationally and nationally, has produced a new global awareness of the environmental implications of human development, translated into greater accountability of society as a whole, in the face of these implications. In fact, the relationship between environmental issues and the impacts on human societies has led to an interpretation of this binomial based on the services provided by ecosystems. In other words, what services ecosystems provide, where some stand out such as food, shelter, natural resources, aesthetic value, etc., and how the use of these resources is reflected in the environmental balance/imbalance.

Society began to organize itself and to demand that more effective efforts be made by world leaders to change the framework of gloomy forecasts that have been drawing and slowly a new sustainable model of development begins to be common, where it is necessary the execution of public and private actions and policies, investments in scientific and technological research, as well as the adoption of new technological methodologies taking into account the preservation of the environment with a view to ensuring the longevity of the Man-Nature relationship.

In this sense, in environmental terms, in recent years companies have been trying to comply with and implement the procedures and regulations required by legislation. From the outset, they play a relevant role in the entire process by carrying out Environmental Audits and preparing Environmental Impact Studies. The adoption of these procedures is a fundamental step towards the integration of the various components of Environmental Management, with a view to sustainable development.

1.2. Composition of the Environmental and Social Impact Assessment

The Environmental and Social Impact Assessment is divided into the Environmental and Social Impact Assessment Report (hereinafter referred to as the Synthesis Report (SR)) and the Non-Technical Summary (NTS)).

The **Synthesis Report (SR)**, of which this document forms part, includes an integrated analysis of the various components evaluated, summarizing all the relevant information to support decision-making by Organs competent bodies. This document is prepared using technical and scientific language.

The **Non-Technical Summary (NTS)** has the function of summarizing the contents of the Synthesis Report (SR), in non-technical language, thus facilitating consultation and understanding, by different stakeholders and the general public, of the main characteristics of the project as well as the main conclusions obtained. According to point 2 of article 16 of Decree no. 117/20, "*the public consultation begins with the prior disclosure of a non-technical summary of the Environmental Impact Study, which contains the most important effects that the project can generate the environment, namely the use of natural resources, the emission of pollutants, the creation of disturbances such as light intensity, temperature, noise and smells or the disposal of waste, identifying preventive methods to assess and reduce the effects on the environment, as well as the impacts of the project on the socio-economic environment*".

According to the Basic Environmental Law, the preparation of the Environmental and Social Impact Assessment (ESIA) makes a synthesis of the various technical studies developed for the various aspects, and the ESIA must present the following minimum content:

- Description of the project;
- The Environmental and Social Impact Assessment Report;
- All technological alternatives and project location, confronting them with the hypothesis of non-execution;
- Identification and assessment of Environmental and Social Impacts generated at all stages of the project throughout its life cycle;
- Definition of the limits of the geographic area to be directly or indirectly affected by the impacts, called the project's area of influence, considering, in all cases, the populations, other living beings and the hydrographic basin where it is located;
- Consideration of governmental plans and programs, proposed and being implemented in the project's area of influence and their compatibility;

- Other elements that, due to the compatibilities and characteristics of the project, are considered relevant.

1.3. Structure of the Environmental and Social Impact Assessment

The Environmental and Social Impact Assessment consists of two volumes. This document corresponds to **Volume I of the Synthesis Report/Technical Report** and includes 17 Chapters, the generic contents of which are described below.

The **EXECUTIVE SUMMARY** presents an overview of the project where the main information of the project is indicated.

In **CHAPTER 1 – INTRODUCTION:** which corresponds to this Chapter, the content of the study is briefly presented. The objectives of the project are also identified and its justification, its location, the phases of the project considered in the ESIA are presented, indicating the Proponent, the licensing entity and those responsible for the elaboration of the ESIA. The scope of the ESIA and the period for its elaboration were also mentioned.

CHAPTER 2 – NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK, INTERNATIONAL REQUIREMENTS AND CONVENTIONS: the legislative framework of the project is made in the national EIA regime and in accordance with the applicable international requirements and conventions in view of the sector of activities and Management Policy adopted by the project. In this Chapter, an analysis of the applicability of the performance standards of the IFC, Equator Principles is also carried out and a gap analysis between international requirements and national legislation is presented.

CHAPTER 3 – GENERAL METHODOLOGY: presents the methodology adopted for assessing the risks and environmental and social impacts of the project and the methodology for identifying, involving, participating and consulting the stakeholders.

In **CHAPTER 4 – ALTERNATIVES CONSIDERED IN THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT:** the alternatives considered for the present project are presented.

In **CHAPTER 5 – CHARACTERIZATION OF THE PROJECT:** the main technical characteristics relating to the project in question are presented. The antecedents of the ESIA and the project and the associated or complementary projects were also mentioned, the socio-environmental information of the project and the indication of the main project management policies were also identified. At the same time, the different areas of influence of the project were defined.

In **CHAPTER 6 – CHARACTERIZATION OF THE REFERENCE SITUATION:** the environmental situation of the area under study is described before the implementation of the project,

analyzing the environmental components most likely to be affected and/or disturbed by its construction, exploration and deactivation. This chapter also describes a predictable scenario for the evolution of the current situation in the absence of the project, that is, the "zero alternative".

In **CHAPTER 7 – RISK ANALYSIS:** potential risks resulting from any accidents that may occur during the different phases of the project are identified.

CHAPTER 8 – IDENTIFICATION AND ASSESSMENT OF IMPACTS: identifies and assesses the main negative and positive impacts resulting from the project's construction, exploration and deactivation phases, as well as the cumulative impacts.

CHAPTER 9 – COMPILATION OF IMPACTS: presents the compilation of impacts identified in the previous chapter, for the three phases of the project (construction, exploration and deactivation).

In **CHAPTER 10 – ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS:** the Environmental and Social Management Plan to be implemented within the scope of the ESIA is presented, where the fundamental monitoring plans are defined for the execution of adequate environmental management in all phases of the project. At the same time, a set of measures is identified to minimize negative impacts. Compensation measures were also identified in cases where the occurrence of an impact is inevitable.

In **CHAPTER 11 – PARTICIPATION AND PUBLIC CONSULTATION:** the main conclusions of the auscultation and public consultation process carried out within the scope of the project are presented.

CHAPTER 12 – COMPLAINTS AND GRIEVANCES MANAGEMENT: presents the project's Complaints and Grievances Management Procedure, which is open to all stakeholders.

In **CHAPTER 13 – INFORMATION GAPS:** the main information gaps that emerged during the ESIA are identified.

In **CHAPTER 14 – CONCLUSIONS:** the main aspects of the project and the place where it operates are summarized, as well as the main impacts and conclusions of the study carried out.

In **CHAPTER 15 – GLOSSARY:** some important expressions for the study in question are defined.

In **CHAPTER 16 – BIBLIOGRAPHICAL REFERENCES:** the documentation consulted and which served as a reference for the preparation of the ESIA is indicated.

At the end, in **CHAPTER 17**, the **ANNEXES** are presented, which include some technical elements that support the analysis of the various environmental and social factors.

These chapters ensure a complete analysis of all relevant descriptors, the further analysis of which was based on the scope discussion (*see* **Chapter 1.7**).

All the information integrated in the ESIA is accompanied by figures, photographs and diagrams, which allow a better understanding of the matters under analysis.

Volume II of the ESIA corresponds to the Non-Technical Summary of the Project.

1.4. Project Identification

1.4.1. Location of the Project

The project for the Rehabilitation of the Section of the Road between Luau-Cazombo-Lumbala Caquengue will be developed in the Province of Moxico, interconnecting, among others, the cities of Luau, Cazombo and Lumbala Caquengue for a total of around 246 km, as can be seen check in the following figure (*see* **Figure 1**).

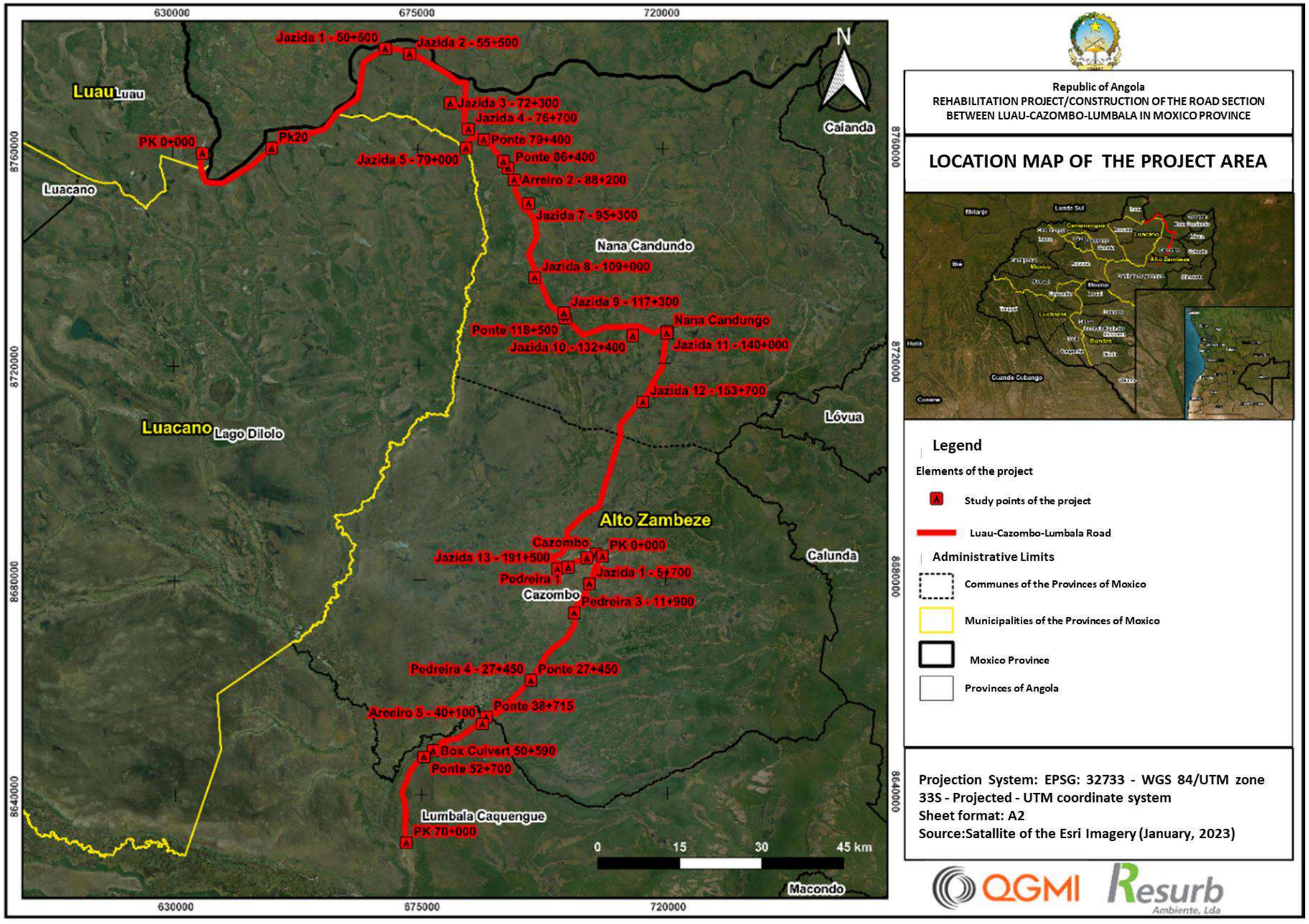


Figure 1 - Geographical location of the Road Section Rehabilitation project between Luau-Cazombo-Lumbala.

The following figure (*see* **Figure 2**) presents a schematic representation of the intervention area and respective infrastructures to be rehabilitated/built within the scope of the project.

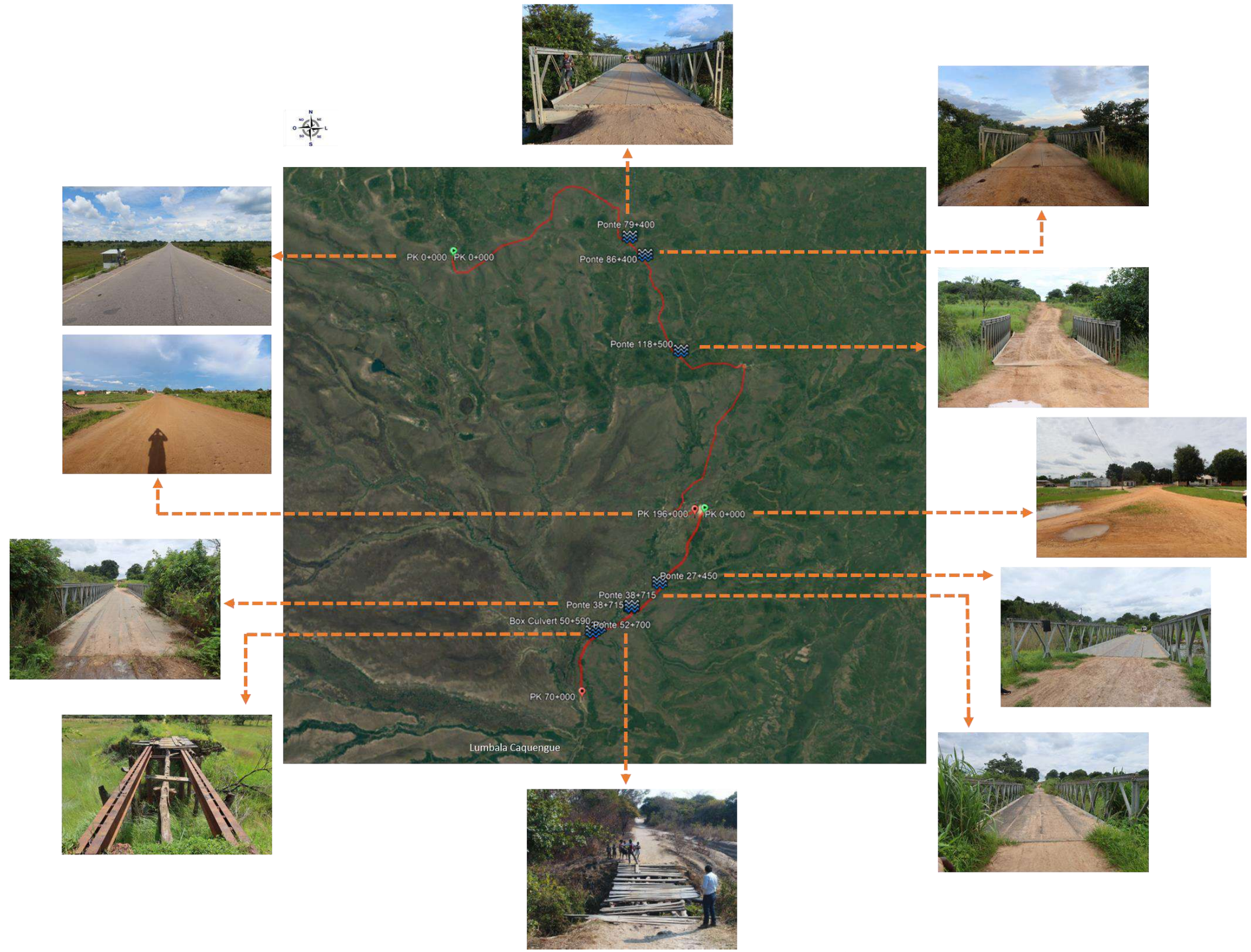


Figure 2 – Schematic representation of the intervention area and respective infrastructures to be rehabilitated/built within the scope of the project.

1.4.2. Project Objectives and Justification

In Angola, local transport infrastructure, namely secondary roads, lanes and bridges that provide access to farms, markets, wells/holes/sources, schools and health posts, are in an advanced state of degradation, and in some cases impassable for most of the year (*in* Long-Term Development Strategy for Angola - 2025).

The objective of this project is the Rehabilitation of the section of the road between Luau-Cazombo-Lumbala Caquengue. The section in question is approximately 246 kilometers long.

The current situation of this section brings risk and insecurity for users, in addition to incurring financial and social losses, as it impairs movement between Communes, access to health infrastructure, access to educational institutions and the transport of loads, between others.

It should be noted that the lack of conservation and continuous maintenance of the roads, the increase in the volume of traffic and the deficiency of inspection are the main factors that are at the origin of the degradation of the roads. The World Bank, in the report issued in 2019, highlights the lack of quality of the roads and the discrepancy between costs and execution. The report also mentions, as an example, that between 2008 and 2017 the Government of Angola spent more than US$20 billion on roads, at a cost of US$2.52 million per kilometer paved, with only two lanes. However, in the same period, only an annual average of 28 million dollars was devoted to road maintenance. Indeed, in the list of global competitiveness, in 2019, Angola was among the last ten countries in terms of road network quality, in position 136 out of 141 countries (World Bank, 2019).

In view of the above, it is essential to carry out the rehabilitation of the section of the road in question in order to mitigate all the problems that affect the road and its surroundings, thus providing dignified conditions for the users who use it. It should be noted that the pavement of the section in question has several deformations and is quite deteriorated, due to the lack of maintenance, and within the scope of this project, it will have to be rebuilt almost in its entirety.

In this sense, the rehabilitation of the section will allow the development of regional potential, the reduction of the overall cost and time of transport, the increase in traffic safety, the satisfaction of international traffic (between Moxico Province and the Democratic Republic of Congo), the reduction in the need for maintenance of the vehicles that use the road and the dynamization of economic activities, thus improving the quality of life of the populations that use this stretch of road.

1.5. Identification of the Proponent

The promoting entity of the project is the Angola Roads Institute of the Ministry of Public Works, Urbanism and Housing (MINOPUH) of the Republic of Angola. The executing entity is QG Konstruktion GmbH.

The table below (*see* **Table 1**) presents the relevant data of the entities involved in the elaboration of the ESIA, as well as the main information related to the project.

Table 1 – Identification of entities involved in the project

Identification of the Promoting Entity	
Entity	Roads Institute of Angola – Ministry of Public Works, Urbanism and Housing
Full address	Via AL,Edifício Transbrás, 4º,5º e 6º andares, Talatona.
Contact Person (s)	Eng. Fernando Manuel
E-mail (s)	fmanuel.inea@gmail.com
Identification of the Executing Entity	
Social denomination	QG Konstruktion, GmbH - Sucursal Angola
Complete address(es)	Rua Comandante Gika 261 D-B Sala 1, Alvalade
Share Capital	AKZ 200.000,00
NIF	5417683477
Contact Person (s)	Bruno Morais
Contact (s)	937405560
E-mail (s)	bruno.morais@qgmic.com
Identification of the Consulting Entity	
Social denomination	Resurb Ambiente, Lda.
Complete address(es)	Avenida Ho Chi Min, Edifício S. Paulo, Loja C Luanda, Angola
Contact Person (s)	Patrícia de Castro Gonçalves
Contact (s)	+244 943 151 492
E-mail (s)	patricia.goncalves@monte.pt
Registration of Environmental Consultant of the company RESURB in the Ministry of Environment	Registration with the Ministry of Environment as an Environmental Consulting company, valid until 08/09/2023
Project data	
Project Name	Contract for the Rehabilitation of the EC 192 / EN 250 / EC 254 / EC 385 Road, Luau / Cazombo
Investment Value	USD 276.091.402,01
Project Location	Between Luau, Cazombo and Lumbala Caquengue in Moxico Province
Geographic Coordinates	PK 0+000 PK 70+000 11°13'6.65"S 12°22'42.07"S 22°14'26.39"E 22°35'1.30"E
Number of Estimated Employees for the Project	500

1.6. Identification of the Team Responsible for Preparating the ESIA

The preparation of the Environmental and Social Impact Assessment (ESIA) involved a multidisciplinary team. The project proponent subcontracted the services of Resurb Ambiente, Lda., which is an Angolan company based in Huambo and with more than 15 years of experience

in consulting in Angola. Resurb is duly registered as an Environmental Consultant at the Ministry of the Environment of the Republic of Angola (*see* **Annex I**), valid until September 08, 2023.

Next, the team assigned to the project and responsible for the technical visits to characterize the Baseline Situation, consultation inquiries and consultation with stakeholders, implementation of the Stakeholder Involvement Plan, socio-environmental monitoring, risk analysis , environmental and social impact assessment, Environmental and Social Management Plan and respective measures to minimize negative environmental impacts and enhance positive environmental impacts, data processing and preparation of documents (*see* **Table 2**).

Table 2 - Team responsible for elaborating the ESIA

Coordination of the Environmental and Social Impact Assessment			**Signature**
Coordenação Geral			
Patrícia C. Gonçalves			
Technical Team Coordination			
Edite Machado			
Technical Team			
Name	**Formation**	**Name**	**Formation**
Filipe Cambão	Environmental Engineer	Air Quality, Noise, Waste and Effluents	
Francisca Brás	Mining and Geo-Environment Engineer	Geology, Geomorphology and Soils	
Vanuza Diogo	Environmental Engineer	Waste/Effluents, Air Quality	
Edite Machado	Environmental Engineer	Air Quality, Noise, Water Resources, Waste and Effluents	
Carlos Oliveira	Environmental Engineer	Geographic Information Systems	
Elisabeth Caplango	Higher Education in Executive Secretariat and Business Communication	Socioeconomics/ Occupational Dynamics	

Luís Castro	Archeology	Cultural Heritage and Socio-Economy	
Noé Bento	Hygiene, Safety and Health at Work Technician	Safety and Health at Work, Environmental Noise	
Fernando Oliveira	Degree in Sociology and Post Graduate in Human Resource Management	Sociology/Occupational Dynamics	
António Messias	Master in Mineral Resources and Environment	Spatial Planning/Cultural Heritage/ Geology/Hydrogeology/ Hydrography/Soils/ Sediments	
Edite Rodrigues	Eng.º do Ambiente	Resíduos e Efluentes, Qualidade do ar, Ruído	

Technical team for field data collection
Noé Bento – Hygiene, Safety and Health at Work Technician
Pedro Faustino – Field assistant
António Messias - Master in Mineral Resources and Environment
Vanuza Diogo – Senior Environmental Technician
José Tito Morais - Master in Mineral Resources and Environment
Timótio Júlio – Field assistant
Carlos de Almeida – Field assistant
Penohamba Matias - Biologist
Francisco Carlos – Senior Social Services Technician

As can be seen from the previous table, it is a multidisciplinary team in environmental sciences, having in its curriculum the elaboration of several Environmental and Social Impact Studies, with knowledge and experience in the Angolan and international context.

1.7. Scope of the Environmental and Social Impact Assessment

This Environmental and Social Impact Assessment (ESIA) concerns the project for the "Contract for the Rehabilitation of Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo".

Taking into account the type of project in question and the general characteristics of its implantation area, the following scope was considered for the Environmental and Social Impact Assessment for the various environmental and social descriptors/factors:

- **Climate and climate change** - Environmental factor of reduced to moderate significance based on the fact that, to date, together with the energy sector, the transport sector is primarily responsible for GHG emissions, and it is expected that for the exploration phase of the project an increase in emissions, largely influenced by

road traffic that is expected to increase inherent to the construction and rehabilitation of the road that will connect Luau-Cazombo-Lumbala Caquengue. This factor is more supportive of other environmental factors analyzed, such as Air Quality. It should be noted that the Angolan Government ratified the Paris Agreement on climate, within the scope of the United Nations Framework Convention on Climate Change, on November 16, 2020, so the Project must adopt mitigation measures for the emission of GHG in order to also meet this commitment. In order to face the problem of climate change, the adaptation component must also be considered. While mitigation is the process that aims to reduce GHG emissions into the atmosphere, adaptation is the process that seeks to minimize the negative effects of the impacts of climate change on biophysical and socioeconomic systems. Due to its location and characteristics, it is considered that the main climate vulnerabilities could be linked to the increase in air temperature and the occurrence of heat waves resulting from GHG emissions. In this ESIA these aspects are considered/analyzed from the perspective of risks induced by climate change in **Chapter 7 – Risk Analysis**;

- **Geology and Geomorphology** - Factor of reduced significance, taking into account the local characteristics of the project's implantation site, since there are no tectogenic deposits that are assumed to be relevant for the various phases of the project;
- **Surface Water Resources** – Factor of reduced to moderate significance taking into account the type of project, since within the scope of this several deteriorated bridges will be rehabilitated and built between the Luau, Cazombo and Lumbala Caquengue road section, whose planned construction activities may, in accident situation affect water quality;
- **Underground Water Resources** - The implementation of the project will not be relevant in terms of affecting the productivity of the aquifers it crosses (Unconsolidated Aquifers, Sedimentary Aquifers with intergranular pores and Base Rocky Substrate Aquifers) for what is considered to be an environmental factor of reduced significance;
- **Environmental Noise** - This environmental factor must be considered as of reduced to moderate significance, taking into account the planned construction activities and areas of intervention of the project. It is expected that discomfort during the construction activities are mainly inherent to the functioning of the equipment/machines used during the excavation, landfill and paving activities for the

rehabilitation of the road section and the circulation of vehicles (light and heavy). It should be noted that during the construction phase of the project, workers will use, whenever necessary, hearing protectors to mitigate the impact of noisy activities on workers' health. At the same time, construction activities will be carried out during working hours, non coincident with the time that the population is in their homes, in order to reduce noise nuisance. The noise assessment was carried out based on campaigns to measure noise levels in different sensitive receptors;

- **Effluents and waste** – Considered an environmental factor of minor significance in view of the constructive characteristics of the project and the type of waste produced, mostly non-hazardous and inert. It should be noted that during the construction phase of the project, priority will always be given to the construction and demolition waste (CDW) management hierarchy, which favors reuse on site, and, whenever possible, soil and rocks will be reused on site not containing hazardous substances, as well as in the environmental and landscape recovery of degraded areas and/or areas temporarily occupied during the construction phase (eg jobsite and temporary deposits) using leftover soil and rocks. With regard to solid waste, it will be temporarily stored in duly segregated and identified waste parks until it is collected by a duly licensed waste management operator who will forward it to an appropriate final destination whenever recovery is not possible;
- **Air Quality** – Environmental factor of reduced to moderate significance, because although, in the overall calculation of national atmospheric emissions, the Air Quality factor may be of some significance, it is mostly expressed at local level;
- **Soils** – Environmental factor of moderate significance for the project implementation area, based on the fact that deforestation, earthworks, excavation and circulation of light and heavy vehicles, machinery and equipment necessary for construction activities in the construction phase of the project, that will contribute to the inevitable weakening/disruption of the soil structure, which will contribute to the acceleration of the process of erosion, destructuring, weakening, waterproofing and/or compaction of the surface layers of the soil. The destruction of the soil texture and the modification of the slopes are two important parameters to be taken into account when carrying out construction activities;
- **Land Use and Spatial Planning** – The classification of land occupation appears as an essential tool for the correct planning of the territory, since it indicates which are the

urban, agricultural and natural spaces soils. In this way, it allows carrying out a territorial expansion in harmony with the other uses, as long as it is articulated with the other existing plans. Territorial organization normally aims to create favorable conditions that guarantee the objectives of economic and social development, social well-being, protection of the environment and quality of life for citizens. In this sense, given the characteristics of the project, this factor is considered to be of reduced significance;

- **Ecological Factors** – Considered, from the outset, a relevant factor due to the location of the road section, due to the existence of temporary and permanent water lines with special importance for the avifauna. However, it should be noted that the project is not located in an area with a protection status and/or classified as sensitive or of high ecological interest;
- **Landscape** – Considered a factor of reduced significance on the basis that the landscape will only be affected during the construction phase of the project through the temporary introduction of foreign elements in the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area. At the end of the construction phase of the project, all the infrastructure supporting the work (eg jobsite, temporary deposits, dumps) will be duly dismantled and restored to the initial conditions of the land. Furthermore, the study area is not of particular scenic interest and is not valued by any relevant tourist activity;
- **Socio-economy** – The socio-economy is considered a factor of greater significance for this type of projects, in terms of local and regional socio-economic development through the improvement of the living conditions of the population and the potential dynamization of other sectors of activity inherent to rehabilitation of the road section. The project will also help to avoid the isolation of vulnerable social groups due to the lack of road access, including bridges;
- **Cultural Heritage** - due to the characteristics of the Project's location, this factor appears a priori to be of reduced significance for the land component. However, during the construction phase, visual observation should be ensured in order to inventory any discoveries of archaeological heritage elements that should be preserved.

1.8. Period of Elaboration of the Environmental and Social Impact Assessment

The elaboration of the ESIA took place between the months of December 2022 up until April 2023, including bibliographical research work, visits to the project site to characterize the environmental and social reference situation, carrying out environmental monitoring in the absence of reference information for this purpose, identification of stakeholders and collection of data for the definition of consultation strategies and public consultation, including vulnerable and disadvantaged stakeholders, carrying out surveys of the population covered by the project, carrying out presentation and clarification sessions for the project, collection and processing of data/information for the preparation of the documents that make up this ESIA.

1.9. Project Elaboration Period

The construction phase of the project will be carried out as detailed in **Chapter 5**, with completion of construction activities expected in approximately 4 years (48 months).

The exploration phase will correspond to the operation of the project, which is expected to last a long time and depending on the type of project.

With regard to the deactivation phase of the project, it will correspond to the final stage of its life cycle and will correspond to the moment when the implemented infrastructures cease to fulfill their function and justify their deactivation or intervention taking into account their reconversion and/or adaptation to new requirements, estimating its occurrence in the long term.

1.10. Project Phases Considered in the Environmental and Social Impact Assessment

In this document, the project will be evaluated considering three distinct phases called Construction Phase, Exploration Phase and Deactivation Phase, namely:

i. **Construction phase:** refers to the rehabilitation of the road section whose construction activities have as their main objective the rehabilitation and requalification of the road section in order to allow road traffic in adequate safety conditions. This phase includes the previous activities and the installation of infrastructures to support the contract, with mobilization of machinery, equipment and personnel for the course of construction activities. The construction phase itself corresponds to all the planned rehabilitation activities and will last approximately 48 months;

ii. **Exploitation phase:** refers to the use of the implemented infrastructures and their functioning according to the characteristics assigned to them. The duration of this phase will vary depending on the use made of the created infrastructures, as well as their maintenance and cleaning.

iii. **Deactivation phase:** will correspond to the final phase of the project's life cycle and will coincide with the dismantling/decommissioning or intervention phase, taking into account its reconversion and/or adaptation to new requirements. Its occurrence is estimated in the long term.

II.

NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK, REQUIREMENTS, AND INTERNATIONAL CONVENTIONS

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Ambiente, Lda

Robert G Ingersall

In nature there are neither rewards nor punishments; there are consequences.

2. NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK, REQUIREMENTS AND INTERNATIONAL CONVENTIONS

2.1. Legal and Regulatory Framework for the Road Sector

Transport infrastructure suffered heavy damage during the civil war years, with destruction and neglect leading to the closure of most of the road and rail network. In recent years, the authorities have made large investments in the rehabilitation of roads, railways, seaports and airports. Most of the investments were financed by lines of credit that have helped rebuild and rehabilitate the country's infrastructure. However, it has been verified that a large part is currently degraded, being an obstacle to the development of Angola, preventing the movement of people and people and goods in the country (Eaglestone, 2020). It is in this context that the Government of Angola, represented by the Ministry of Transport, is responsible, among other functions, for promoting road safety through the definition of priorities and implementation of investment programs in structuring road infrastructure networks that allow the circulation them in safe conditions and that contributes to the social inclusion of vulnerable stakeholders, who are isolated due to the non-existence and/or degradation of the current road network.

The institutional framework of the infrastructure sector in Angola comprises the Institute of Roads of Angola (INEA), which is a public institute of the economic sector, endowed with administrative, financial and patrimonial autonomy, which aims to ensure the functions of promotion and coordination the development of road infrastructure corresponding to the national network, as well as its management and, in particular, its conservation and operation. INEA had its organic statute approved by Presidential Decree n.º 320/14 of December 1st. This is subject to the supervision of the Holder of Executive Power, exercised by the Minister of Construction.

INEA is the entity responsible for the management, operation, conservation and development planning of the National Roads Network. Municipal Administrations and Local Authorities are responsible for the management, operation, conservation and planning of the network of municipal roads in their respective jurisdictions, which are not part of the National Road Network. INEA is also responsible for preparing technical information on national, provincial and municipal roads, their classification, origin, route, as well as the extensions of sections and sub-sections with the respective indication on the map of Angola (Presidential Decree n. 20/21 of 22 January, article 12).

It should be noted that the project, in the absence of national regulations for this purpose, will consider good international practices defined for the activity sector and project typology.

2.2. National Legal and Environmental Framework of the Project

In terms of Angolan legislation, the first law that focused on environmental issues was the Basic Environmental Law, Law no 5/98., which defines that in order to maintain an environment conducive to guaranteeing the population's quality of life, it is necessary to guarantee the least environmental impact of the actions necessary for the development of the country through correct territorial planning and the application of appropriate techniques and technologies.

According to article 15, the implementation of infrastructures in the national space, which, due to their size, nature or location, cause a significant negative impact on the natural or social environment, is conditioned to an Environmental and Social Impact Assessment process, in which determine their social, environmental, economic viability and the methods for neutralizing or minimizing their effects.

In view of the provisions of the n. º 1 of Article 4 of the Decree on Environmental Impact (Decree No. 117/20 of April 22, 2020):

"*The licensing of agricultural, forestry, industrial, commercial, housing, tourist or infrastructure processes that, by their nature, size or location, have implications for environmental and social balance and harmony are subject to a prior Impact Assessment process which implies the elaboration of an Environmental Impact Study (EIS) to be submitted for approval by the competent entity responsible for the environmental area*".

Given the typology of the project under analysis, it falls within **Point 15** of **Annex II** of Decree No. 117/20 of April 22, 2020, namely in **Category B Activities**, **point j)** "All main roads of the urban area". Thus, it lacks an Environmental Impact Assessment procedure.

The Environmental and Social Impact Assessment will focus on the various phases of the project: construction, exploration and deactivation. The assessment of the environmental impacts resulting from the different phases of the project will make it possible to assess the strengths and weaknesses, with regard to the execution of the same, with particular relevance in the environmental descriptors Landscape, Spatial Planning, Water Resources, Geology and Soils, Ecological Factors, Environmental Noise, Air Quality, Socioeconomic, whose allocation by the project may have greater impact.

The construction phase will have a relevant impact on the evaluated descriptors, since, despite being of moderate duration (4 years), it refers to a phase of alterations and modifications of the current situation.

The exploration phase will be the one that will last the longest in time, since it refers to the use of the rehabilitated road infrastructure.

The deactivation phase will last for a short time and will start as soon as the project is considered economically/socially and environmentally unviable. Basically, this phase dictates the end of the project's life cycle, being also evaluated in the ESIA phase, as well as the implementation of mitigation and compensation measures.

The Environmental Impact Assessment (EIA) process of the project and in particular the documents that make up the Synthesis Report (SR) and Non-Technical Summary (NTS) will be duly assessed by the Ministerial Department responsible for the Environment Sector formally designated for this purpose.

An integral part of the Environmental and Social Impact Assessment (ESIA) is public participation and stakeholder consultation. This point is of particular importance in the institutional procedure for Environmental Impact Assessment, as defined in Article 16 - Public Consultations, of Decree No. 117/20, since it is through this instrument that stakeholders can comment on your expectations for the project and the relevance of the impacts caused in your area of interest.

During the elaboration of the present Study, the legal diplomas and regulations in force contained in the following table (*see* **Table 3**) were taken into account, insofar as they are applicable to the project's activities.

Table 3 – Summary of Applicable Legislation and Regulations

Descriptor	Applicable legislation/regulations
Licensing	- Presidential Decree No. 117/20, 22 April 2020 - Approves the General Regulation for Environmental Impact Assessment and the Environmental Licensing Procedure; - Executive Decree no. 87/12, of 24 February - Approves the regulation of Public Consultations of Projects Subject to Environmental Impact Assessment; - Decree No. 1/10, of 13 January – Concerning Environmental Audits; - Joint Executive Decree No. 130/09, of 26 November, which replaces the Table Attached to Joint Executive Decree No. 96/09, of 6 October - Fees payable for Environmental Licensing; - Executive Decree no. 92/12, of 1 March - Terms of Reference for the Preparation of Environmental Impact Studies; - Presidential Decree No. 173/13 of 30 October - Establishes the procedures and defines the powers for the purposes of licensing and inspection of storage facilities for petroleum products, installations

Descriptor	Applicable legislation/regulations
	for supplying liquid and gaseous fuels derived from petroleum. - Decree n.º 8/02 of April 12 - Regulation of the Public Works Law.
Road Sector	- Presidential Decree n.º 20/21 of 22 January – Approves the Road Plan for Angola; - Decree No. 77/91, of December 13 - Statute of Roads in Angola; - Presidential Decree n.º 106/14 of 19 May - Approves the Organic Statute of the Ministry of Construction; - Presidential Decree n.º 320/14 of December 1st - Approves the Organic Statute of the Roads Institute of Angola, abbreviated as "INEA".
Water	- Law no. 6/02 of 21 June - Water Law; - Executive Decree No. 261/11 of 6 October – Regulation on Water Quality; - Presidential Decree no. 82/14 of 21 April – Regulation of – General Use of Water Resources; - Presidential Decree no. 83/14 of 22 April – Regulation on public water supply and wastewater sanitation; - National Water Plan – 2017-2025.
General	- Constitution of the Republic of Angola – Law of 5 February 2010; - Law no. 5/98, of 19 June – Environmental Law; - General Environmental, Health and Safety Guidelines - EHS Guidelines.
Air/Atmospheric Emissions/Climate Change	- Law no. 5/98, of 19 June – Environmental Law; - Resolution no. 12/09 of 28 August – Convention on climate change; - Resolution no. 14/07 of 28 March – Adhesion to the Kyoto Protocol; - Presidential Decree No. 153/11, of 15 June – Regulation that establishes the rules on the production, import and export of products capable of depleting the ozone layer; - Reference Values defined by the WHO - EHS Guidelines - Air Quality Guidelines for Europe regarding air quality (considered as an indication); - European Directive 2019/130 on Carcinogenic and Mutagenic Substances amending Directive 2004/37/EC on the protection of workers against risks related to exposure to carcinogens or mutagens at work; - Directive no. 2010/75/EU of 24 November, on industrial emissions (PCIP); - Regulation (EU) No. 517/2014, on fluorinated greenhouse gases; - Regulation (EC) No. 2037/2000, of the European Parliament and of the Council, of 29 June, concerning substances that deplete the ozone layer; - Presidential Decree no. 216/22 of 23 August, which approves the National Strategy for Climate Change; - Directives no. 2008/50/EC, of the European Parliament and of the Council, of 21 May, and 2004/107/EC, of the European Parliament and of the Council, of 15 December, which establish the regime for the evaluation and management of ambient air quality.
Waste Management	- Presidential Decree no. 190/12, of 24 August – Regulation on Waste Management; - Construction and Demolition Waste Management Legal Regime (Executive Decree no. 17/13, of 22 January); - Presidential Decree No. 181/14, of 28 July, creating the National Waste Agency and approving its organic structure; - Guiding Standard for the Preparation of Provincial Urban Waste Management Plans (Executive Decree No. 234/13, of 18 July); - Presidential Decree No. 196/12, of 30 August, which approves the

Descriptor	Applicable legislation/regulations
	Strategic Plan for Urban Waste Management (PESGRU); - Executive Decree no. 24/15, of 29 January – Regulation for the registration and licensing of companies that carry out activities in the areas of waste, water and wastewater treatment; - Presidential Decree No. 203/19 of 25 June – Legal Regime for Landfills.
Noise and Vibrations	- Reference Values defined by the WHO - EHS Guidelines regarding the monitoring of environmental noise (considered as an indication); - Law no. 5/98, of 19 June – Environmental Law; - Directive No. 2003/10/EC on the minimum safety and health requirements in terms of workers' exposure to risks due to physical agents (noise); - Directive no. 2005/88/EC, of the European Parliament and of the Council, of 14 December, which amends Directive no. the environment of equipment for outdoor use (considered as an indication).
Human Resources	- Law no. 7/15, of 15 June – General Labor Law; - Fundamental Convention of the International Labor Organization; - United Nations Guiding Principles on Business and Human Rights; - General Environmental, Health and Safety Guidelines - EHS Guidelines; - EU Regulation No. 2016/679 (General Data Protection Regulation - GDPR); - International Charter of Human Rights.
Biodiversity and Ecological Factors	- Forest and Wildlife Basic Law (Law no. 6/17 of 24 January); - Convention on Biological Diversity (CBD) - 23/97 of 4 July; - Convention on the Conservation of Migratory Species Belonging to Wild Fauna - Bonn Convention, 2006; - Conservation on Biodiversity Conservation, 1992; - Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2007; - International Convention on the Conservation of Wetlands, 2016; - Law on Biological Aquatic Resources - Law no. 6-A/04 of 8 October; - Regulation on the Protection of Soil, Flora and Fauna* - Decree No. 40,040 of 20 January 1955; - Forest Regulation* - Decree No. 44,531 of August 21, 1962; - Joint Executive Decree No. 26/99 of 27 January – Determines that the illegal felling of trees and the illegal transit of forest products will be subject to fines; - Legislative Diploma No. 2,873 of December 11, 1957 – Hunting Regulations*; - National Parks Regulation* - Ordinance No. 10,375 of October 15, 1958; - Decree no. 43/77 of 5 May – Approves the structure of the Ministry of Agriculture and defined five different categories for conservation areas; - Law no. 38/11 of 29 December (last legal instrument relating to the establishment of new conservation areas in Angola) – Created three more conservation areas, namely the Luengue-Luiana and Mavinga Parks (in Cuando Cubango) and Mayombe (in Cabinda).
Hygiene, Safety and Health at Work	- Decree no. 31/94 of 5 August – Principles aimed at promoting safety, hygiene and health at work; - Executive Decree no. 128/04, of 23 November – Regulation that standardizes safety and health signs in workplaces; - Decree no. 53/05, of 15 August – Legal Regime for Accidents at Work and Occupational Illnesses;

Descriptor	Applicable legislation/regulations
	- Presidential Decree No. 195/11 of 8 July – Legal framework for fire safety in buildings; - Executive Decree no. 6/96 of February 11, 1994 – Approves the General Regulations for Safety and Hygiene Services at work in companies; - Executive Decree No. 40/86 of September 13, 1986 – Approves the general rules of protection and hygiene at work per workplace; - Executive Decree no. 21/98, of 30 April – Approves the General Regulation of the Workplace Accident Prevention Commissions (CPAT); - Fundamental Conventions of the International Labor Organization (ILO).
Environmental Emergency	- Law no. 5/98, of 19 June – Environmental Law; - Presidential Decree No. 194/11, of 7 July – Regulation on Liability for Environmental Damage; - National Environmental Management Program (PNGA).
Soils and Spatial Planning	- Land Law (Law No. 9/04 of 9 November); - Territorial and Urban Planning Law (Law no. 3/04 of 25 June); - General Regulations for Territorial, Urban and Rural Plans (REPTUR) (Decree no. 2/06, of 23 January); - Decree no. 13/07 of 26 February (All buildings subject by law to an urbanization and expansion plan); - Presidential Decree No. 117/16 of 30 May – Approves the Regulation for Rehousing Operations; - Decree no. 58/07, of 13 July - General Land Concession Regulation; - Expropriation Law No. 2030, of June 22, 1948; - Land Law no. 9/04 of 9 November - Establishes the fundamental principles of land rights and classifies State land as grantable and non-grantable; - Law n.º 3/04 on Spatial Planning and Urbanism - Establishes the instruments for urban and rural territorial management; - Convention to Combat Desertification, 2000.
Environmental Management	- Basic Environmental Law – Law no. 5/98, of 19 June; - Environmental Health, and Safety (EHS) Guidelines; - Presidential Decree no. 190/12, of 24 August; - Executive Decree No. 249/17 of 25 April – Regulation of the Environmental Audit for Certification; - Decree No. 1/10, of 13 January – Concerning Environmental Audits; - Presidential Decree No. 194/11, of 7 July – Regulation on Liability for Environmental Damage.
Cultural Heritage	- Law no. 14/05 of 7 October – Cultural Heritage Law; - Convention for the Protection of World, Cultural and Natural Heritage.
Normative References	- ISO 14001:2015/NA ISO 14001:2004 – Environmental Management System - Requirements and guidelines for its use; - ISO 14004:2012 Environmental management systems – General guidelines on implementation; - ISO 14015:2006 - Environmental management – Environmental assessment of sites and organizations; - ISO 14031:2005 Environmental management – Environmental performance assessment – Guidelines; - ISO 19011:2012 - Guidelines for audits of quality management and/or environmental management systems; - ISO 9001:2015 - Quality Management System; - ISO 45001:2018 - Occupational health and safety management system;

Descriptor	Applicable legislation/regulations
	- ISO 37301:2021 - Compliance Management Systems.

Note: * These regulations were recently revoked by Law n.º 6/17 of 24 January (Bases of Forests and Wild Fauna) with the exception of the component of conservation areas.

2.3. Equator Principles

The Equator Principles (EP4, July 2020) are a set of socio-environmental guidelines and criteria created with the purpose of supporting Lenders to identify, assess and manage socio-environmental risks in the financing of projects, in order to guarantee that financed projects are developed in an environmentally and socially responsible manner.

The Equator Principles developed by the financing entities, which govern their action for the management of social and environmental areas with regard to the financing of large investment projects, are the following:

- Principle 1: Review and Categorization;
- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Social and Environmental Standards;
- Principle 4: Socio-environmental Management System and Equator Principles Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting;
- Principle 10: Communication and Transparency.

2.3.1. Scope of Application of EP

The Equator Principles apply globally and to all sectors of the economy. Since the Project is located in Angola, which is a Non-Designated Country, it must, as defined in Principle 3, regarding the Applicable Social and Environmental Standards, comply with the applicable IFC Social and Environmental Sustainability Performance Standards (Performance Standards) and the World Bank Environment, Health and Safety Guidelines (EHS Guidelines) which are described in Chapters 2.4 and 2.7, respectively.

2.3.2. GAP Analysis of the Project against the Equator Principles

Table 4 presents the Equator Principles analyzed and evaluated, also from the point of view of applicability, considering the implementation of mitigation measures and monitoring programs defined in the Environmental and Social Management Plans (*see* **Chapter 10**).

Table 4 - The ten Equator Principles and Applicability in relation to the project

Equator Principles	Main objective	Applicability	Assessment
Principle 1: Review and Categorization	- Categorize projects based on the magnitude of risks and potential socio-environmental impacts, including those related with Human Rights, climate change and biodiversity. This categorization is based in the socio-environmental categorization process of the International Finance Corporation (IFC). The categories are: **Category A** - Projects with potential risks and/or adverse socio-environmental impacts significant and that are diverse, irreversible or unprecedented; **Category B** - Projects with limited risk potential and/or adverse socio-environmental impacts, few in number, generally local, largely reversible and promptly treatable through mitigation measures; and **Category C** – Projects with minimal risks and/or socio-environmental impacts or without risks and/or adverse socio-environmental impacts. **NOTE:** There may be a variation in the scale of risks and potential socio-environmental impacts for Projects classified as Category B. In general terms, the highest risk Category B Projects will be treated similarly to Category A Projects and Category B Projects lower risk will be treated more lightly. The EPFI shall, at its own discretion, determine the appropriate level of Assessment Documentation, analysis and/or monitoring required to address these risks and impacts in accordance with Principles 1 to 10.	- The Principle applies to all projects seeking funding from EPFIs. It recommends that projects be previously categorized based on the magnitude of risks and potential socio-environmental impacts. - The EPFI's socio-environmental due diligence process must be proportionate to the nature, scale and the stage of the Project and the categorized level of socio-environmental risks and impacts.	**Applicable.** The project is categorized based on the magnitude of potential socio-environmental risks and impacts, including those related to Human Rights, climate change and biodiversity (*in* **Chapter 2**).

Equator Principles	Main objective	Applicability	Assessment
Principle 2: Environmental and Social Assessment	- Ensure that an appropriate Assessment process is carried out, which is satisfactory to the EPFI, to address the socio-environmental risks and the scale of the Project's impacts;	- For Category A and, as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialized studies may also be required. For other Category B and potentially C Projects, a limited or focused environmental or social assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorization process; - The client is expected to include assessments of possible adverse impacts on human rights and climate change risks as part of the ESIA or other assessment, and these will be included in the assessment documentation; The principle recommends that the Assessment documentation propose measures to minimise, mitigate and, where there are residual impacts, offset/remediate the risks and impacts to workers, Affected Communities and the environment in a way that is meaningful and appropriate to the nature and scale of the Proposed Project.	**Applicable.** According to the assessment process, the project is categorized as Category B. In this sense, the Assessment Documentation developed includes an Environmental and Social Impact Assessment (ESIA) report that contains the following information: ○ Project description and justification; ○ Alternatives to the project; ○ Definition of the scope and areas of influence of the project; ○ Assessment of national legal requirements and applicable international requirements; ○ Characterization of the Reference Situation (socio-environmental base study), in the pre-construction phase; ○ Identification and assessment of environmental and social impacts and risks generated in all phases of the project throughout its life cycle; ○ Definition of Grievance Management Mechanism; ○ Stakeholder Engagement Plan and Relevant Consultation in the Pre-construction Phase of the project; ○ Environmental and social management plan that includes the programs defined to

Equator Principles	Main objective	Applicability	Assessment
			mitigate and/or compensate the impacts of the project throughout its life cycle.
Principle 3: Applicable Social and Environmental Standards	- Verify the socio-environmental compliance of the Project with national regulations and international requirements, in order to ensure the socio-environmental protection of the project throughout its entire life cycle.	EPFI will assess, with the assistance of the Independent Socio-Environmental Consultant, when applicable, the Project's compliance with the standards complied with, as follows: 1. For Projects located in Non-Designated Countries, compliance with the Standards of Social and Environmental Sustainability Performance (Performance Standards) IFC and World Bank Environment, Health and Safety Guidelines (EHS Guidelines); 2. For Projects located in Designated Countries, in compliance with laws, regulations and licenses granted by the host country in the socio-environmental scope.	**Applicable.** Since the Project is located in Angola, which is a Non-Designated Country, it must, as defined in Principle 3, with respect to the applicable Socio-environmental Standards, comply with the IFC Performance Standards and the World Bank EHS Guidelines. In case of discrepancy, the more rigorous requirements and more robust methodologies will prevail.

Equator Principles	Main objective	Applicability	Assessment
Principle 4: Socio-environmental Management System and Equator Principles Action Plan	- Define the need to prepare a Socio-environmental Management Plan to deal with the issues raised in the Assessment process and incorporate the necessary actions for the Project to comply with the applicable standards.	This requirement applies to all Category A and Category B Projects.	**Applicable.** Following what is expressed in the Project Management Policies, the Environmental and Social Management Plan (*see* **Chapter 10**) has defined several programs and plans, with the main objective of minimizing and/or dealing with the risks and potential impacts of the project.
Principle 5: Stakeholder Engagement	- Demonstrate the effective involvement of the Stakeholders, as a continuous process, in a structured and culturally appropriate way, including the Affected Communities, Workers, among other Stakeholders identified.	This requirement applies to all Category A and Category B Projects.	**Applicable.** In the Stakeholder Engagement Plan (*see* **Annex II** of the SR of the ESIA) potential stakeholders are identified and respective communication strategies defined to facilitate dialogue with all identified stakeholders, including disadvantaged and/or vulnerable stakeholders. The SEP was developed in order to be able to collect the opinions of all Stakeholders, including vulnerable groups, and guarantee that the Consultations were carried out based on the principle of inclusion, and the participation of all segments of the community and in a transparent way. During the relevant Consultations carried out in the pre-Construction phase (5 and 6 of January 2023), relevant information on the project was disclosed, namely: ○ Scope, objectives and provisional location of the project (based on the fact that, at the time, demining work was still ongoing); ○ Duration of the contract; ○ Project Management Policies,

Equator Principles	Main objective	Applicability	Assessment
			including the Grievance Management and Data Protection Mechanism; ○ Explanation of the environmental and social impact assessment process and the main expected impacts; ○ Explanation of the consultation and public consultation process and the objectives of these processes. The stakeholders consulted within the scope of the process gave their prior consent (*see* **Annex III** – SEP Questionnaire Model – Annex II of the ESIA SR).
Principle 6: Grievance Mechanism	- Establish an efficient grievance mechanism to be used by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances regarding the socio-environmental performance of the Project.	This requirement applies to all Category A and, where appropriate, Category B Projects.	**Applicable.** The Grievance Management Mechanism is set out in Chapter 12 of this ESIAS summary report. This chapter contains the key principles, the description of the procedure and the main stages of the procedure that should be adopted throughout the project. All complaints and complaints received will be registered on a specific complaint form to assign an individual reference number. The Grievances Management Mechanism was disclosed within the scope of a transparent and easy-to-understand process during the process of participation and consultation with stakeholders so that this process is

Equator Principles	Main objective	Applicability	Assessment
			carried out without cost and retaliation to the party that gave rise to the issue or concern.
Principle 7: Independent Review	- Determine compliance with the Equator Principles through an Independent Review of the EIA process, including the ESMP and all Stakeholder Engagement process documentation, in order to assist EPFI due diligence.	This requirement applies to all Category A and, where appropriate, Category B Projects.	**Applicable.** As the Project is Category B, any due diligence process may be conducted by a multilateral or bilateral financial institution or an Export Credit Agency of the Organization for Economic Co-operation and Development (OECD) may be taken into consideration to determine whether an Analysis Independent will be required.
Principle 8: Covenants	- Ensure compliance with the project's socio-environmental contractual clauses.	This requirement applies to all Category A and B Projects.	**Applicable.** The project proponent undertakes, in the financing documentation, to comply with all the applicable laws, regulations and socio-environmental licenses of Angola in all relevant aspects and international conventions and good practices.
Principle 9: Independent Monitoring and Reporting	- Assess the Project's compliance with the Equator Principles after the Termination of the Financial Operation. Monitoring and reporting must be provided by an Independent Social and Environmental Consultant.	This requirement applies to all Category A and, where appropriate, Category B and B+ Projects.	**Applicable.** Based on the assessment of the categorization envisaged for the project (Category B) and given that the project proponent is the Angola Roads Institute – Ministry of Public Works, Urbanism and Housing, the monitoring of the compliance assessment and report may be ensured by an Independent Environmental and Social Consultant or if the EPFI decides, it can rely on the internal monitoring carried out by the same. In addition, any monitoring carried out by a financial institution multilaterally or bilaterally or by an OECD Export Credit

Equator Principles	Main objective	Applicability	Assessment
			Agency may be taken into account.
Principle 10: Communication and Transparency	- Ensure that, as a minimum, a summary of the ESIA is accessible and available on the Internet and that it includes a summary of the risks and impacts on human rights and climate change where applicable; - The client must publicly disclose the levels of greenhouse gas (GHG) emissions (annually) during the operational phase of Projects that emit more than 100 thousand tons of CO_2 equivalent per year; - Share non-commercially sensitive Project-specific biodiversity data with the Global Biodiversity Information System (GBIF) and applicable national and international data repositories, using formats and conditions that allow this data to be captured and reused in future decisions and research applications.	This requirement applies to all Category A and, where appropriate, Category B Projects.	**Applicable.** As defined in the EIA procedure (point 2 of Article 16 of Decree No. 117/20), in addition to the relevant public consultation campaign carried out prior to the construction phase of the project, a public consultation session for prior dissemination of a non-technical summary of the Environmental and Social Impact Assessnent, which contains the most important effects that the project can generate on the environment and on the socio-economic environment.

2.4. International Finance Corporation Performance Standards

This ESIA also considered the Performance Standards (PS) of the International Finance Corporation (IFC) of the World Bank Group (2012) which define the sustainability criteria for the environment, social, health and safety that must be respected during the entire life cycle of the project and its investment. For this purpose, the IFC prepared a series of Guidance Notes corresponding to the 8 PS that aim to guide and inform about the requirements, including reference documents and good sustainability practices that aim to improve the performance of the project. Additionally, there are also a set of more technical specific manuals and directives.

The main objectives of the 8 IFC Performance Standards are presented below.

// Performance Standard 1: Assessment and Management of Social and Environmental Risks and Impacts

- Identify and assess environmental and social risks, including Stakeholder involvement in risk identification, analysis and assessment;
- In order of priority: avoid, minimize, repair or compensate for negative impacts;
- Ensure that affected communities and other Stakeholders are involved in the management of matters that concern them;
- Ensure that complaints from affected communities and external communications from other Stakeholders are responded to and managed appropriately;
- Improve environmental, social and health and safety performance through a "lightweight" and efficient management system.

// Performance Standard 2: Employment and Working Conditions

- Promote fair treatment, non-discrimination and equal opportunities for workers;
- Promoting safe and healthy working conditions and protecting workers' health;
- Establish, maintain and improve relations between workers and management;
- Promote respect for labor rights and national labor legislation;
- Protect workers and the identification, analysis, assessment and mitigation of hazards in the workplace;
- Have a system for reporting, recording and investigating work-related injuries and illnesses;

- Have emergency measures/procedures to adequately respond to emergencies;
- Avoid the use of forced labor.

// Performance Standard 3: Resource Efficiency and Pollution Prevention

- Avoid or reduce negative impacts on human health and the environment, avoiding or reducing pollution generated and other negative effects by project activities;
- Promoting more sustainable use of resources, especially energy and water;
- Reduce project-related GHG emissions;
- Plan mechanisms to adequately dispose of hazardous waste generated during construction (if any), during exploration and deactivation.

// Performance Standard 4: Community Health and Safety

- Anticipate and avoid, during the life cycle of the project, negative impacts on the health and safety of the Affected Communities that may result from ordinary or unusual circumstances;
- Ensure the protection of people and property during all phases of the project in accordance with applicable human rights principles and in such a way as to avoid and expose the Affected Communities to risks or to minimize the latter.

//Performance Standard 5: Land Acquisition and Involuntary Resettlement

- Avoid, and whenever not possible, limit involuntary resettlement considering alternative project designs;
- Avoid forced evictions; anticipate and avoid, or where it is not possible to avoid, limit the negative social and economic impacts resulting from land acquisition or restrictions on its use by:
    - provide compensation for loss of assets at replacement cost;
    - ensure that resettlement activities are accompanied by adequate communication and that the process of consultation and informed participation of affected people is appropriate to them;
- Improve or at least restore the livelihoods and living conditions of displaced people;
- Improve the living conditions of physically displaced people by providing adequate housing with security of tenure in resettlement sites.

// Performance Standard 6: Biodiversity Preservation and Sustainable Management of Living Natural Resources

- Protect and conserve biodiversity;
- Maintain benefits derived from ecosystem services;
- Promoting the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

// Performance Standard 7: Indigenous People

- Ensure that the development process promotes full respect for the human rights, dignity, aspirations, cultures and natural resource-based livelihoods of indigenous people;
- Anticipate and avoid the negative impacts of the projects on the communities of the People or, if this is not possible, reduce, restore and/or compensate for these impacts;
- Promote benefits and opportunities related to sustainable development for culturally appropriate Indigenous People;
- Establish and maintain a permanent relationship of consultation and transparent participation with the Indigenous People affected by a project;
- Obtain the Free, Prior and Informed Consent of Indigenous People when the circumstances described in this Performance Standard exist;
- Respect and preserve the culture, knowledge and practices of Indigenous People.

// Performance Standard 8: Cultural Heritage

- Protect cultural heritage from the negative impacts of project activities and support its preservation;
- Promoting the equitable sharing of benefits arising from the use of cultural heritage.

2.4.1. GAP Analysis of the Project in relation to the Performance Standards

In **Table 5**, the Performance Standards (PS) of the International Finance Corporation of the World Bank Group are presented, analyzed and evaluated, also, from the point of view of applicability, considering the implementation of mitigation measures and defined monitoring programs in Environmental and Social Management Plans (*see* **Chapter 10**).

Table 5 – The eight Performance Standards and their applicability assessment in relation to the project

Performance Standard	Objectives	Application	Requirements	Assessment
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	- To identify and evaluate environmental and social risks and impacts of the project; - To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment; - To promote improved environmental and social performance of clients through the effective use of management systems; - To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; - To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.	Performance Standard 1 applies to all projects that present socio-environmental risks and impacts, as it does not address a specific technical issue, but the necessary structure for the project to be able to identify, assess, mitigate and monitor its socio-environmental risks and impacts and thus advance in adherence to the other Standards. Depending on the circumstances of the project, other Performance Standards may also apply. **The Performance Standards should be read together and cross-referenced as needed**. The requirements section of each Performance Standard applies to all activities funded under the project, unless otherwise noted in the specific limitations described in each paragraph. Clients are encouraged to apply the ESMS developed in accordance with Performance Standard 1 to all project activities regardless of funding source. Several cross-cutting themes such as climate change, gender, human rights and water resources are addressed in various Performance Standards. In addition to meeting the requirements of the Performance Standards, **clients must comply with applicable national laws**, including those implementing host country obligations under international law. The World Bank Group Environment, Health, and Safety Guidelines (EHS Guidelines) are technical reference documents that provide general and specific examples of good international sector practice. The IFC uses the EHS Guidelines as a technical source of information during project appraisal. The EHS Guidelines contain performance levels and measures that are generally acceptable to IFC and are generally considered to be achievable in new installations at reasonable cost using existing technologies. Performance Standard 1 underscores the **importance of managing social and environmental performance throughout the lifecycle of a project.** **When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects must meet whichever is more rigorous.** In short, this requirement acts as an "umbrella" for the others. It is required that	**PS1: POLICY** - The client must establish a comprehensive policy that defines the environmental and social objectives and principles that guide the project to achieve solid socio-environmental performance; - The policy should provide a framework for the socio-environmental assessment and management process and ensure compliance with applicable laws and regulations, including laws that define the host country's obligations under international law; - The policy must be coherent with the principles of the Performance Standards and other international requirements and good practices applicable to the sector of activity, and the commitment to these same requirements must be expressly assumed in the Policy(ies). **PS1: RISKS AND IMPACTS IDENTIFICATION** - The Client must establish and maintain a process to identify risks and socio-environmental impacts of the project; - The risk and impact identification process should be based on recent socio-environmental reference data with an appropriate level of detail; - The process should consider all environmental and social risks and impacts relevant to the project, including the risk issues identified in Performance Standards 2 to 8 and the stakeholders likely to be affected by such risks and impacts; - The process of identifying risks and impacts should consider greenhouse gas emissions, relevant risks associated with climate change and adaptation opportunities, as well as possible transboundary effects such as air pollution or use or pollution of international waterways ; - socio-environmental risks and impacts will be identified in the context of the project's area of influence. This should cover, where appropriate: - The area likely to be affected: (i) by the project (e.g. include project sites, immediate atmospheric and watersheds or transport corridors) and by client activities and facilities directly occupied, operated or	**APPLICABLE.** The project management policies are highlighted in **Chapter 5.7** of this technical report, following the principles of the PS and other international requirements and good practices. The Performing Entity has also established an Environmental and Social Management System that will be implemented together with the Environmental and Social Management Plan (ESMP) presented in **Chapter 10** of this document. **APPLICABLE.** - This technical report established a procedure for identifying socio-environmental risks and impacts based on reference data, monitoring, public consultation process, participation and consultation with interested parties, in other elements described in Chapter 3 – General Methodology, Chapter 7 – Risk Analysis and Chapter 8 - Identifying and Assessing Impacts. - The impact assessment process considered greenhouse gas emissions and relevant risks associated with climate change (see Chapter 7 and 8.6) and adaptation opportunities (see Chapter 6.1.7 – Climate Change). - The project's socio-environmental impact assessment considered the project's areas of influence defined in Chapter 5.6, which make it possible to assess the socio-environmental context of the Project's area of influence in accordance with the requirements expressed for this purpose in PS1, namely: ▪ Directly affected area, which includes the sites potentially affected by the project, referring to the sites crossed by the components of the Electric Power System foreseen within the scope of the project and construction activities, accesses and support facilities for the contract; ▪ Area of Direct Influence constituted

Performance Standard	Objectives	Application	Requirements	Assessment
		the Project, through the structuring of an effective and continuous socio-environmental management system, promote a solid and sustainable performance, obtaining better financial, social and environmental results. To this end, the project shall continuously and systematically: i) Identify and assess all risks and impacts on the environment, workers or other affected communities; ii) adopt a mitigation hierarchy to first anticipate and avoid these impacts and, only when this is not possible, avoid, minimize or, as a last resort, compensate/neutralize; It is iii) ensure involvement and absorb complaints from affected people.	managed (including by companies contractors) and that are part of the project (eg access roads, borrow areas, jobsites, etc.); (ii) impacts of unplanned but foreseeable developments caused by the project that may occur later or at a different location; or (iii) indirect impacts of the project on biodiversity or on ecosystem services on which the Affected Communities depend for survival; - Associated facilities, which are those that are not financed as part of the project and that would not have been built or expanded if the project did not exist and without which the project would not be viable (e.g. railways, roads, power stations or transmission lines captives, etc.). - Cumulative impacts (e.g. interference with migratory routes or wildlife movement; or increased traffic congestion and increased number of accidents due to increased vehicle traffic on community roads) resulting from the additional impact on areas or resources used or suffering direct impact of the project, other existing, planned or reasonably defined developments at the time the impact identification process is carried out; - Assess risks and impacts in the project's area of influence resulting from third-party actions; - Where the client can reasonably exercise control, the risk and impact identification process should also take into account the risks and impacts associated with key supply chains as defined in Performance Standard 2 and 6; - The evaluation should consider the results of plans, studies and evaluations prepared by government authorities and other parties directly related to the project. The identification of risks and impacts must also take into account the result of the engagement process with the Affected Communities, when appropriate; - Identify individuals and groups that may be directly and differentially or disproportionately affected by the project because they are disadvantaged or vulnerable. When individuals or groups are identified as disadvantaged or vulnerable, the client will propose and apply differentiated measures so that adverse impacts do not disproportionately affect them, and they	by the area that could be affected by the direct impacts of the Project. Such impacts may occur in the physical environment (eg, noise, reduction in air quality due to dust emission, soil compaction, erosion processes, etc.), in the biotic environment (eg, destruction of habitats of flora and fauna) and the socio-economic environment (eg loss of cultivated land, increased flow of vehicles in the area), in the construction/installation, operation and decommissioning phases of the project; ▪ Area of Indirect Influence consisting of a broader area where the Project's influences on the physical, biotic and socioeconomic environment can be felt, not directly, but via the possible secondary effects resulting from the various activities and typology of the project ; - In this environmental and social impact assessment report, the cumulative impacts for each socio-environmental descriptor/factor were assessed (see Chapter 8 – Identification and Assessment of Impacts); - In Chapter 7 – Risk Analysis, the actions inherent to third parties are also evaluated; - In accordance with the commitment of top management, assumed through the Project Management Policies, suppliers and service providers must comply with the requirements expressed therein, in order to guarantee the good environmental, social, health and safety performance of the project in its entire life cycle; - The assessment of the project's socio-environmental risks and impacts also took into account the National legislation and respective studies, plans and other documented reference information, whenever available, to characterize the socio-environmental situation of the project. This information was complemented with information collected during the field work carried out by Resurb Ambiente, environmental monitoring and the result of the consultation and public consultation process, which includes the following groups that may be affected by the project: - Potential Stakeholders who intervene or

Performance Standard	Objectives	Application	Requirements	Assessment
			have the opportunity to share benefits and development opportunities equally.	have a specific interest at any level of project implementation; - Stakeholders Susceptible to be Directly Affected by the Project which may include, in addition to the community surrounding the project, direct workers and indirect workers. Direct workers are project employees (assigned technicians and/or recruited personnel) with formal contracts. Indirect workers are agents of partner companies in the project and agents of subcontracted companies, etc.; - Disadvantaged or vulnerable individuals or groups, namely people and groups who may have more difficulty participating and those who may be unequally or disproportionately affected by the Project due to their vulnerable situation: - women and young people without identity documents and likely to be excluded from the single identification system due to their marginalization; - people with a disability/handicap; - elderly people, especially those living in rural areas; - people in an extremely precarious situation and/or specific difficulties (adult orphans, poor people living alone, widows, people without a fixed abode or living on the street, etc.); - people belonging to "disadvantaged" minority groups, such as minority communities in numbers or with a specific way of life (transhumants), people with a specific sexual orientation, sex sellers/prostitutes, chronic illnesses, etc. In the project's Stakeholder Engagement Plan, a specific consultation strategy was proposed to be able to consider, equally, the opinions of vulnerable groups, and to guarantee that the Consultations are carried out based on the principle of inclusion, and the participation of all segments of the community.
			PS1: MANAGEMENT PROGRAMS - In line with the client's policy and with the objectives and principles described therein, the client will establish management programs that, in short, will describe the measures and actions for mitigation and performance improvement that take into account the risks and socio-environmental impacts identified from the project; - Depending on the nature and size of the	**APPLICABLE.** - The technical report/synthesis of the present Environmental and Social Impact Assessment includes in Chapter 10 the Environmental and Social Management Plans of the project, which gathers information on the activities associated with the implementation of the same in its various phases, the socio-environmental components likely to be affected by the Project , and the set of environmental and social

Performance Standard	Objectives	Application	Requirements	Assessment
			project, these programs may consist of a documented combination of procedures, practices and operational plans and related supporting documents (including legal contracts) systematically managed. The programs may be applied broadly across the client's organization, including contractors and key suppliers over which the organization has control or influence, or at specific locations, facilities, or activities. The mitigation hierarchy to deal with the identified risks and impacts will prioritize the prevention of impacts over their reduction and, in cases where residues of the impact remain, compensation/neutralization, whenever technically and financially feasible; - When identified risks and impacts cannot be avoided, the client will identify mitigation and performance measures and determine corresponding actions to ensure that the project will operate in compliance with applicable laws and regulations and will meet the requirements of Performance Standards 1 to 8. The level of detail and complexity of this collective management program and the priority of the identified measures and actions will be compatible with the risks and impacts of the project and will take into account the outcome of the engagement process with the Affected Communities, as appropriate; - The management programs will establish the environmental and social Action Plans, which will define the desired results and actions to address the issues raised in the process of identifying risks and impacts as measurable events, as far as possible, with elements such as performance indicators, goals or acceptance criteria that can be monitored over defined periods and with estimates of resources and responsibilities in the implementation. As appropriate, the management program will recognize and incorporate the role of relevant actions and events controlled by third parties to address identified risks and impacts. Recognizing the dynamic character of the project, the management program will respond to changing conditions, unforeseen occurrences and the results of monitoring and analysis.	management procedures to be adopted based on the impact mitigation measures and monitoring programs proposed in this ESIA. In order to make the ESMP operational, the intervenient and/or entities in each phase of the Project are defined, as well as their responsibilities in the implementation, verification or inspection of the envisaged environmental management procedures, as well as the necessary resources. The ESMP presents the monitoring programs that include measures to mitigate and offset impacts and other complementary initiatives, organized by project phase and entity responsible for its implementation. The ESMP thus aims to make available in a systematic way the set of socio-environmental management activities to be implemented and the ways to control their implementation, ensuring compliance with the applicable legal, regulatory or normative requirements, and the commitments assumed by the Project Management Policies, with emphasis on environmental and social issues.
			PS1: ORGANIZATIONAL CAPACITY AND COMPETENCE - Establish, maintain and strengthen as necessary an organizational structure that	**APPLICABLE.** In subchapter 10.1 – Structure of Implementation and Responsibility, direct responsibility for the environmental and

Performance Standard	Objectives	Application	Requirements	Assessment
			defines roles, responsibilities and authority to implement the ESMP. Specific personnel, including management representative(s), should be designated with clear lines of responsibility and authority. Key environmental and social responsibilities should be clearly defined and communicated to relevant employees and the rest of the client's organization. Sufficient management support and human and financial resources must be constantly provided in order to achieve effective and continuous socio-environmental performance; - In the client's organization, employees with direct responsibility for the social and environmental performance of the project will have the necessary knowledge, skills and experience to carry out their work, including current knowledge of host country regulatory requirements and applicable requirements of the Performance Standards 1 a 8. Employees should also have the necessary knowledge, skills and experience to adopt the specific measures and actions required by the ESMS, as well as the methods necessary to carry out the actions competently and efficiently; - The risk and impact identification process will consist of an adequate, accurate and objective assessment and exposure, prepared by competent professionals. For projects that have potentially significant adverse impacts or where there are technically complex issues, clients may be required to call in external experts to assist with the risk and impact identification process.	social management of project implementation is distributed, in accordance with the attributions defined, and who will be responsible for ensuring the implementation of the programs defined in the ESMP (see Chapter 10.2.1 and 10.2.2), in order to ensure the good socio-environmental performance of the project and compliance with the defined objectives. At the same time, the Socio-Environmental Mitigation, Compensation and Improvement Program recommends various measures to minimize and/or compensate for the project's potential socio-environmental risks and impacts, as well as defining the respective responsible parties, the implementation period and the respective socio-environmental indicators to be considered. Regarding organizational capacity and competence, measures are also defined to ensure the systematic implementation of Awareness, Information and Training actions, throughout the life cycle of the project, in order to mitigate the potential risks and negative impacts of the project on the various factors/socioenvironmental descriptors.
			PS1: EMERGENCY PREPARATION AND RESPONSE - The ESMP shall establish and maintain an emergency preparedness and response system so that the client, in collaboration with appropriate and relevant third parties, is prepared to respond to accidents and emergency situations associated with the project in an appropriate manner to prevent and mitigate any injuries to people and/or damage to the environment; - As applicable, the client will also assist and collaborate with Potentially Affected Communities (see Performance Standard 4) and local government agencies in their preparations to respond effectively to emergency situations, especially when their participation and collaboration is necessary to ensure an effective response.	**APPLICABLE.** - The Emergency Plan, which will comprehensively include all emergency scenarios, will be prepared by the Executing Entity in accordance with what is defined in Chapter 7.1 – Emergency Response Plan. Whenever relevant, the involvement and participation of the community and government bodies will be provided when carrying out practical emergency simulation exercises in order to guarantee an efficient response in an accident scenario situation (see Chapter 7).

Performance Standard	Objectives	Application	Requirements	Assessment
			PS1: MONITORING AND ANALYSIS - Establish procedures to monitor and measure the effectiveness of the management program, as well as compliance with any legal and/or contractual obligations and regulatory requirements. Where appropriate, clients should consider involving representatives of the Affected Communities to participate in monitoring activities. The client monitoring program must be overseen by an employee of the appropriate level in the organization. For projects with significant impacts, the client will engage external experts to verify its monitoring information. The scope of monitoring must be proportionate to the risks and socio-environmental impacts of the project and compatible with compliance requirements; - Monitoring must be adjusted according to performance experience and actions requested by the competent regulatory authorities. The client will document monitoring results and identify and reflect corrective and preventive actions in the program and amended management plans. The client, in collaboration with appropriate and relevant third parties, will take these corrective and preventive actions and follow them up in subsequent monitoring cycles to ensure their effectiveness; - The effectiveness and performance of the ESMP must be reported to top management periodically so that it adopts necessary and appropriate measures to ensure that the objectives of the Policies are achieved and that the procedures, practices and plans implemented are considered effective.	**APPLICABLE.** Monitoring the implementation of mitigation measures is an integral part of this ESMP. The socio-environmental monitoring and follow-up of the project will be ensured by the Socio-environmental Monitoring and Workplace Safety Team (see chapter 10.1). The Team will also be responsible for drawing up monthly socio-environmental and safety reports on site in order to monitor the performance and effectiveness of the ESMP of the contract and report to top management, in order to assess the need to update the defined management programs.
			PS1: STAKEHOLDER ENGAGEMENT - Clients should identify potential stakeholders in their actions and consider how external communications can facilitate dialogue with all identified stakeholders; - The client must develop and implement a Stakeholder Engagement Plan scaled according to the risks and impacts and the development phase of the project and adapted to the characteristics and interests of the Affected Communities. When applicable, the SEP must include differentiated measures to allow the effective participation of people identified as disadvantaged or vulnerable. When the stakeholder engagement process relies substantially on community	**APPLICABLE.** In the Stakeholder Engagement Plan (see Annex II of the SR of the ESIA) potential stakeholders are identified and respective communication strategies defined to facilitate dialogue with all identified stakeholders, including disadvantaged and/or vulnerable stakeholders. In order to ensure adequate inclusion, participation and involvement of the consulted stakeholders, separate consultation sessions (individual) and/or in small groups are defined in the SEP in order to facilitate access and inclusion of vulnerable groups. As defined in the Management Program (see Chapter 10.2.2.2) the activities related to the

Performance Standard	Objectives	Application	Requirements	Assessment
			representatives, the client should make all reasonable efforts to ensure that such persons truly represent the views of the Affected Communities and that they can be trusted to faithfully communicate to their constituents the results of the consultation; - In cases where the exact location of the project is not known, but its implementation is expected to have significant impacts on local communities, the client will prepare a Stakeholder Engagement Framework as part of its management program, outlining general principles and a strategy for identifying Affected Communities and other relevant stakeholders, as well as a plan for an engagement process consistent with this Performance Standard, which will be implemented once the project location is known; - Disclosure of relevant project information should help Affected Communities and other stakeholders to understand the risks, impacts and opportunities of the project. The customer must provide the Affected Communities with access to relevant information regarding: (i) the Purpose, nature and size of the project; (ii) the duration of the proposed project activities; (iii) any risks and potential impacts to such communities and relevant mitigation measures; (iv) envisaged stakeholder engagement process; and (v) the grievance mechanism; - When the Affected Communities are subject to identified risks and adverse impacts caused by the project, the client will undertake a consultation process in order to provide the Affected Communities with the opportunity to express their views on the risks, impacts and mitigation measures of the project and allow the client to analyze and respond to them. The extent and degree of involvement required by the consultation process should be proportionate to the risks and adverse impacts of the project and the concerns expressed by the Affected Communities. Effective consultation is a two-way process that should: (i) start at the earliest stages of the socio-environmental risks and impacts identification process and continue uninterrupted as risks and impacts emerge; (ii) be based on prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible	Public Consultation process must be detailed in periodic reports (monthly, quarterly or annual) in order to monitor the degree of implementation of the actions implemented and respective social performance of the project. During the relevant Consultations carried out in the pre-Construction phase (5 and 6 of January 2023), relevant information on the project was disclosed, namely: ▪ Scope, objectives and provisional location of the project (based on the fact that, at the time, demining work was still ongoing); ▪ Duration of the contract; ▪ Project Management Policies, including the Grievance Management and Data Protection Mechanism; ▪ Explanation of the environmental and social impact assessment process and the main expected impacts; ▪ Explanation of the consultation and public consultation process and the objectives of these processes. The stakeholders consulted within the scope of the process gave their prior consent (see Annex III - SEP Questionnaire Model - Annex II of the SR of ESIA) Throughout the construction and operation phase of the project, the executing entity and proponent of the project must ensure that systematic public consultations are carried out with stakeholders, and may, for this purpose, subcontract a competent consulting firm for the purpose, in order to guarantee the carrying out of a process of informed, effective and inclusive participation and consultation. - The project is not expected to have adverse impacts on Indigenous People, as although ethnic groups in the areas of influence of the project (see **Figure 203**) who speak some dialects/mother tongues were identified, the community also speaks the official language (Portuguese) and does not self-identify as belonging to a distinct indigenous cultural group that is recognized as such. At the same time, they are fully integrated into society.

Performance Standard	Objectives	Application	Requirements	Assessment
			information in the local language(s) and in a culturally appropriate and understandable format for the Affected Communities; (iii) emphasize the inclusive involvement of those directly affected as opposed to those not directly affected; (iv) be free from outside manipulation, interference, coercion or intimidation; (v) allow for significant participation, when applicable; and (vi) be documented. The client will adapt its consultation process to the language preferences of the Affected Communities, its decision-making process and the needs of disadvantaged or vulnerable groups. If customers are already involved in this process, they must provide adequate and documented proof of such involvement; - The Client must ensure that an Informed Consultation and Participation (ICP) process is carried out. The consultation process should: (i) capture the views of men and women, if necessary, through separate forums or engagements; and (ii) reflect the different concerns and priorities of men and women regarding impacts, mitigation mechanisms and benefits, if appropriate. The client will document the process, particularly measures taken to avoid or minimize risks and adverse impacts to Affected Communities, and inform affected people of how their concerns are being addressed and/or addressed; - In the case of projects with adverse impacts on Indigenous People, the client must include them in a ICP process and, under certain circumstances, must obtain their Free, Prior and Informed Consent (FPIC). The requirements related to Indigenous People and the definition of the special circumstances that require FPIC are described in Performance Standard 7; - In cases where stakeholder engagement is the responsibility of the host government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve results consistent with the objectives of this Performance Standard. If the government-led process does not meet the relevant requirements of this Performance Standard, the client will undertake a follow-up process and, where appropriate, identify follow-up actions.	
			PS1: EXTERNAL COMMUNICATIONS AND GRIEVANCES MECHANISMS	**APPLICABLE.** The Grievance Management Mechanism is set

Performance Standard	Objectives	Application	Requirements	Assessment
			- Implement and maintain a procedure for external communications that includes methods for: (i) receiving and recording external communications from the public; (ii) review and evaluate the issues raised and determine how to address them; (iii) provide, monitor and document responses, if any; and (iv) adjust the management program, as appropriate. Furthermore, clients are encouraged to make available to the public periodic reports on their socio-environmental sustainability; - Where there are Affected Communities, the client should establish a grievance and grievance management mechanism. The grievance mechanism should be proportionate to the risks and adverse impacts of the project, and the Affected Communities should be its primary users. The grievance mechanism should seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate and readily accessible and without cost or retaliation to the party making the complaint and/or complaint. The mechanism must not prevent access to judicial or administrative measures. The client will inform Affected Communities about the mechanism throughout the stakeholder engagement process.	out in Chapter 12 of this ESIA summary report. This chapter contains the key principles, the description of the procedure and the main stages of the procedure that should be adopted throughout the project. All complaints and complaints received will be registered in a specific complaint form to assign an individual reference number.
			PS1: CONTINUOUS PREPARATION OF REPORTS TO AFFECTED COMMUNITIES - The Client shall provide the Affected Communities with periodic reports describing progress in implementing the project's Action Plans on issues involving ongoing risks or impacts on the Affected Communities and also on issues that the consultation process or grievance mechanism have identified as concerns for these Communities. If the management program results in relevant changes or additions to the measures or mitigation actions described in the Action Plans referring to problems of concern to the Affected Communities, the updated relevant measures or mitigation actions will be communicated to those Communities. The frequency of these reports should be commensurate with the concerns expressed by the Affected Communities, but not less than once a year.	**APPLICABLE.** As defined in the Stakeholder Engagement Plan, the information contained in the periodic reports describing the socio-environmental performance of the project must be disclosed to the stakeholders throughout its life cycle. It should be noted that disclosure of the ESIA and ESMP will precede approval so that any concerns are raised and addressed before the project is approved and licensed.
Performance Standard 2: Labor and Working Conditions	- To promote the fair treatment, non-discrimination, and equal opportunity of workers;	Performance Standard 2 applies to all projects that present socio-environmental risks and impacts.	**PS2: WORKING CONDITIONS AND RELATIONSHIP MANAGEMENT WITH WORKERS**	**APPLICABLE.** - The Project shall comply with national legislation and EHS Guidelines and other

Performance Standard	Objectives	Application	Requirements	Assessment
	- To establish, maintain, and improve the worker-management relationship; - To promote compliance with national employment and labor laws; - To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply Chain; - To promote safe and healthy working conditions, and the health of workers; - To avoid the use of forced labor.	Inspired by several international conventions and instruments, including those of the International Labor Organization (ILO), this Standard focuses on protecting the basic rights of workers. Thus, it aims to provide safe and healthy working conditions to this important affected group, so that: i) strict compliance with local legislation occurs; ii) no type of unequal treatment occurs; It is iii) an improvement in relations between workers and management is promoted, especially workers belonging to more vulnerable groups. In addition to meeting the requirements of the Performance Standards, clients must comply with applicable national laws, including those implementing host country obligations under international law.	- The client must adopt and implement human resources policies and procedures appropriate to its size and workforce, which define its approach to managing workers in compliance with PS2 requirements and national laws; - The client must provide workers with documented, clear and understandable information about their rights under national labor and employment law and any applicable collective agreements, including their rights pertaining to working hours, wages, overtime, compensation and benefits at inception of the employment relationship and when any significant changes occur; - When the client is part of a collective bargaining agreement with a workers' union, this agreement must be respected. If no such agreement exists or the agreement does not provide for working and employment conditions, the customer must provide reasonable working and employment conditions; - The client must identify migrant workers and ensure that they are hired on terms and conditions substantially equivalent to those of non-migrant workers performing similar work: - When accommodation services are provided to workers who fall within the scope of PS2, the customer will adopt and implement policies on quality and management of accommodation and on the provision of basic services. Accommodation services should be provided in a manner consistent with the principles of non-discrimination and equal opportunities. Workers' accommodation agreements shall not restrict workers' freedom of movement or association; - The client shall not make employment decisions based on personal characteristics unrelated to the requirements inherent in the service The client shall base the employment relationship on the principle of equal opportunities and fair treatment and shall not discriminate with respect to any aspect of the employment relationship, such as recruitment and hiring, remuneration (including wages and benefits), working and employment conditions, access to training, assignment of position, promotion, termination of employment or retirement and disciplinary practices. The client must take steps to prevent and address issues of harassment,	reference requirements and/or international conventions in order to ensure adequate employment and working conditions for all workers by ensuring: - safe and healthy working conditions; - the protection of the workforce; - occupational health and safety. To this end, the Project has defined Project Management Policies (*see* Chapter 5.7) which express the composition of top management for the fulfillment of these applicable national requirements and international good practices. The workers assigned to the project will be housed on a living basis, located in the Main and Secondary Jobsites equipped with basic infrastructures necessary to ensure adequate conditions of safety, quality, hygiene and comfort. Periodic training will be administered to workers in order to inform them about the Project Management Policies, complaint mechanism, legislation, rights and duties of workers, risks and procedures and good practices defined to prevent risks and impacts, among others. The management policies defined within the project are: • Code of Ethics and Legal Compliance; • Prevention of Criminal Risks; • Secrecy and Confidentiality; • Data Protection; • Prevention Program of the Occupational Risk Management System; • Environmental Protection; • Protection, Participation and Social Inclusion; • Protection of Workers; • Prevention of Sexual Harassment; • Commitment to Respect for Human Rights. - It should be noted that there is no provision for collective redundancies within the scope of the project, so this requirement does not apply. - According to the Project Management Policy, the Project will not use child labor, nor of trafficked persons, so these requirements are not applicable.

Performance Standard	Objectives	Application	Requirements	Assessment
			intimidation and/or exploitation, especially with regard to women. The principles of non-discrimination apply to migrant workers; - Before making any collective dismissals, the client will make an analysis of the alternatives for the reduction. - The customer must ensure that all employees receive timely notice of dismissal and the severance amounts determined by law and collective agreements. All payments due, social security contributions and outstanding benefits will be paid (i) to workers at the time of termination of the employment relationship or earlier, (ii) where appropriate, for the benefit of workers or (iii) payment will be made according to a schedule guaranteed through a collective agreement. When payments are made for the benefit of workers, they must receive proof of payment. - The customer must provide workers (and their unions, if any) with a grievance mechanism through which they can voice their concerns about the workplace. **PS2: WORKFORCE PROTECTION** - The client will not employ children in any way that is economically exploitative, that may be dangerous or interfere with the child's education, or that may be harmful to the child's health or physical, mental, spiritual, moral or social development. The customer will identify the presence of any minors under 18 years of age. If national legislation contains provisions on the employment of minors, the customer will observe the laws that apply to him. Minors under the age of 18 will not be employed in hazardous activities. All work performed by persons under the age of 18 shall be subject to an appropriate risk assessment and regular monitoring of their health, working conditions and working hours; - The client must not make use of forced labor, which consists of any non-voluntary work or service that is required of a person under coercion or penalty. This involves any type of non-voluntary or compulsory work, such as unpaid work, debt bondage, or similar methods of staffing. The client will not employ trafficked persons. **PS2: OCCUPATIONAL HEALTH AND SAFETY** The client must provide workers with a safe and healthy working environment that takes	- **APPLICABLE.**.Following what is expressed in the Project Management Policies, several programs and Plans are defined in the Environmental and Social Management Plan, including, the Safety and Health Plan that will ensure compliance with occupational health and safety requirements; - **APPLICABLE.** In the need to resort to outsourced contracting, these must comply with what is defined in the Project Management Policies, being a mandatory requirement for the hiring of third parties. If outsourced workers do not have a complaint and complaint management mechanism, they may use the one defined for the project. - **APPLICABLE.**The supply chain will be systematically monitored within the project in order to avoid the risk of child and/or forced labour as expressed in the Management Policies; - If the service providers and/or suppliers do not comply with the objectives and requisites of the project ESMP, the main supply chain of the project will be replaced by another that complies with the Project Management Policies**.**

Performance Standard	Objectives	Application	Requirements	Assessment
			into account the risks inherent in their particular sector and the specific classes of hazards in their areas of work, including physical, chemical, biological and radiological hazards, as well as specific threats to women. The client must take measures to prevent accidents, injuries and diseases resulting from the work, associated with it or occurring during its course, minimizing as reasonably practicable the causes of danger. Consistent with international industry best practices, as reflected in a number of internationally recognized sources, including the World Bank Group's Environmental, Health and Safety Guidelines, the client should address areas that include (i) identifying potential risks to workers, especially those that may threaten their lives; (ii) adoption of preventive and protective measures, including modification, replacement or elimination of hazardous conditions or substances; (iii) training of workers; (iv) documentation and notification of accidents, diseases and occupational incidents; and (v) agreements on emergency prevention, preparedness, and response. **PS2: OUTSOURCED WORKERS** - Ensure that companies that hire outsourced workers are reputable and legitimate companies and that they have an appropriate EMS that is compatible with PS2 requirements; - The customer shall establish policies and procedures to manage and monitor the performance of these third-party employers with respect to PS2 requirements. In addition, the customer must make commercially reasonable efforts to incorporate these requirements into the contractual agreements entered into with these third-party employers; - The client must ensure that the contracted outsourced workers have access to a complaint mechanism. In cases where the third party is unable to provide a complaint mechanism, the customer will extend its own complaint mechanism to serve the workers hired by the third party. **PS2: SUPPLY CHAIN** - If there is a high risk of child or forced labor in the main supply chain, the customer must identify these risks. If cases of child or forced	

Performance Standard	Objectives	Application	Requirements	Assessment
			labor are identified, the client will take appropriate measures to correct them. The customer shall monitor the main suppliers in its supply chain on an ongoing basis in order to identify any significant changes and, should new risks or incidents of child and/or forced labour be identified, the customer shall take appropriate measures to correct them. Where there is a high risk of security issues related to workers in the supply chain, the customer shall adopt procedures and mitigation measures to ensure that key suppliers in the supply chain are taking measures to prevent or correct life-threatening situations; - The customer's ability to fully address these risks will depend on their level of management control or their influence over their key suppliers. When it is not possible to correct these risks, the customer must exchange the main supply chain of the project over time for suppliers able to demonstrate that they are acting in compliance with this Performance Standard	
Performance Standard 3: Resource Efficiency and Pollution Prevention	- Avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution resulting from project activities; - Promote more sustainable use of resources, including energy and water; - Reduce GHG emissions related to the project.	By recognizing that environmental resources are scarce, this standard promotes their efficient use, as well as the prevention and control of pollution, including that from the emission of greenhouse gases. To this end, this Standard suggests the adoption of viable technologies and good international practices in order to avoid and minimize adverse impacts on human health and the environment. Performance Standard 3 applies to all projects that present socio-environmental risks and impacts. **The implementation of the project should ensure efficient management of resources and prevent pollution.**	**PS3: RESOURCE EFFICIENCY** **-** During the life cycle of the project, the client must consider the environmental conditions and apply the principles and techniques that are technically and financially feasible, that promote resource efficiency and pollution prevention and that are most appropriate to avoid adverse impacts on human health and the environment and if it is not possible, to minimize them. The principles and techniques applied during the life cycle of the project should be adapted to the risks and hazards associated with the nature of the project and compatible with international industry good practices (BIS), as reflected in several internationally recognized sources, including the World Bank Group's Environment, Health and Safety Guidelines (EHS Guidelines); **-** The customer should consult the EHS Guidelines or other internationally recognized sources, as appropriate, when evaluating and selecting resource efficiency and pollution prevention and control techniques for the project. The EHS Guidelines contain the performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from the levels and measures presented in the EHS Guidelines, customers must reach the levels that have been most stringent. If levels	**APPLICABLE.** The Project must be implemented in order to guarantee a sustainable management of resources and minimize the pollution resulting from the project's activities throughout its life cycle, namely in the construction, exploration and decommissioning phases. - It is estimated that water consumption, based on the construction and cleaning activities to be carried out within the contract, is around 94.000 m^3 for the entire contract (*see* **Chapter 5.3.1.2.**). However, during the contract, monitoring of consumption and the adoption of mitigation and reduction measures will be ensured in order to avoid wasting water and ensure proper management of this natural resource; - In the course of constructive activities will always be adopted the Principle of Waste Prevention and Reduction. In this sense, the Executing Entity will implement waste management measures that give priority to reduction operations, followed by reuse/re-incorporation, recycling (when feasible) and finally, the disposal operation (landfilling). Thus, whenever technically possible, the material resulting from the excavation will be

Performance Standard	Objectives	Application	Requirements	Assessment
			or measures less stringent than those indicated in the EHS Guidelines are appropriate in view of the specific circumstances of the project, the client will provide a full and detailed justification of any proposed alternatives through the process of identifying and assessing socio-environmental risks and impacts. This justification must demonstrate that the choice of any alternative performance levels is compatible with the PS3's objectives; - When the project is a potentially significant water consumer, the customer, in addition to applying the resource efficiency requirements of this Performance Standard, must adopt measures that prevent or reduce water use so that the project's water consumption does not have significant adverse impacts on other people. Such measures include, among others, the use of additional technically feasible water conservation measures in the customer's operations, the use of alternative water supply sources, offsets of water consumption to reduce the total demand for water resources within the scope of the available supply, and evaluation of alternative sites for the project. **PS3: POLLUTION PREVENTION** - The customer must avoid the emission of pollutants or, when it is not possible to avoid, minimize and/or control the intensity and flow of the mass of its emission. This applies to the release of pollutants into the air, water and soil due to routine, non-routine or accidental circumstances, with the possibility of causing local, regional and transboundary impacts. When there is historical pollution, such as soil or groundwater contamination, the customer will seek to determine whether it is responsible for mitigation measures. If it is established that the customer is legally liable, these responsibilities will be resolved in accordance with national law or, where this is omitted, with BPIS; - To address potential adverse impacts of the project under existing environmental conditions, the customer will consider relevant factors, including, for example, (i) existing environmental conditions; (ii) the finite assimilative capacity of the environment; (iii) current and future land use; (iv) the proximity of the project to areas	reincorporated in a ditch, in order to prevent the amount of construction and demolition waste produced during the construction activities. Waste prevention also seeks to reduce the adverse impacts on the environment and human health resulting from the waste produced and the content of hazardous substances present in materials and products. Thus, the waste will be stored in a specific place (waste park), properly waterproofed and covered, in the support yards, until its forwarding to the destination of recovery and / or for final disposal by Waste Management Operator (OGR) duly licensed by the National Waste Agency (ANR) (*see* Chapter 5.3.4 and Waste Management Plan); - The application and handling of pesticides is not applicable to the project, since their application is not foreseen within the scope of the project.

Performance Standard	Objectives	Application	Requirements	Assessment
			important for biodiversity; and (v) the potential for cumulative impacts with uncertain and/or irreversible consequences. In addition to applying the relevant measures to resource efficiency and pollution control required in this Performance Standard, when the project has the potential to be a significant source of emissions in an already degraded area, the customer will consider additional strategies and adopt measures that avoid or reduce the negative effects. Such strategies include, inter alia, the assessment of alternative sites for the project and means of offsetting emissions; - The customer must avoid the production of hazardous and non-hazardous waste. When it is not possible to avoid the generation of waste, the customer must reduce the production of this waste, recovering and reusing it in a way that is safe for human health and the environment. When it is not possible to recover or reuse the waste, the customer must treat, destroy or dispose of it in an environmentally safe manner, including adopting an appropriate control of emissions and residues resulting from the handling and processing of waste. If the waste generated is considered hazardous, the customer must adopt BPIS alternatives to carry out the environmentally safe disposal of such waste, observing the limitations applicable to its transboundary transport. When the disposal of hazardous waste is done by a third party, the customer will use well-regarded and legitimate contractors, licensed by the relevant governmental regulatory bodies, and must obtain documentation from the chain of custody to the final destination. It is up to the customer to verify that the sites licensed for elimnation are being operated to acceptable standards and, if this is the case, the customer must use these sites. Otherwise, the customer should reduce the waste sent to such sites and consider other disposal options, including the possibility of establishing their own recovery or disposal facilities at the project site; - The customer must avoid the release of hazardous materials or, where this is not possible, minimize and control such emission. In this context, the production, transport, handling, storage and use of hazardous materials in project activities should be	

Performance Standard	Objectives	Application	Requirements	Assessment
			assessed. When hazardous materials are intended to be used in manufacturing processes or other operations, the customer should consider less hazardous substitutes. The customer must avoid the manufacture, marketing and use of hazardous chemicals and materials subject to international bans or gradual interruptions due to the high level of toxicity to living organisms, environmental persistence, possibility of bioaccumulation or possible destruction of the ozone layer; - Efficient and safe management of pesticide handling and application.	
Performance Standard 4: Community Health and Safety	- Predict and avoid adverse impacts on the health and safety of the Affected Community during the life cycle of the project, whether due to routine or non-routine circumstances; - Ensure that the protection of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to Affected Communities.	The applicability of this Performance Standard is established during the process of identifying socio-environmental risks and impacts. The implementation of the necessary actions to comply with the requirements of this Performance Standard is managed by the Environmental and Social Management System of the client/borrower, whose elements are described in Performance Standard 1. This Standard deals with new impacts or aggravation of existing impacts on communities surrounding the project. The objective of this Standard is to make the project, workers and their structures prevent and avoid adverse impacts on the health and safety of the surrounding population throughout the life cycle of the project, whether these impacts are foreseen or unexpected, direct or indirect. This Performance Standard **addresses the potential risks and impacts of project activities on Affected Communities, including workers.** Occupational health and safety requirements for workers are included in Performance Standard 2. Environmental standards for the prevention or minimization of the impacts of pollution on human health and the environment are described in Performance Standard 3.	**PS4: COMMUNITY HEALTH AND SAFETY** - The client must assess the risks and impacts on the health and safety of the Affected Communities during the life cycle of the project and establish prevention and control measures in accordance with international good industry practices (BIS),1 such as those described in the World Bank Group's Environmental, Health and Safety Guidelines (EHS Guidelines) or other internationally recognized sources; - It will be the responsibility of the Client to prepare, build, operate and deactivate the structural elements or components of the project in accordance with the BPIS, taking into account the risks to the safety of third parties or the Affected Communities; - The customer must avoid or minimize the potential for community exposure to hazardous materials and substances that may be released by the project; - Adverse impacts on ecosystem services should be avoided and if they are unavoidable, the customer should implement mitigation measures aimed at maintaining the value and functionality of priority services. With respect to the impacts on the priority ecosystem services on which the project depends, customers should minimize the impacts on the priority ecosystem services and implement measures that increase the resource efficiency of their operations; - The client should avoid or minimize the potential for community exposure to waterborne or vector-borne diseases and infectious diseases arising from project activities, taking into account the degree of exposure and increased sensitivity of vulnerable groups; - The client must avoid or minimize the spread	**APPLICABLE.** As part of the process of identifying socio-environmental risks and impacts, measures were defined to minimize and/or avoid adverse impacts on the health and safety of the potentially affected Community. Considering the entire life cycle of the project, as well as emergencies and/or non-routine situations (see Chapter 7 and 10.2.1). In addition to the requirements that the Project must comply with in relation to the Management Policies defined, mitigation measures have been defined in the ESMP that aim to avoid and/or minimize the potential for exposure of the community to diseases transmitted by water or by third parties (workers/community), namely, the supply of drinking water to workers, the definition of environmental protection measures to be adopted during the construction activities in order to avoid pollution of natural resources and the systematic holding of Awareness, Information and Training sessions for workers and the surrounding community. - As stated in the PS1 assessment, where possible the community and government bodies will be involved when conducting practical emergency simulation exercises in order to provide an efficient response in an accident scenario situation. - The construction sites supporting the contract will be duly sealed, signaled and supervised by a Security Team duly qualified for this purpose. The monitoring and evaluation of the provision of services of the Security Company will be ensured in order to ensure compliance with the various requirements and their good performance.

Performance Standard	Objectives	Application	Requirements	Assessment
			of infectious diseases that may be associated with the influx of temporary or permanent labor contracted for the project; - In addition to the emergency preparedness and response requirements outlined in Performance Standard 1, the customer should also assist and collaborate with Affected Communities and local government agencies, as well as other relevant parties, in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. **PS4: SECURITY PERSONNEL** - Whenever the client hires direct or contracted workers to provide security services to protect their employees and property, they will assess the risks generated by their security agreements for people, whether they are on or off the project site. When establishing such agreements, the client shall be guided by the principles of proportionality and good international practice with regard to hiring, standards of conduct, training, equipment and monitoring of such workers and shall be in compliance with applicable legislation; - The customer must assess and record the risks arising from the project's use of government security officials seconded to provide security services. The customer shall ensure that security personnel act accordingly and shall encourage the competent public authorities to disclose to the public the security arrangements for the customer's premises, subject to priority safety concerns. - The client will consider and, where appropriate, investigate all allegations of illegal or abusive acts committed by security personnel, take measures (or request that the parties concerned take them) to prevent such acts from being repeated, and notify public authorities of illegal and abusive acts.	
Performance Standard 5: Land Acquisition and Involuntary Resettlement	- Avoid, and when not possible, minimize displacement by exploring alternative elaborations of the project; - Avoid forced eviction; - Predict and avoid or, where this is not possible, minimize adverse environmental and social impacts arising from land acquisition or restrictions on its use (i) through compensation for loss of property for	Performance Standard 5 recognizes that the acquisition of land related to a project and restrictions on its use can have adverse impacts on the communities and people who use that land. **It is noteworthy that Involuntary Resettlement refers to both physical displacement (relocation or displacement) and economic displacement (loss of assets or**	**PS5: GENERAL ASPECTS** **-** Where displacement cannot be avoided, the customer shall offer displaced communities and persons compensation for loss of property at full replacement cost and other forms of assistance that help them improve or restore their living standards or livelihoods as set forth in this Performance Standard. Standards for compensation will be	**NOT APPLICABLE.** As transmitted by the Executing Entity, no involuntary physical and/or economic resettlement is foreseen within the scope of the project. Regarding the construction phase of the project, land will be temporarily occupied for the installation of infrastructure to support the contract (support yards and temporary deposits) which at the end of the

Performance Standard	Objectives	Application	Requirements	Assessment
	replacement cost and (ii) ensuring that resettlement activities are carried out after appropriate disclosure of information, consultation and informed participation of affected parties; - Improve or restore the livelihoods and living standards of displaced persons; - Improve the living conditions of physically displaced persons by providing adequate housing, with guaranteed ownership in resettlement sites.	**access to goods causing loss of sources of income or other means of subsistence) resulting from the acquisition of land related to a project and/or restrictions on the use of these lands.** Resettlement is considered involuntary when affected persons or communities do not have the right to prevent land acquisition or restrictions on its use, resulting in physical or economic displacement. This occurs in cases of (i) legal expropriation or temporary or permanent restrictions on land use; and (ii) negotiated agreements in which the buyer may resort to expropriation or impose legal restrictions on the use of the land if negotiations with the seller fail. Thus, the first major recommendation is to avoid involuntary resettlement, either by means of alternative locations for the project, or through a negotiation process that seeks an amicable settlement. Where involuntary resettlement is unavoidable, it is necessary to develop an appropriate process of information disclosure, consultation and informed participation of the affected parties in order to obtain a fair negotiation of compensation for the lost goods and services. The long-term goal of this process is to seek the improvement, recovery, or even improvement of the standard of living of resettled people.	transparent and applied uniformly to all communities and people affected by displacement. In cases where the livelihoods of displaced persons are land-based or where the land is collectively owned, the client, where feasible, should offer the relocated persons land-based compensation. The client will only take possession of the acquired land and related assets after compensation is made available and, if applicable, when the locations for resettlement and the cost of moving expenses have been provided to the displaced communities and persons, in addition to compensation. The Client also provides opportunities for communities and displaced persons to adequately benefit from the development provided by the project; - The client should work with the Affected Communities, including the host communities, through the stakeholder engagement process described in PS 1. Decision-making processes related to resettlement and livelihood recovery should include options and alternatives, where applicable. The dissemination of relevant information and the participation of Affected Communities and individuals should continue during the planning, execution, monitoring and evaluation of compensation payments, livelihood recovery and resettlement activities to achieve outcomes that are in line with PS5 objectives. Additional provisions apply to consultations with Indigenous People in accordance with PS7; - As soon as possible during the development phase of the project, the customer should establish a complaint mechanism consistent with the PS1. This will allow the client to receive and address, in a timely manner, specific concerns about compensation and relocation expressed by displaced persons or members of host communities, including an appeal mechanism designed to resolve disputes impartially; - When involuntary resettlement is unavoidable by virtue of a negotiated agreement or expropriation, a survey should be carried out to gather appropriate socio-economic reference data to identify the persons who will be displaced by the project, determine who will have the right to receive compensation and assistance, and prevent persons who do not have this right as	contract will be duly dismantled, as defined in Chapter. 10.2.2.10. ensuring the restoration of the land's initial conditions. The provisional occupation of the land will be duly authorized by the competent Entity and/or owner. However, although this PS is not applicable, a mitigation measure was preventively defined in the Socio-environmental Mitigation and Improvement Program (MM72) do ESMP requesting the elaboration by the executing entity of a Land Acquisition Procedure, if necessary, during the construction/deactivation phase of the project.

Performance Standard	Objectives	Application	Requirements	Assessment
			opportunistic "occupiers", can claim benefits. In the absence of procedures on the part of the host government, the client must establish a deadline for the qualification of those who will have the said rights. Information regarding the deadline should be well documented and disseminated throughout the project area. - In cases where affected persons reject offers of compensation that meet the requirements of this Performance Standard and where, as a consequence, expropriation proceedings or other legal proceedings are initiated, the client should take opportunities to collaborate with the relevant government body and, if it obtains permission from that body, play an active role in planning, in the execution and monitoring of resettlement; - The client shall establish procedures to monitor and evaluate the implementation of a Resettlement Action Plan or the Livelihood Recovery Plan and take any corrective action as necessary. The degree of monitoring activities shall be proportionate to the risks and impacts of the project. For projects with significant risks of involuntary resettlement, the client should hire competent resettlement professionals to advise on compliance with this Performance Standard and verify the client's monitoring information. Affected persons shall be consulted during the monitoring process; - A Resettlement Action Plan or a Livelihood Recovery Plan shall be deemed to have been implemented when the adverse impacts of resettlement have been addressed in accordance with the relevant plan as well as the objectives of this Performance Standard. Depending on the size and/or complexity of the physical and economic displacement associated with a project, it may be necessary for the client to request an external audit of the Resettlement Action Plan or the Livelihood Recovery Plan to verify that the provisions have been observed. The completion audit should be done as soon as all mitigation measures are substantially completed and once displaced persons are deemed to have received adequate opportunity and assistance to recover their livelihoods in a sustainable manner. The completion audit should be carried out by specialist resettlement professionals as soon	

Performance Standard	Objectives	Application	Requirements	Assessment
			as the agreed monitoring period is completed. The completion audit shall include, as a minimum, an analysis of all mitigation measures implemented by the client, a comparison between the results of the implementation and the agreed objectives, and a decision on whether or not to terminate the monitoring process; - When the exact nature or magnitude of the land acquisition or land use restrictions related to a project with the potential to cause physical and/or economic displacement is unknown because of the development stage of the project, the client shall develop a Framework for the Resettlement and/or Recovery of Livelihoods outlining general principles aligned with this Performance Standard. When the individual components of the project are defined and the necessary information is made available, this structure will be extended to a Resettlement Action Plan and/or Livelihood Recovery Plan and specific procedures. **PS5: OFFSET** - Displaced persons may be those who (i) have formal legal rights to land or property occupied or used by them; (ii) have no formal legal rights to the land or property, but have a claim to that land, which is recognized or recognizable by national law; or that (iii) they have no recognizable legal rights or claims to the land or property occupied or used by them. The census shall establish the situation of displaced persons; - **The acquisition of land and** /or restrictions on the use of such land related to a project may result in both the physical displacement of people and their economic displacement. Consequently, the requirements of this Performance Standard with respect to physical displacement and economic displacement may apply simultaneously; - In the case of physical displacement, the client must develop a Resettlement Action Plan that, at a minimum, includes the applicable requirements of this Performance Standard, regardless of the number of people affected. This will include compensation for the full cost of replenishing the land and other lost property. The Plan will be designed to minimize the negative impacts of displacement; identify development opportunities; develop a resettlement budget and timeline and establish	

Performance Standard	Objectives	Application	Requirements	Assessment
			the rights of all categories of affected persons (including host communities). Special attention will be paid to the needs of the poorest and most vulnerable. The client must document all transactions for the acquisition of land rights, as well as compensation measures and relocation activities; - In the case of projects involving only economic displacement, the client must develop a Livelihood Recovery Plan to compensate the affected persons and/or communities, as well as provide other forms of assistance to meet the objectives of this Performance Standard. The Livelihood Recovery Plan should set out the rights of affected persons and/or communities and ensure that these rights are provided in a transparent, coherent and equitable manner. Mitigation of economic displacement shall be deemed completed when affected persons or communities have received compensation and other assistance in accordance with the requirements of the Livelihood Recovery Plan and this Performance Standard and when they are deemed to have received adequate opportunity to restore their livelihoods; -Economically displaced persons who suffer loss of property or access to property should be compensated for that loss at the full cost of replacement; Temporary support should be provided to all economically displaced persons as needed, based on a reasonable estimate of the time needed to regain their ability to earn income, their levels of production and their standards of living. **PS5: RESPONSIBILITY OF THE PRIVATE SECTOR ACCORDING TO THE RESETTLEMENT MANAGED BY THE PROJECT** -In cases where land acquisition and resettlement are the responsibility of the government, the client must collaborate with the competent government agency, to the extent permitted by it, to achieve results that are consistent with this Performance Standard. In addition, when government capacity is limited, the client should play an active role during the planning, execution, and monitoring of resettlement; - In cases of acquisition of land rights or access rights to it through compulsory measures or negotiated agreements involving physical	

Performance Standard	Objectives	Application	Requirements	Assessment
			displacement, the client must identify and describe government resettlement measures. In the event that such measures do not meet the requirements required by this Performance Standard, the customer shall prepare a Supplementary Resettlement Plan, which, together with the documents prepared by the competent governmental body, shall address the relevant requirements of this Performance Standard (the General Requirements and the requirements for Physical Displacement and Economic Displacement). The client must include in his/her Complementary Resettlement Plan at least: (i) the identification of affected persons and impacts; (ii) a description of the regulated activities, including the rights of displaced persons, provided that they comply with applicable national laws and regulations; (iii) the complementary measures to meet the requirements of this Performance Standard, as permitted by the responsible body and by the implementation schedule; and (iv) the client's financial and implementation responsibilities in the execution of its Complementary Resettlement Plan; - In the case of projects involving only economic displacement, the client should identify and describe the measures that the responsible government agency plans to use to compensate the affected communities and persons. If such measures do not meet the relevant requirements of this Performance Standard, the client must develop a Social and Environmental Action Plan to complement the governmental action. This may include additional compensation for loss of property, as well as additional efforts to recover means of subsistence, if applicable.	
Performance Standard 6: Biodiversity Preservation and Sustainable Management of Living Natural Resources	- Protect and conserve biodiversity; - Maintain the benefits of ecosystem services; - Promote the sustainable management of living natural resources through the adoption of practices that integrate both conservation needs and development priorities.	Performance Standard 6 applies to all projects that present risks and impacts on biodiversity and ecosystems, in order to: - Protect and conserve biodiversity; - Maintain the benefits of ecosystems; - Promote the sustainable management of living natural resources through the adoption of practices that integrate both conservation needs and development priorities. In critical habitat situations, a Biodiversity Action Plan should be drawn up. The requirements of this standard were based	**PS6: GENERAL** **-**The risk and impact identification process set out in PS 1 should consider the direct and indirect impacts related to the project on biodiversity and ecosystem services, and identify significant residual impacts. This process should consider relevant threats to biodiversity and ecosystem services, focusing especially on habitat loss, degradation and fragmentation, invasive alien species, over-exploitation, hydrological changes, nutrient loads and pollution. It should also take into	**APPLICABLE.** A “minor” applicability of this PS is considered since the implementation of the project envisages ensuring the protection and conservation of biodiversity and also because the project is not included in a Critical Habitat and/or in areas with protection and conservation status (*see* **Chapter 6.9**). According to the Ecosystem Services Approach considered in the project's Environmental and Social Impact Assessment

Performance Standard	Objectives	Application	Requirements	Assessment
		on the UN Convention on Biological Diversity. It is defined as a project must manage throughout its implementation and operation the protection and conservation of biodiversity at all its levels, maintain the benefits of ecosystem services (the benefits that people and companies obtain from ecosystems) and promote the sustainable management of living natural resources.	account the different values attributed to biodiversity and ecosystem services by Affected Communities and, where relevant, by other stakeholders. -The client should, as a priority, try to avoid impacts on biodiversity and ecosystem services. Where such impacts cannot be avoided, measures should be taken to minimise them and restore biodiversity and ecosystem services. Given the complexity of predicting the project's impacts on biodiversity and ecosystem services over the long term, the client should adopt an adaptive management practice in which the implementation of mitigation and management measures are sensitive to changing conditions and monitoring outcomes during the life cycle of the project. **PS6: PROTECTION AND CONSERVATION OF BIODIVERSITY** - The hierarchy of mitigation including biodiversity offences that can only be considered after appropriate measures for prevention, minimisation and restoration have been taken into account for the protection and conservation of biodiversity; - The client must not significantly transform or degrade a natural habitat unless all of the following hypotheses are proven: o There are no other viable alternatives within the region for the development of the project in a modified habitat; o The consultation defined the views of stakeholders, including those of Affected Communities, on the extent of transformation and degradation; o And any transformation or degradation will be minimized according to the mitigation hierarchy. - In areas of natural habitat, mitigation measures will be developed so that there is no net loss of diversity when this is feasible. Appropriate actions include: o Avoid impacts on biodiversity through the identification and protection of rehabilitation/preservation areas ("set-asides"): o Implement measures to minimize habitat fragmentation, such as biological corridors;	(*see* **Annex XVII** of the SR of the ESIA), it appears that the project will also not affect priority ecosystem services. At the same time and given that the project is inherent in the rehabilitation of an existing road section and limited to the road easement area, it is not foreseen the need to carry out relevant deforestation activities that would require the elaboration of an Action Plan for Biodiversity with the aim of assessing the eventual net damage to biodiversity and definition of concrete measures for this purpose. At the same time, it considers that the mitigation measures that are defined in the ESMP will be sufficient to prevent possible negative impacts (*see* **Chapter 10.2.1**). It should also be mentioned that the Mitigation Measure MM86 – *If it becomes necessary, within the scope of the construction/deactivation phase, to carry out activities that imply the loss of biodiversity, the Executing Entity, within the scope of the environmental monitoring of the contract, must define strategies for compensation of residual impacts (compensations for loss of biodiversity) through the development and implementation of a Biodiversity Action Plan (BAP),* also defines that, if necessary, during the construction/deactivation phase, as a result of a change to the project, carrying out activities that cause a net loss in the natural habitat, it should be developed and implemented a Biodiversity Action Plan to ensure compensation for biodiversity loss. Finally, it is mentioned that the project activities will not introduce exotic and/or invasive species.

Performance Standard	Objectives	Application	Requirements	Assessment
			○ Restore habitats during and/or after operations; ○ And, implement biodiversity offsets; - . In critical habitat areas, the client should not implement any project activity unless all of the following are proven: ○ Lack of viable alternatives within the region for the development of the project in modified or natural habitats that are not critical; ○ The project does not entail measurable adverse impacts on the biodiversity values for which the critical habitat has been designated, nor on the ecological processes that support those biodiversity values; ○ The project does not entail a net reduction in the global and/or national/regional population of any Seriously Threatened or Threatened species for a reasonable period of time; ○ And, a robust biodiversity monitoring and assessment program, properly designed, long-term and integrated into the client's management program. - In cases where a proposed project is located in a legally protected area or in an internationally recognized area, the client must: ○ Demonstrate that proposed development in such areas is legally permitted; ○ Consistently observe any government-recognized management plans for these areas; ○ Consult with the sponsors and managers of the preservation area, the Affected Communities, the Indigenous People and other stakeholders in the proposed project, as appropriate; ○ and implement additional programs, as appropriate, to promote and strengthen conservation objectives and effective management of the area. - The client shall not intentionally introduce any new exotic species (not currently based in the country or region of the project) unless it does so in accordance with the regulatory framework in place for such introduction.	

Performance Standard	Objectives	Application	Requirements	Assessment
			Notwithstanding the foregoing, the client will not purposely introduce any exotic species that present a high risk of invasive behavior, regardless of whether or not such introductions are permitted under the existing regulatory framework. All introductions of alien species will be subject to a risk assessment (as part of the process of identifying the client's socio-environmental risks and impacts) to determine the possibility of invasive behaviour. The customer will implement measures to avoid the possibility of accidental or involuntary introduction, including the transport of substrates and vectors (such as soil, ballast and plant material) that may harbor exotic species. **PS6: ECOSYSTEM SERVICES MANAGEMENT** -Where there is a possibility that the project will negatively impact ecosystem services, as determined by the process of identifying risks and impacts, the client should conduct a systematic review to identify priority ecosystem services. The following are considered to be priority ecosystem services: (i) those services on which project operations are most likely to have an impact and which therefore result in adverse impacts to Affected Communities and/or; (ii) those services on which the project operations depend directly (such as water). Where Affected Communities are likely to be harmed, they shall participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in PS1. - In relation to impacts on priority ecosystem services that are relevant to Affected Communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided. If these adverse impacts are unavoidable, the customer should minimize them and implement mitigation measures that aim to maintain the value and functionality of the priority services. In relation to the impacts on the priority ecosystem services on which the project depends, customers should minimise the impacts on the priority ecosystem services and implement measures that increase the resource efficiency of their operations, as described in PS3.	

Performance Standard	Objectives	Application	Requirements	Assessment
			PS6: SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES - Customers who are involved in the primary production of living natural resources, including natural forests and forest plantations, agriculture, livestock, aquaculture must comply with the requirements of the sustainable management of living natural resources; -In the absence of a relevant and reliable global, regional or national standard for the specific living natural resource in the country in question, the customer shall: o Commit to adopt operational principles and good international practices in the sector, and make use of the Best Techniques available; and o Actively participate in and support the development of a national standard, where relevant, including studies that contribute to the definition and demonstration of sustainable practices. **PS6: SUPPLY CHAIN** - **When the customer is purchasing primary production** (especially, but not limited to, food and fiber commodities) whose production is notoriously carried out in regions where there is a risk of significant transformation of natural and/or critical habitats, verification systems and practices should be adopted as part of the customer's EMS to evaluate its primary suppliers. verification systems and practices (i) identify the source of supply and habitat type of that area; (ii) provide an ongoing analysis of key suppliers in the customer's supply chain; (iii) limit procurement to those suppliers who can demonstrate that they are not contributing to the significant transformation of natural and/or critical habitats (this may be demonstrated by the supply of certified products or by progress in obtaining verification or certification under a reliable scheme of certain commodities and/or locations); and (iv) where possible, require actions to replace the customer's primary supply chain over time with suppliers who can demonstrate that they are not significantly adversely affecting those areas. The customer must demonstrate the ability to control management and/or influence over its main suppliers.	
Performance Standard 7: Indigenous People	- Ensure that the development process promotes full respect for the human rights,	This Standard assumes that traditional people, including indigenous people,	**PS7: PREVENTION OF ADVERSE IMPACTS** - The client must identify, through a process	**NOT APPLICABLE.** The project is not expected to have adverse

Performance Standard	Objectives	Application	Requirements	Assessment
	dignity, aspirations, culture and livelihoods based on the natural resources of Indigenous People; - Predict and avoid adverse impacts arising from projects on communities of Indigenous People or, when it is not possible to avoid them, minimize them and/or compensate them Indigenous People for such impacts; - Promote the benefits and opportunities of sustainable development for Indigenous People in a culturally appropriate manner; - Establish and maintain an ongoing relationship based on Informed Consultation and Participation (CIP) with the Indigenous People affected by a project throughout its entire life cycle; - Ensure the Free, Prior and Informed Consent (FPIC) of the Affected Communities of Indigenous People in the presence of the circumstances described in this Performance Standard. - Respect and preserve the culture, knowledge and practices of Indigenous People.	represent a vulnerable population, especially when a project directly or indirectly impacts their material and immaterial resources. Likewise, the Standard provides recommendations for actions that should be adopted so that these people benefit from the impacts generated by the project. The objective of this Standard is to ensure respect for the unique characteristics of these people by seeking their free, prior and informed consent in relation to the actions proposed by the project and by establishing a continuous and culturally appropriate communication channel. In this Performance Standard, the term "Indigenous People" is used in a broad sense to refer to a distinct social and cultural group, which presents, to varying degrees, the following characteristics: - Self-identification as members of a distinct indigenous cultural group and recognition of that identity by others; - Collective connection with geographically distinct ancestral habitats or territories within the project area and with the natural resources in them; - Traditional cultural, economic, social or political institutions, separate from those of the dominant society or culture; or - Distinct language or dialect, usually different from the official language or languages of the country or region where they reside. This Performance Standard applies to communities or groups of Indigenous People who maintain a collective connection, that is, whose identity as a group or community is linked to distinct ancestral habitats or territories and to the natural resources existing in them. It may also apply to communities or groups that have lost a collective connection with distinct ancestral habitats or territories within the project area, during the lifetime of the members of the group in question, due to forced separation, conflict, government resettlement programs, expropriation of their lands, natural disasters, or incorporation of these territories into an urban area.	of risk assessment and socio-environmental impacts, all communities of Indigenous People located within the area of influence of the project that may be affected by it, as well as the nature and degree of economic, social, cultural (including cultural heritage) and environmental impacts on these communities; - Where possible, adverse impacts on Affected Communities of Indigenous People should be avoided. When alternatives are explored and adverse impacts are unavoidable, the client shall minimize, restore and/or compensate such impacts in a culturally appropriate manner proportionate to the nature and extent of those impacts and the vulnerability of the Affected Communities of Indigenous People. The actions proposed by the client will be developed with the Informed Consultation and Participation (CIP) of the Affected Communities of Indigenous People and contained in a plan with a defined schedule, such as a Plan for Indigenous People or a broader community development plan with separate components for Indigenous People; -The customer must undertake a process of engagement with the Affected Communities of Indigenous People as required in PS1. This engagement process should include stakeholder analysis, engagement planning, information dissemination, and consultation and participation in a culturally appropriate manner. In addition, this process must: ○ Involve the representative bodies and organizations of Indigenous People (e.g., councils of elders or village councils), as well as members of the Affected Communities of Indigenous People; and ○ Allow Indigenous People sufficient time for decision-making processes. - Free, Prior and Informed Consent (FPIC) must be created through negotiation and good faith between the Client and the Affected Communities of Indigenous People. The customer must document: i) the mutually agreed process between the client and the Affected Communities of Indigenous People, and (ii) evidence of agreement between the parties as a result of the negotiations. The FPIC does not necessarily require	impacts on Indigenous People, as although ethnic groups in the project's areas of influence (see **Figure 203**) who speak some dialects/mother tongues were identified, the community also speaks the official language (Portuguese) and does not self-identify as belonging to a distinct indigenous cultural group that is recognized as such. 194 surveys were carried out in Portuguese.

Performance Standard	Objectives	Application	Requirements	Assessment
			unanimity and can be obtained even if individuals or groups within the community explicitly disagree. **PS7: CIRCUMSTANCES REQUIRING FREE, PRIOR AND INFORMED CONSENT** - In the event that the client proposes to locate a project or commercially exploit natural resources on lands traditionally owned or subject to customary use by Indigenous People and adverse impacts can be expected, the client must take the following steps: o Document efforts to avoid and otherwise minimize the extent of land proposed for the project; o Document efforts to avoid or otherwise minimize impacts on natural resources and natural areas of importance to Indigenous People; o Identify and analyze all interests in ownership and uses of traditional resources before buying or leasing land; o Assess and document the use of resources by Affected Communities of Indigenous People without prejudice to any claim by Indigenous People to land. The assessment of land and the use of natural resources should cover both sexes and specifically consider the role of women in the handling and use of these resources; o Ensure that Affected Communities of Indigenous People are informed of their rights with respect to land under national law, including any national law recognizing customary use rights; and o Offer Affected Communities of Indigenous People compensation and due process of law in the event of commercial exploitation of their lands and natural resources, along with culturally appropriate sustainable development opportunities, including: - Provision of land-based compensation or in-kind compensation in lieu of monetary compensation, where feasible. - Ensuring continued access to natural resources by identifying equivalent replacement resources or, as a last option, providing compensation and identifying	

Performance Standard	Objectives	Application	Requirements	Assessment
			alternative livelihoods should the development of the project result in loss of access and loss of natural resources, regardless of the acquisition of land for the project. - Ensuring a fair and equitable participation in the benefits associated with the use of resources by the project when the client intends to use natural resources that are fundamental to the identity and livelihood of the Affected Communities of Indigenous People and when the use of these resources increases subsistence risks. - Providing Affected Communities of Indigenous People with access, use and transit on the land being exploited, subject to priority health and safety considerations. - The client must take into account the definition of viable alternatives to the project to avoid the relocation of Indigenous People from communally owned lands and natural resources subject to traditional ownership or customary use. If such relocation is unavoidable, the client will only proceed with the project if it has obtained a FPIC as described above. Any relocation of Indigenous People must comply with PS5 requirements. Where feasible, relocated Indigenous People should be able to return to their traditional or customary lands if the cause of their relocation ceases to exist. - Where a project can significantly impact critical cultural heritage that is essential to the identity and/or cultural, ceremonial or spiritual aspects of the lives of Indigenous People, priority will be given to preventing such impacts. When significant impacts of the project on critical cultural heritage are unavoidable, the client must obtain the FPIC of the Affected Communities of Indigenous People; **PS7: MITIGATION AND BENEFITS OF DEVELOPMENT** - The client and the Affected Communities of Indigenous People will identify mitigation measures compatible with the mitigation hierarchy described in PS1, as well as opportunities for culturally appropriate and sustainable development benefits. The client shall ensure the timely and equitable provision of the agreed measures to the Affected Communities of Indigenous People; -The determination, transfer and distribution of compensation and other measures of	

Performance Standard	Objectives	Application	Requirements	Assessment
			participation in the benefits to Indigenous People will take into account the laws, institutions and customs of these communities, as well as their level of interaction with conventional society. Eligibility for compensation may be on an individual or collective basis or combine the two. When the compensation occurs collectively, mechanisms will be defined and implemented to promote the effective delivery and distribution of compensation to all eligible members of the group.	
Performance Standard 8: Cultural Heritage	- Protect cultural heritage against the adverse impacts of project activities and support their preservation: - Promote the equitable distribution of benefits arising from the use of cultural heritage.	The Standard provides recommendations to protect the cultural heritage that may be affected by the project in some cases, to promote the equitable distribution of the benefits arising from the use of this heritage. To do so, it is determined that the entire work needs to be accompanied by an archaeologist and the workers involved need to be properly trained to identify and rescue any archaeological evidence. The client/borrower shall identify the physical cultural resources likely to be affected by the project and assess potential impacts of the project on those resources as an integral part of the EIAS process in accordance with the requirements of the Financial Institution's EIA.	**PS8: PROTECTION OF CULTURAL HERITAGE IN THE DESIGN AND IMPLEMENTATION OF THE PROJECT** **-**In addition to compliance with applicable legislation regarding the protection of cultural heritage, including national laws that provide for the host country's obligations under the Convention on the Protection of the World Cultural and Natural Heritage, the client must identify and protect cultural heritage by ensuring the adoption of internationally recognized practices of protection, field studies and documentation of cultural heritage. - If the risk and identification process determines the existence of the possibility of impacts on cultural heritage, the client should hire competent professionals to assist in the identification and protection of cultural heritage. **-** The client is responsible for locating and planning a project that avoids significant adverse impacts on cultural heritage. The process of identifying socio-environmental risks and impacts should determine whether the proposed location for a given project is in areas where cultural heritage is expected to be found, either during construction or during operations. In such cases, as part of its EMS, the client must develop measures to manage random discoveries through a random discovery procedure, which will be applied in cases where a cultural heritage is subsequently found. The customer shall not interfere with any random discovery until it has been evaluated by competent professionals and actions consistent with PS8 requirements have been defined; **-** If there is a possibility that a project may affect cultural heritage, the client should consult the Affected Communities of the host	**APPLICABLE.** We consider a “minor" applicability of this PS since as confirmed during the fieldwork, it is not expected that any cultural heritage will be affected by the project since it concerns the rehabilitation of an existing road section.. When carrying out the field work, no property occurrences were identified in the directly affected area ("footprint"), even though the presence of elements of high cultural and heritage value is admitted, as shown, in the area of direct and indirect influence of the project. However, preventively, mitigation measures were defined since, although the existence of relevant archaeological sites had not been identified in a previous phase, it is considered important to provide for a closer and more careful monitoring during the deforestation phase and remaining earthworks for the implementation of project support infrastructures (Mitigation Measure MM124). All heritage occurrences identified along the road section must be preserved *in situ* in their entirety, during the eventual deforestation process. Movable finds recorded during archaeological monitoring must be placed in a deposit accredited by the cultural heritage guardianship body (Mitigation Measure MM125). It should also be noted that the Implementing Entity has, within the scope of its Management System, a procedure for safeguarding property occurrences, which will be implemented during the construction phase of the project.

Performance Standard	Objectives	Application	Requirements	Assessment
			country that use, or remember using, the cultural heritage for long-standing cultural purposes. The client should consult with the Affected Communities to identify important cultural heritage sites and incorporate into the client's decision-making process the opinions of the Affected Communities on that cultural heritage. The consultation shall also involve the competent national or local regulatory bodies responsible for protecting cultural heritage; - If the client's project site contains cultural heritage or prevents access to previously accessible cultural heritage sites that are being used or have been used by the Afetcadas Communities for long-standing cultural purposes, the client shall allow, on the basis of the consultations, continuous access to that cultural site or provide an alternative access route, observing the predominant health and safety considerations; - If the client finds tangible cultural heritage that can be reproduced but is not critical, he must apply mitigation measures that favor prevention. In cases where prevention is not feasible, the customer should apply the following mitigation hierarchy: ○ Minimise adverse impacts and implement on-site restoration measures that ensure the maintenance of the value and functionality of cultural heritage, including the maintenance or restoration of any ecosystem processes necessary to protect it; ○ Where it is not possible to carry out on-site restoration, restore the functionality of the cultural heritage in a different location, including the ecosystem processes necessary to protect it; ○ Remove historical and archaeological artifacts and structures, permanently; ○ And only in cases where the minimisation of adverse impacts and restoration works necessary to ensure the maintenance of the value and functionality of cultural heritage is not demonstrably feasible, and where Affected Communities are using tangible cultural heritage for	

Performance Standard	Objectives	Application	Requirements	Assessment
			long-standing cultural purposes, to offer compensation for the loss of that tangible cultural heritage; - The best way to protect cultural heritage should be to preserve it in its own place, as its removal would likely result in irreparable damage or destruction. The customer must not remove cultural heritage that cannot be reproduced, unless all of the following conditions are met: ○ Technical or financial infeasibility of removal; ○ The overall benefits of the project are far greater than the estimated loss of cultural heritage resulting from the removal; ○ The removal of cultural heritage will be carried out using the best available technique. - The client must not remove and not significantly alter or damage critical cultural heritage. In exceptional circumstances, where impacts to critical cultural heritage are unavoidable, the customer must resort to an Informed Consultation and Participation (CIP) process of the Affected Communities, as described in PS1, which uses a good faith negotiation process and provides a documented outcome. The client must hire external experts to assist in the assessment and protection of critical cultural heritage; -Areas with legally protected cultural heritage are important for the protection and conservation of cultural heritage, and additional measures are required for any projects that may settle in these areas, covered by the applicable national legislation. In circumstances where the proposed project is situated within a legally protected area or a legally demarcated buffer zone, the client, in addition to the requirements relating to critical cultural heritage must meet the following requirements: ○ Compliance with established national and local regulations on cultural heritage or management plans for the protected area; ○ Consultations with the sponsors and managers of the protected area, local communities and other stakeholders about the proposed project and ○ Implementation of additional programs, as appropriate, to promote	

Performance Standard	Objectives	Application	Requirements	Assessment
			and enhance the conservation objectives of the protected area. **PS8: USE OF CULTURAL HERITAGE IN THE PROJECT** - In cases where the project proposes to use cultural heritage, including knowledge, innovations or practices of local communities for commercial purposes, the client must inform these communities about (i) their rights under national law; (ii) the scope and nature of the proposed business development; and (iii) the possible consequences of this development. The customer shall not proceed with such marketing unless it (i) initiates a CIP process as described in PS1 and uses in good faith a trading process that produces a documented result and (ii) ensures a fair and equitable share in the benefits of marketing such knowledge, innovations or practices in accordance with its customs and traditions.	

2.5. Comparison of the National Environmental Legal Framework with the Equator Principles and IFC Performance Standards

The first National Law that focused on environmental issues was the Basic Environmental Law (BEL), Law No. 5/98. The BEL defines the concepts and basic principles of protection, preservation and conservation of the Environment, promotion of the Quality of Life and the rational use of Natural Resources, in accordance with the Constitutional Law of the Republic of Angola. To this end, it states in article 10 that all projects that involve the interests of communities must be subject to environmental and social impact assessment processes, where public consultations are mandatory. Article 16 also mentions the mandatory Environmental Impact Assessment for actions that have implications for environmental and social balance and harmony.

Thus, the General Regulation on Environmental Impact Assessment and the environmental licensing procedure (Decree no. 117/20 of April 22, 2020, which revokes Decree No. 51/04, of 23 July – On Environmental Impact Assessment, and Decree No. 59/07, of 13 July – On Environmental Licensing) appears to establish the rules and procedures that regulate the environmental impact assessment of public and private projects and the environmental licensing procedure for activities that, by their nature, location or size, are likely to have a significant environmental and social impact.

Chapter II of the General Regulation presents a set of requirements on environmental impact assessment, such as exemptions, documents to be submitted, categories, pre-assessment, environmental pre-feasibility study, content of the environmental impact study, content of the simplified environmental study, public consultations, deadlines, opinions, public disclosure and environmental audits.

Chapter III presents a set of requirements on the environmental licensing procedure, declaration of environmental compliance, environmental license for installation, environmental license for operation, renewal, suspension, extinction, transmission, installation of new activities covered by environmental licensing and registration of environmental consultants.

Chapter IV establishes requirements on inspection, fines and fees, while chapter V establishes the environmental license model, which is presented in Annex VI.

The remaining annexes of the diploma are divided into Annex I with activities of category A, Annex II with activities of category B, Annex III with activities of category C, Annex IV with

activities of category D, Annex V with fatal issues to be analyzed in the environmental impact assessment processes.

With regard to the Equator Principles, and as mentioned in **Chapter 2.3**, these were designed to serve as a common basis and framework for financial institutions to identify, assess and manage a project's socio-environmental risks. As referred to in Principle 3 of the EP, the Assessment Processes for Projects taking place in Non-Designated Countries must comply with the applicable IFC Social and Environmental Sustainability Performance Standards and the Environmental, Health and Security of the World Bank Group (EHS Guidelines).

In order to identify the main similarities and differences between Angolan laws and regulations and International Guidelines, namely, the Equator Principles and Performance Standards of the International Finance Corporation, a comparative analysis is presented in the following table (*see* **Table 6**) in order to identify possible gaps and/or discrepancies between the assessment documentation to be presented and the project's categorization for environmental licensing of the project.

Table 6 – Main similarities and differences between Angolan laws and regulations and International Standards and respective GAP analysis with regard to the Environmental Licensing of the project

Item	National Environmental Legislation (Angolan)	Performance Standards IFC (2012)	Equator Principles (EP4)	Differences/Conflicts
Project categorization	The General Regulation for Environmental Impact Assessment and Licensing Procedure is regulated by Presidential Decree No. 117/20 of 22 April 2020. This regulation presents a specific categorization of projects, namely for Category, A, B, C and D. Category D activities are exempt from environmental licensing.	Under PS1, projects are classified into three categories according to the expected magnitude of their negative environmental and social impacts, in which Category A projects are associated with more severe impacts and lack a full EIA; B those with lower impacts, whose measures defined in the ESMP may be sufficient to mitigate and control the identified negative socio-environmental impacts; and C those that do not have significant expected impacts and therefore can be exempted from an EIS, although they are obliged to follow the guidelines and good practices. The IFC also have an FI category that refers to investments of Bank funds through a financial intermediary.	According to EP1, projects are classified into 3 categories, based on the magnitude of risks and potential socio-environmental impacts, which categories are: • Category A – Projects with potential risks and/or significant adverse socio-environmental impacts and that are diverse, irreversible or unprecedented; • Category B – Projects with limited risk potential and/or adverse socio-environmental impacts, few in number, generally local, largely reversible and readily treatable through mitigation measures; and • Category C – Projects with minimal risks and/or socio-environmental impacts or without risks and/or adverse socio-environmental impacts. There may also be a variation in the scale of risks and potential socio-environmental impacts in Projects classified as Category B, classifying them as a Category B of higher risk that will be treated similarly to Category A projects, although in a lighter way (Classification EDFI B+).	In regard to Project Categorization, there is a difference between Angolan rules and International Standards (Equator Principles and Performance Standards of the IFC), however, they categorize the project as Category B.
Environmental Pre-Feasibility Study and Definition of Scope and Terms of Reference	Presidential Decree No. 117/20 of 22 April 2020 refers in its art. 12th, the obligation to prepare an Environmental Pre-Feasibility Study and Scope Definition (EPDA) and Terms of Reference (ToR) for all Category A activities, constituting an obligation of the full responsibility of the proponent of the activity and aims to: - Determine the possible existence of fatal issues regarding the implementation of the activity; - Determine the scope of the EIS and, consequently, the description of the ToR, in cases where there are no fatal issues that make the activity unfeasible. At the same time, Executive Decree 92/12 of March 1ft aims to establish guidelines for the preparation of EIS, for the analysis of the environmental feasibility of projects subject to environmental impact assessment, namely, the terms of reference for the preparation of EIS. The EIS must be prepared in accordance with the legislation on EIA and strictly comply with the ToR approved by the Ministry of the Environment, which guide their preparation. According to the specificity of each project.	The requirements defined by the International Finance Corporation, define several guiding guidelines for the preparation of ESIA, in order to ensure the protection of the environment, the protection of affected communities and disadvantaged or vulnerable groups and the socio-economic sustainability of the project.	EP3 defines the need to verify the Project's socio-environmental compliance with national regulations and international requirements, in order to ensure the socio-environmental protection of the project throughout its entire life cycle.	Since the project is classified as Category B, the elaboration of an EPDA and ToR is not applicable.
Environmental and Social Management Plans	The General Regulation for Environmental Impact Assessment and the Licensing Procedure regulated by Presidential Decree No. 117/20 of 22 April 2020 does not refer to the requirement to carry out an Environmental and Social Management Plan (ESMP), be requested as a mitigation/ compensation measure at the time of the Environmental Licensing of the Project, by the Guardianship Entity.	Under PS1, projects categorized as category A and B must be subject to an EIA that must culminate in the preparation of a ESMP that is intended to outline the strategies to be carried out during the various phases of the project, to monitor, report, assess, review and proactively respond to change and mitigate potential negative impacts of a project.	Under EP2, it is recommended that the Social and Environmental Impact Assessment documentation propose measures to minimize, mitigate and, when there are residual impacts, compensate/resolve the risks and impacts to workers, Affected Communities and the environment in a meaningful way and appropriate to the nature and scale of the Proposed Project.	Although Presidential Decree No. 117/20 of April 22, 2020 and the Equator Principles do not refer to the express need to prepare a ESMP for Category A, B and C projects, during the EIA process, it is recommended to the need to define mitigation and/or compensation measures for project risks and impacts. In this sense, the IFC requirements that recommend the elaboration of a ESMP prevail.

Item	National Environmental Legislation (Angolan)	Performance Standards IFC (2012)	Equator Principles (EP4)	Differences/Conflicts
Waste Management Plan	Presidential Decree No. 190/12 of 24 August, concerning the Regulation on Waste Management and Executive Decree No. 17/13, of 22 January, concerning the Legal Regime for Waste Management Construction and Demolition, refer to the obligation to prepare a Waste Management Plan for the project.	The PS do not specifically refer to the preparation of a Waste Management Plan, however, they refer to the obligation to prevent the production of hazardous and non-hazardous waste, valuing them, whenever possible, to the detriment of final disposal (landfill). At the same time, they refer to the need to ensure correct storage, forwarding and disposal in an environmentally safe manner, using companies duly licensed for this purpose. Licensed sites for the forwarding and disposal of waste must operate to acceptable standards. If not, reduce the amount of waste going to such sites and consider other options for disposal, including the possibility of establishing their own recovery or disposal facilities at the project site.	EP2 defines that an EIA process must be carried out to deal with socio-environmental risks and the scale of the Project's impacts, however it does not specifically mention the elaboration of a Waste Management Plan. This EP refers, however, that pollution prevention and waste minimization, pollution controls (liquid effluents and atmospheric emissions) and waste management which must be ensured during the project.	The obligation to draw up a Waste Management Plan for the project prevails, according to the structure defined in the national legislation. This is a "live" document, so after approval by the Guardianship entity (NWA) it may be revised periodically, depending on any operational changes that may occur, thus remaining duly adequate to the reality and phase of the Project. In accordance with international guidelines, this must always give priority to the prevention, reduction and recovery of waste to the detriment of disposal, ensuring the prevention and control of pollution and proper management of the waste produced.
The environmental authority must issue an environmental permit before any further assessment of a project	Presidential Decree No. 117/20 of 22 April 2020 refers in its art. 16.º the licensing requirement and in its art. 17 explains that the environmental license for installation precedes the environmental license for operation.	PS1 requires approval and disclosure of the EIA by relevant government authorities.	PE8 defines the need to ensure compliance with the socio-environmental contractual clauses of the project, which is why it must comply with all applicable socio-environmental laws, regulations and licenses in Angola in all relevant aspects and the respective guidelines and good international practices.	In all cases disclosure of the EIA precedes approval so that any concerns are raised and addressed prior to approving/licencing the project.

2.6. Result of the Socio-Environmental Categorization Framework

This subchapter (*see* **Table 7**) presents the result of the project categorization considering the National Legislation, the IFC Performance Standards and the Equator Principles, in view of the framework made in the subchapters prior to the Chapter 2.

Table 7 - Summary analysis of project categorization as defined in National Legislation, IFC Performance Standards and Equator Principles

International Legislation and Requirements	Framework for the socio-environmental categorization of the project
National Legislation - Decree No. 117/20 of April 22, 2020	Given the typology of the project under analysis, it fits in **Point 15**, **Annex II** of Decree No. 117/20 of April 22, 2020, namely in **Category B Activities**, **point j)** "*All main roads outside of the urban area*". Thus, it lacks an Environmental Impact Assessment procedure.
IFC Performance Standards	IFC's Environmental and Social Categorization process is intended to reflect the magnitude of risks and impacts of a given Project. Based on the applicability of the IFC requirements presented in **Chapter 2.4.1.**, the results of the ESIA process presented in the present study show that *the potential risks and negative environmental impacts are few in number, generally site-specific, largely reversible and readily available and treated through mitigation measure*s, so the project will fall under **Category B**.
Equator Principles	The categorization of EP based on the IFC socio-environmental categorization process, which is proportional to the socio-environmental risks and/or impacts foreseen for the project. Taking into account the results of the ESIA process, the project will fall into **Category B**: "*Projects with limited risk potential and/or adverse socio-environmental impacts, in small numbers, generally local, largely reversible and readily treatable through measures mitigation measures"*.

The analysis of the previous table (*see* **Table 7**) shows a harmonization of the criteria with regard to the framework of the socio-environmental categorization of the project, classifying it as **Category B**.

With regard to the content of the ESIA, the most rigorous requirements and the most robust methodologies will prevail in order to guarantee the desired performance standards in the assessment of risks and socio-environmental impacts of the project under analysis in this report.

2.7. International Conventions and Good Practices

2.7.1. International Charter of Human Rights

The UN Human Rights System is made up of nine treaties, focusing on all types of human rights. The Universal Declaration, the International Covenant on Civil and Political Rights (ICCPR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR) form what is called the International Bill of Human Rights. The International Bill of Human Rights is

the cornerstone of a series of international human rights treaties that embody a variety of different rights. The principal international human rights treaties incorporate:

- Civil and Political Rights (International Covenant on Civil and Political Rights);
- Economic, Social and Cultural Rights (International Covenant on Economic, Social and Cultural Rights);
- The elimination of racial discrimination (Convention on the Elimination of All Forms of Racial Discrimination);
- The elimination of discrimination against women (Convention on the Elimination of All Forms of Discrimination against Women);
- Protection against torture (Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment);
- The Rights of Children (Convention on the Rights of the Child);
- The Rights of Migrant Workers (Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families);
- The Rights of People with Disabilities (Convention on the Rights of People with Disabilities); and
- Protection against Enforced Disappearance (Convention for the Protection of All People from Enforced Disappearance).

In order to improve the social performance of the project, the aforementioned human rights reflected in the Project Management Policies will be fulfilled. The organizational policy from a human rights perspective will contribute to the success of the project's human relations management.

2.7.2. United Nations Guiding Principles on Business and Human Rights

The 2011 United Nations Guiding Principles on Business and Human Rights (UNGPs) promote the human rights due diligence approach - business policies to identify, prevent and mitigate risks of adverse human rights impacts on its operations and the account. Despite their non-binding nature, they are still the most authoritative regulatory framework in this area. Currently, all companies have a responsibility to respect human rights under the UNGPs. This responsibility aims to prevent (eg, in case of rape, repair) intolerable situations of social atrocities caused or enhanced by business activities, such as human trafficking, child labour, modern slavery, forced displacement of communities or discriminatory practices based on

gender, ethnicity, disability or sexual orientation, among others. In view of the above, the project, will adopt the principles referred to in the UNGPs, expressing its commitment through the Project Management Policies referred to in **Chapter 5.7**.

2.7.3. Fundamental Convention of the International Labor Organization (ILO)

The project will adopt the fundamental principles and rights at work contained in the Fundamental Convention of the International Labor Organization (ILO). Considering that economic growth is essential, but not sufficient to ensure equity, social progress and poverty eradication, the need for the ILO to promote strong social policies, justice and democratic institutions is confirmed.

The ILO Governing Council qualified eight conventions as fundamental, which deal with issues considered as fundamental principles and rights at work, namely, freedom of association and effective recognition of the right to collective bargaining, elimination of any and all forms of forced or compulsory labour, effective abolition of child labor and elimination of discrimination in terms of employment and occupation.

These principles are also set out in the ILO Declaration on Fundamental Principles and Rights at Work (1998).

The fundamental conventions are as follows:

- Convention No. 182, Worst Forms of Child Labor, 1999;
- Convention No. 138, on the Minimum Age, 1973;
- Convention No. 111 on Discrimination (Employment and Occupation), 1958;
- Convention No. 105 on the Abolition of Forced Labour, 1957;
- Convention No. 100, on Equal Remuneration, 1951;
- Convention No. 98, on the Right to Organize and Collective Bargaining, 1949;
- Convention No. 87, on Freedom of Association and the Protection of the Right to Organize, 1948;
- Convention No. 29, on Forced or Compulsory Labour, 1930.

2.7.4. Environmental, Health and Safety Guidelines

The World Bank Group's Environmental, Health and Safety Guidelines (EHS Guidelines) are tools that allow the implementation of practical aspects of environmental protection and safety at work, with the main objective of preventing and reducing accidents, emergencies,

and health problems at work. Thus, the project will also take into account the General Environmental, Health and Safety Guidelines and the adoption of recommended mitigation measures.

2.7.5. National Strategy for Adaptation to Climate Change

The National Strategy for Climate Change (ENAC) 2022-2035 arises from the need to articulate the mitigation policy and adaptation to the effects of climate change, considering Angola's vulnerability to climate change and its harmful effects. Thus, the objective of the National Strategy is to provide sustainable low carbon development that also contributes to the eradication of poverty. ENAC was structured taking into account the following 5 pillars:

a) Mitigation;

b) Adaptation;

c) Capacity building;

d) Financing;

e) Research, observation and systematic analysis.

It is important to mention that the project under analysis in this Environmental and Social Impact Assessment is part of Program 6.2. of Adaptation, as can be seen from the representative scheme of the pillars and programs of ENAC 2022-2035 contained in Presidential Decree no. 216/22 of August 23 approving the National Strategy (*see* **Figure 3**), which succeeds the first Climate Change Strategy 2007-2012, which emerged in response to the National Implementation Strategy of the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

ENAC intends to respond to the challenges posed by the Paris Agreement and the Agency's 2030 Sustainable Development Goals (*see* **Figure 3**) and establish the vision of Angolan national policy on the horizon 2035, taking into account the need to articulate Angolan policy in terms of adaptation and mitigation to the impacts of climate change. ENAC will give rise to the development of the National Emissions Plan (PNE) and the National Plan for Adaptation to Climate Change (PNAAC).

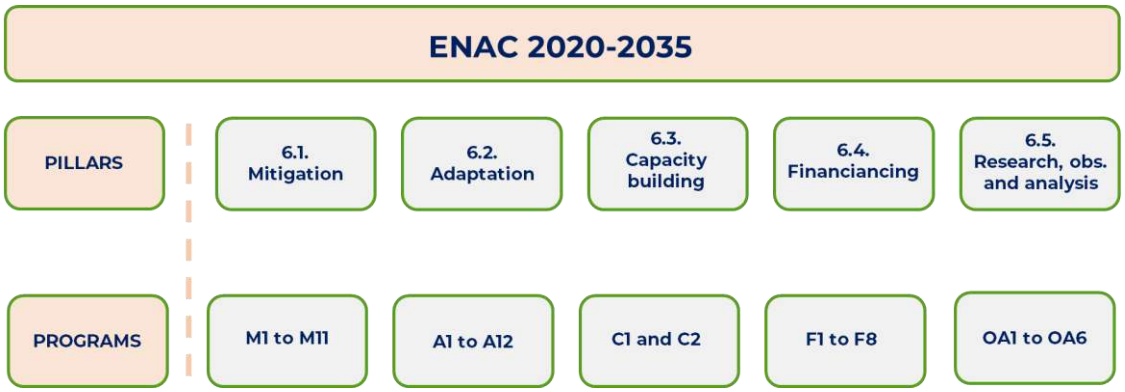


Figure 3 – Representative scheme of ENAC pillars and programs 2022-2035 (Source: adapted from Presidential Decree no. 216/22 of 23 August).

Analyzing the previous figure, it is considered that the project under analysis meets, particularly, the objective defined in the initiative "A12 - Construction and resilient infrastructures", since the construction of resilient road infrastructures are fundamental for the improvement of the population's living conditions and is also an important factor for the transformation and diversification of the economy, given that the recovery of the country's road infrastructure is a basic requirement in any process of socioeconomic development, also meeting the Sustainable Development Goals of the 2030 Agenda.

III.

GENERAL METHODOLOGY

Resurb
Ambiente, Lda

Fabiano Maisonnave

In the environment, every victory is temporary, every defeat permanent.

3. GENERAL METHODOLOGY

The methodology adopted for the environmental and social impact assessment consisted, in summary, of:

1. Analysis of project documentation, planned activities and general schedule;
2. Analysis of the applicable legal framework and international standards;
3. Bibliographic research on the project implementation area and respective environmental and social descriptors;
4. Delineation of the project's areas of influence for the different environmental and social descriptors;
5. Carrying out technical visits to the area directly affected, area of direct influence and area of indirect influence of the project;
6. Carrying out environmental monitoring to characterize the reference situation in the absence of reference documentation, for the socio-environmental descriptors, in the project implementation area;
7. Conducting surveys to the population to characterize the socioeconomic descriptor and collect contributions/concerns as well as the expectations of the population to be taken into account in the preparation of this study and definition of mitigation/compensation measures;
8. Identification of the project's stakeholders, definition of a methodology for carrying out their involvement, participation and consultation, and definition of the complaints and grievances management procedure;
9. Characterization of the project's reference situation (physical, biotic and socio-economic environment);
10. Identification and assessment of environmental and social risks;
11. Forecast and assess potential positive and negative environmental and social impacts likely to be caused during the various phases of the project included in the environmental and social impact assessment;
12. Preparation of the Environmental and Social Management Plan that includes the environmental and social mitigation and compensation measures to be implemented throughout the life cycle of the project and the respective responsible people;

13. Definition of the environmental and social monitoring program;
14. Preparation of the Environmental and Social Impact Assessment (Synthesis Report and Non-Technical Summary) and other complementary studies, when necessary;
15. Public Consultation, for the presentation and discussion of matters relating to the Project, the content of the ESIA Report and the public consultation process itself;
16. Revision of the ESIA Report, as necessary, based on input from interested and affected parties, collected during the Public Consultation.

3.1. Environmental and Social Impact Assessment

The methodology used in the preparation of the Environmental and Social Impact Assessment (ESIA) was defined in advance, that is, in the preliminary phase of the Study, in order to identify, characterize and evaluate the ecological, biophysical, socio-economic and cultural aspects existing in the area of the project, the impacts resulting from its execution and the minimization and/or compensation measures for each verified impact.

It is important to point out that the main phase of elaboration of the ESIA is the survey of field data, which allows obtaining the information to carry out all the aforementioned points, on the project area and its surroundings, thus providing elements for the characterization of the Situation of Environmental and Social Reference and elaboration of the remaining constituent elements of the ESIA, being as such of paramount importance, as it provides a basis for the assessment of environmental and social impacts.

The work was developed based on the various environmental and social descriptors that best characterize the area where the project is integrated, based on the use of specific methodologies for its quick classification.

The analysis and assessment of the environmental and social impacts resulting from the execution of a given project constitute a key step towards defining the best alternatives, defining preventive and mitigation measures for negative impacts and measures that enhance positive impacts.

The methodology for assessing the environmental and social impacts must be coherent, robust and comprehensive, in order to support the decision process intrinsic to the project appraisal.

The assessment of environmental and social impacts determines, whenever possible in a qualitative and quantitative way, the most significant effects associated with the different phases of the project, throughout the life cycle, these being the construction/installation phase, the exploration/ operation and deactivation phase.

Thus, in the present study, the identification of impacts was based on qualitative and quantitative methods supported by the bibliography, reference studies and national legislation and international requirements, information collected during fieldwork, namely socio-environmental and biodiversity monitoring, auscultation and consultation of stakeholders, existence of associated and/or complementary projects, mitigation and compensation measures, national and international best practices and Best Available Techniques (BAT) for the sector of activity planned to be implemented in the various phases of the project to mitigate risks and impacts potentially foreseen, as well as the experience of the technical team in similar works and expert opinions whenever necessary, interrelating the main actions of the project and its implementation with the scenario of evolution of socio-environmental variables and consequent changes and direct and indirect allocations produced (*see* **Figure 4**).

This report was based on information provided by the proponent and obtained by the team from RESURB Ambiente, Lda. Some of the findings were collected with photographic support, which attest to the observations contained in this report. It should also be noted that available databases were consulted, namely INAMET, INE, Botanical Centre, Provincial Directorates, Municipal Administrations, among others.

The qualitative assessment of the environmental and social impacts was based on the characteristics of the impacts (*see* **Table 8**) taking into account the following qualifiers: Qualification, Magnitude, Incidence, Probability or Degree of Certainty, Duration, Occurrence or Beginning of Impact, Spatial Dimension, Reversibility, the assessment being carried out through a relational matrix of impact assessment, also known as the cause/effect matrix, in which the main actions of the project were compared with the environmental descriptors considered relevant.

For the assessment of impacts, their degree of significance was taken into account, both in relation to environmental and social factors and other impacts (cumulative). Significance refers to the importance attributed to a change in the state of the environment and was evaluated on the following scale: Low Significant, Significant and Very Significant Impact (*see* **Table 8**).

Table 8 - Synthesis of the impact assessment methodology

Typology	Classification
Qualification (Reveals if the impact is positive or negative for the environment)	Positive / Negative
Magnitude (Refers to the degree of affectation on a given factor)	Low / Moderate / High
Incidence (Refers if the impact results form direct actions of the	Direct / Indirect

Typology	Classification
project or its effects)	
Probability or Degree of Certainty (Degree of probability of the impact occurring)	Certain / Probable / Improbable
Duration (Refers to the time scale in which a given impact acts)	Temporary / Permanent
Occurrence or start of impact (Refers to the temporal phase in which the impact takes place)	Immediate / Medium Term / Long Term
Spatial Dimension (Area of geographic occurrence of the impact)	Local / Regional / National / Cross-border
Reversibility (Consider the possibility that once the impact is produced, the affected system may return to this initial stage)	Reversible / Irreversible

In this sense, the assessment of environmental and social impacts will be carried out, in a first phase, through the rigorous characterization of the planned activities, as foreseen in the genesis of the Impact Assessment methodology, illustrated in the following figure (*see* **Figure 4**).

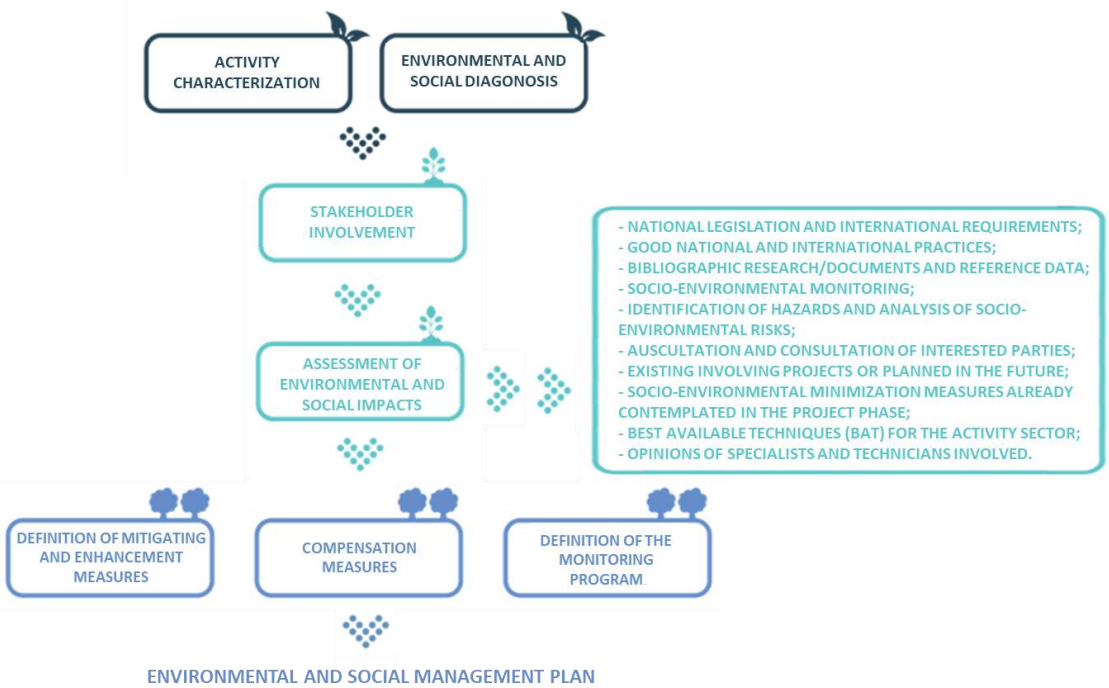


Figure 4 - Methodology of action for the elaboration of the ESIA (Source: Resurb Ambiente, Lda.).

3.1.1. Cumulative Impact Assessment

The analysis of cumulative impacts is a complex aspect in the environmental and social impact assessment, due to the need to know, in the required detail, the existence/definition of planned projects with similar impacts in the surroundings or in the project's area of influence.

The assessment of the cumulative impacts (ACI) of a given project differs in essence from the general assessment of impacts, since the object of the assessment becomes the resource in which the potential impacts can be felt. The Cumulative Impacts assessment for this project may be related to the fact that:

- In the surroundings there are some sources of pollution and contamination of water resources, soil and air, inherent to the way of life of the local population and access to basic infrastructure (eg water, sanitation, energy);
- Projects with a potential impact on the physical environment (soil, air, water, etc.), biophysical (fauna and flora) and socioeconomic (economic activities, housing, accessibility, access to natural resources, among others) are identified in the surroundings.

Cumulative impacts are generated by the aggregation of actions that took place in the past, present and also those that are expected to occur in the future. Cumulative impacts are, therefore, the total impacts, including direct and indirect impacts on a given resource, ecosystem and human community of all actions, regardless of their origin, and therefore require an integrated analysis in terms of the resource, ecosystem or human community specifically affected.

The following figure (see **Figure 5**) outlines the impact assessment approach, comparing the typical procedures of the ESIA and the cumulative impacts (Fonte Partidário & Jesus).

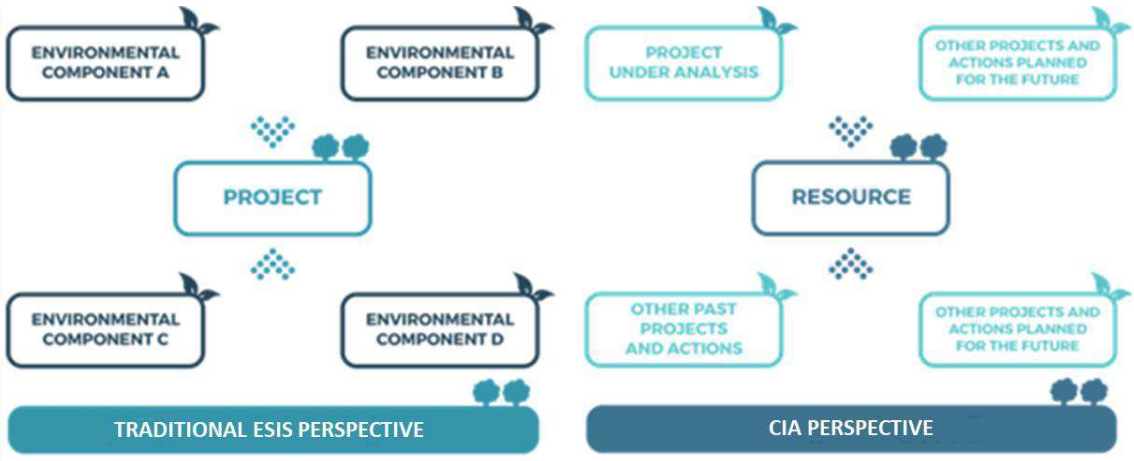


Figure 5 – Schematic representation of the Cumulative Impact and Impact Assessment approach (ESIA: Environmental and Social Impact Assessment; CIA: Cumulative Impact Assessment) (Source: Adapted from Partidário & Jesus).

Contrary to the traditional impact assessment, in which the impacts associated with the environmental aspects of the project are evaluated, the approach taken in the cumulative impact assessment will be based on the analysis of other projects and actions, past and

foreseeable, which may affect a particular descriptor, as per requirements defined in the International Finance Corporation's Performance Standards, as it considers the combination of diverse impacts from existing projects, the proposed project and/or projects planned for the future that may result in adverse impacts and/or or significant benefits that would not be expected from an independent project.

In this context, the analysis of cumulative impacts (CI) was considered based on the following:

- Identification of impacts likely to present cumulative effects;
- Definition of temporal and spatial limits;
- Identification of other activities or actions of current, future or past projects that enhance the cumulative impact of the project under analysis;
- Evaluation the meaning of cumulative impacts;
- Identification of the most important cause-effect relationships, between resources, human activities and human communities;
- Determine the magnitude and significance of CI;
- Modify or add alternatives to avoid, minimize or mitigate significant CI;
- Monitor the CI of the selected alternatives and adapt their management.

With a view to classifying the cumulative impacts, according to the categories listed above, essentially resorted to the expert opinions of the technicians involved in the study by weighing the predictable thresholds of sensitivity, probability and scales of occurrence, which made it possible to assess the degree of significance of impacts for different environmental and social variables.

It is also important to mention that the impact assessment was carried out taking into account its stage of occurrence, thus being presented in detail for each of the stages that make up the life cycle of the project (construction/installation, exploration/operation and deactivation).

3.2. Stakeholder Engagement, Participation and Consultation

The methodology adopted for the identification, involvement, participation and consultation of stakeholders is defined in the Stakeholder Involvement Plan (SEP).

Below is a summary of the steps defined for the methodological process of approaching the involvement of Stakeholders or Interested Parties:

a. Identification of the Municipalities and respective Communes covered by the project;

b. Quantification of the number of surveys to be carried out based on the information provided in the 2014 Census, in order to obtain a representative sample by Municipality;

c. Carrying out visits to the project implementation site;

d. Identification and analysis of Stakeholders that may be affected by the project;

e. Identification of the information to be disclosed in the public domain, languages and places/means where it will be disclosed, based on the strategies defined for this purpose;

f. Conducting socio-environmental surveys to the inhabitants;

g. Dissemination of project information and explanation of the possibilities for public consultation;

h. Call for identified stakeholders to present the project and gather relevant information to analyse their needs and expectations;

i. Presentation and brief description of the project and activities to stakeholders;

j. Description and explanation of the project's grievance mechanism;

k. Commitment to the publication of routine information on the project's environmental and social performance, including additional consultation possibilities, as well as monitoring the handling of complaints.

Annex II presents the Stakeholder Engagement Plan (SEP) of the project.

IV.

ALTERNATIVES CONSIDERED IN THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Resurb
Ambiente, Lda

Charles Lindbergh

When environment changes, there must be a corresponding change in life.

4. ALTERNATIVES CONSIDERED IN THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

4.1. Alternative Zero

For the construction of the project, it is also necessary to consider the Alternative zero, which corresponds to the absence of intervention, that is, the non-rehabilitation of road infrastructure. In this sense, there are no alternatives for the location of the project, given that the road in question already exists and should only be rehabilitated and built in some sections in order to allow road traffic and improve their safety conditions.

In **Chapter 6** regarding to the Characterization of the Reference Situation of the project, and for each environmental and social descriptor, the respective Evolution of the Reference Situation without the Project is presented.

4.2. The Absence of Location Alternatives

The ESIA will not consider location alternatives, since the project under analysis in this document refers to the rehabilitation of the current section of the road between Luau-Cazombo-Lumbala Caquengue, in an extension of about 246 km, which is already implanted.

In view of the above, the Environmental and Social Impact Assessment will be carried out in comparison with the scenario of non-implementation of the project, corresponding to alternative zero (H0).

V.

PROJECT CHARACTERIZATION

Resurb
Ambiente, Lda

Humberto De Campos

Nature is wise and just. The wind
shakes the trees, moves the branches,
so that all the leaves can see the sun.

5. PROJECT CHARACTERIZATION

5.1. Project General Description

The present study focuses on the project for the rehabilitation of the road section between Luau-Cazombo-Lumbala Caquengue, which is a structuring road section, since it will allow the road connection between the municipal headquarters and the circulation in the aforementioned section, which currently due to poor conditions, also aggravated by the rainy season, it has favored the vulnerability of the surrounding Municipalities, since the non-existence and/or deterioration of the road section, which makes circulation impossible, favors the isolation of the population and delays the socio-economic development of the region, since it makes the free movement of people and goods impossible.

5.1.1. Reabilitation of the Road Section

The road section under analysis in this ESIA needs road rehabilitation, in its entirety, as previously mentioned, which also includes the rehabilitation of seven (7) bridges that exist along the route between Luau-Cazombo-Lumbala Caquengue.

The road section can be divided into two sections, namely section 1 with a length of 176 km and section 2 with a length of 70 km.

Section 1 runs between the Bridge over the Sapo and Cazombo rivers (EC192/EN250/EC254/EC382). However, the scope of the work starts at Estrada Nacional (EN) 250, 20Km southeast of Rio Sapo bridge, where the asphalt pavement ends (11°12'35.98"S; 22°21'26.19"E). There are three bridges planned for this section.

Section 2 includes the rehabilitation of 70 km of the EN 190, starting in the village of Cazombo towards Lumbala Caquengue. Four bridges are planned for this section.

The rehabilitation activity of a road aims to restore the structural integrity of the pavement and allow it to withstand the loads imposed by vehicle traffic. The rehabilitation of roads manages to promote greater mobility of the population, improves access to education and health services, boosts economic activity growth in the regions benefited by the rehabilitated road, reduces the need for maintenance on the vehicles that use it, among others.

Below is a photographic record that illustrates the scope of intervention of the Contract for the Rehabilitation of Road EC 192/EN 250/ EC 254/EC 385, Luau/Cazombo (*see* **Figures 6** to **17**).

Figure 6 – Photographic record of the beginning of the road section between the Sapo River and Cazombo located at PK 0+000.

Figure 7 – Photographic record of the end of the road section between Rio Sapu and Cazombo located at PK 196+000.

Figure 8 – Photographic record of the beginning of the road section between Cazombo and Lumbala Caquengue located at PK 0+000.

Figure 9 – Photographic record of the end of the road section between Cazombo and Lumbala Caquengue located at PK 70+000 (Source: QG Konstruktion GmbH).

Figure 10 – Photographic record of the bridge located at PK 79+400.

Figure 11 – Photographic record of the bridge located at PK 84+400.

Figure 12 – Photographic record of the bridge located at PK 118+500.

Figure 13 – Photographic record of the bridge located at PK 27+450.

Figure 14 – Photographic record of the bridge located at PK 39+175.

Figure 15 – Photographic record of the bridge located at PK 38+175.

Figure 16 – Photographic record of the bridge located at PK 52+700 (Source: QG Konstruktion GmbH).

Figure 17 – Photographic record of *Box Culverts* located at PK 50+590.

Analyzing the previous figures, it can be seen that the pavement of the section in question is mostly unpaved, has several deformations, is quite deteriorated and that some of the sections and bridges existing along the section are impassable, due to its lack of maintenance and vulnerability to weather conditions and in some situations, due to the malevolence of the local community inherent to cultural beliefs whose some of the bridges were damaged/burned.

It should be noted that along the entire length of the section in question, no horizontal signaling devices were identified and the vertical signaling devices are practically non-existent. There is also a lack of sidewalks for passers-by along the road.

5.1.2. Geometric Characteristics

The existing road seems to have been built in the early 1980s. The surface consists of a lateritic layer 7 to 9 m wide in the segment of the road section between Sapo river and Cazombo and about 4 m wide in the section between Cazombo and Lumbala Caquengue. In areas of higher elevation, the section thickness varies between 300 mm to 400 mm and in flood zones it increases to about 1 m to 1.5 m above the natural terrain (Source: QG Konstruktion GmbH).

The lifetime of the project is 10 years for a driving speed of 80km/h. The execution project should be drawn up considering the SATCC standard - Code of Practice for the Geometric Design of Trunk Roads as a basis. Thus, the following table (*see* **Table 9**) presents the technical parameters of the project.

Table 9 - Technical parameters of the road rehabilitation project EC 192/EN 250/EC 254/EC 385 between Luau and Cazombo (Source: QG Konstruktion GmbH, 2023).

Technical Parameters	
Project lifetime	10 years
Speed Project Guideline	80 km/h
Paved Platform Width	9,0 m
Carriage way	7,0 m
Coated Berth (Angola Road Plan - 1st Class Roads)	1,0 m
Cross Slope	3,0%
Maximum superelevation	8,0
Minimum Grade Slope	0,50%
Maximum Grade Slope	6,0%
Skimming Type	Paving Grade
Minimum Horizontal Curvature Radius	230 m

5.1.2.1. Longitudinal Profile Type

The vertical alignment was elaborated according to the parameters discussed in the SATCC Code of Practice for Geometric Design according to the parameters indicated in the previous table (*see* **Table 10**).

The k values for the design speed of 80km/h are shown in the following table (*see* **Table 10**).

Table 10 - Values of *k* for design velocity (Source: QG Konstruktion GmbH, 2023)

V (km/h)	Crest curve	Camber curve (*k*)
80	33	25

In special cases, for example, inside towns, the minimum crest curve adopted was *k*=18, with the guideline speed reduced to 60km/h, as indicated on the signs.

In order to improve the technical characteristics of the existing road, and to meet the safety and comfort conditions for this road pattern, the project's grading will try to maintain the geometry of the existing terrain.

5.1.2.2. Tranversal Profile Type

This subchapter intends to present the typical geometric characteristics of the road section under analysis in this report, namely: the type cross-sectional profile.

The new transverse section will have a carriageway in each direction, 11 m wide (2.00+3.50m+3.50m+2.00m) and with a surface area of 9 m (*see* **Figures 18** and **19**). The horizontal alignment of the existing road is characterized by long straight sections. The vertical alignment has long sections a very low slope. In this sense, an adequate drainage system should be implemented.

The rehabilitation of the road will adopt the following type of transverse profile:

- ✓ **Full transverse profile in landfill:**
  - Two Lanes: 3.50 m;
  - Berm: 1.0 m;
  - Platform: 9.0 m;
  - Slope: 1.0 (V): 1.5 (H);
- ✓ **Full cross-sectional profile:**
  - Two Lanes: 3.50 m;
  - Berm: 1.0 m;
  - Platform: 9.0 m;
  - Slope: 1.0 (V): 1.0 (H);
- ✓ **Transverse slope of the semi-platform:**
  - On a tangent: 3%;
  - In curve: 3% to 8%.

This typical transverse profile will involve paving a total width of 9.0 m, as previously mentioned, for the two solutions, as shown in the following figures (*see* **Figures 18** and **19**).

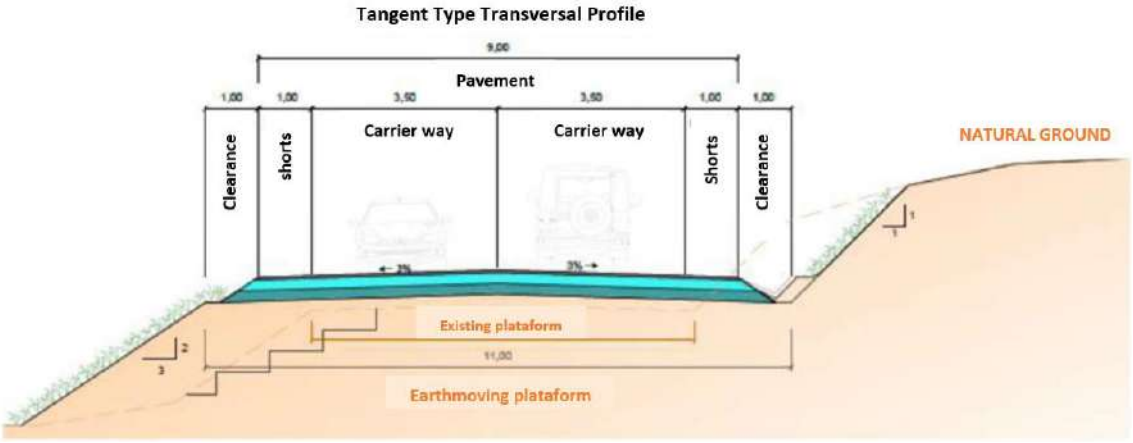


Figure 18 – Illustration of the Tangent Type Transversal Profile (Source: QG Konstruktion GmbH).

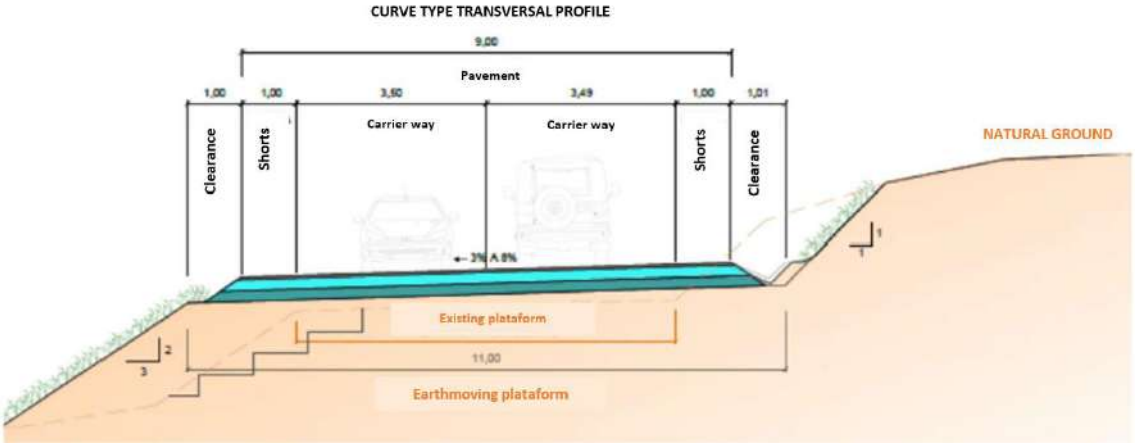


Figure 19 – Illustration of the Curve Type Transversal Profile - (Source: QG Konstruktion GmbH).

The ditches (clearances) will be installed on both sides of the road, in the cut and embankment sections, and have a width of 1.0 m for the installation of drainage devices, metal guards and signalling signs.

5.1.3. Earthwork Project

The purpose of the Earthmoving Project is to ensure physical and operational improvement to the study section with traffic discipline through geometric adequacy, providing better fluidity, safety, and comfort to users.

For the identification of the earth movement necessary for the rehabilitation of the road, the following basic elements will be considered:

- Topographic survey of the current situation;
- Geotechnical studies, with study of subgrade and occurrences;

- Geometric design, with the typical sections adopted and projected grade line;
- Projected floor structure.

The geotechnical studies will provide the elements related to the quality of the materials existing in the subgrade/natural terrain, through their physical-mechanical characteristics obtained in the laboratory tests of soils. This allowed the knowledge about the materials that will constitute the bodies of the landfills, as well as the definition of the places of loans, when needed.

The Earthmoving Project will be elaborated in order to determine and quantify the necessary earthmoving services for the implementation of the road platforms under study, ensuring the widths of each type profile, considering the needs of loans and spillways, with their respective available areas.

To carry out the constructive activities it will be necessary to carry out the cleaning of the land and pickling of the area of implantation of the project, and it is expected that this activity will be carried out in about 2.475.00 m^2 (including the area of the existing road). The cleaning of the land corresponds to the removal of the vegetal layer of the land, with 20 cm of average thickness, in order to leave the area of the work ready for the accomplishment of the constructive activities. It is also planned to remove trees with a diameter of less than 0.15 m, with a height of more than 1.00 m (Source: QG Konstruktion GmbH).

The material removed should be removed to an appropriate place, with reuse of vegetable land whenever possible, and all necessary care should be taken for safety and personal hygiene and the environment, not allowing the permanence of debris in the vicinity of the projected area and in situations that may cause problems in the drainage system of the work.

5.1.3.1. Transversal Profile Type of Earthmoving

As mentioned in **Chapter 5.1.2.2.**, the main geometric characteristics of the transverse profile to be adopted are as follows:

- ✓ Full transverse profile in landfill:
  - Platform: 11,0m;
  - Slope: 2.0 (V): 3 (H);
  - Shorts: Hmáx = 8.0m / L = 4.0m.
- ✓ Full cross-sectional profile:
  - Platform: 11,00m;

- Slope: 1 (W): 1 (H);
- Shorts: Hmáx = 6.0m / L = 4.0m.

✓ Transverse slope of the semi-platform:

- On a tangent: 3%;
- In curve: 3% to 8% (lifting).

The road platform develops mostly in embankment, with a total width of 11,00 m, with a transverse slope of 3%. In this sense, the following figures show the cross-sectional profiles in tangent (*see* **Figure 20**) and curved (*see* **Figure 21**).

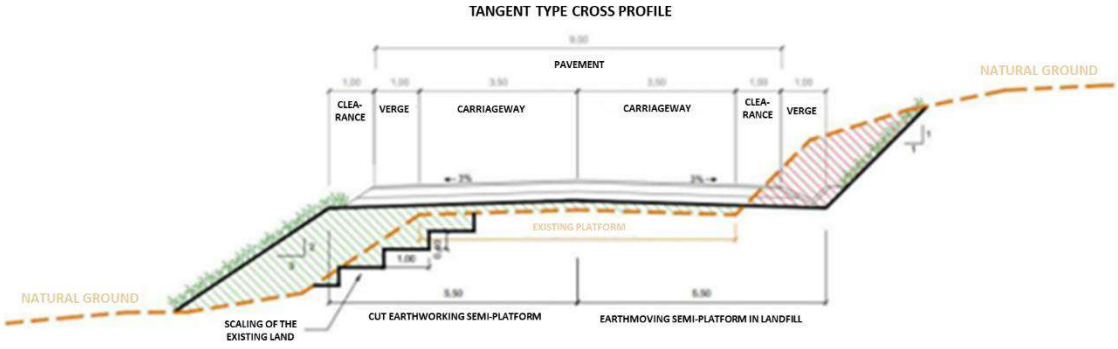


Figure 20 – Illustration of the tangent-type cross-sectional profile (Source: QG Konstruktion GmbH).

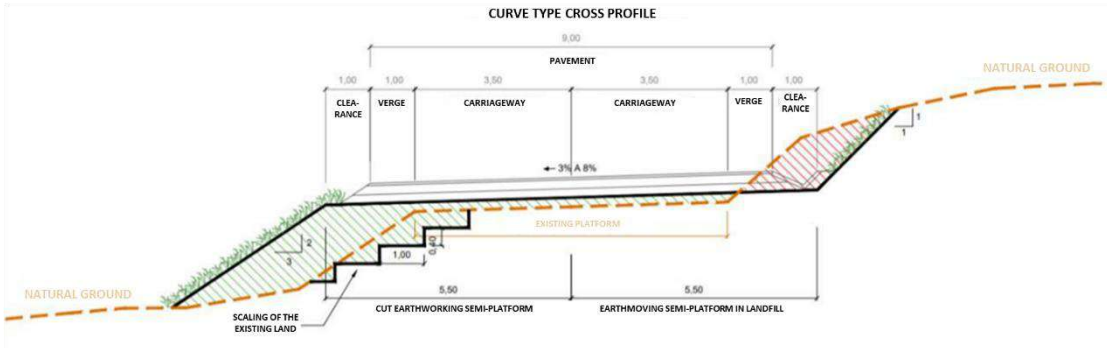


Figure 21 – Curved type cross profile illustration (Source: QG Konstruktion GmbH).

5.1.3.2. Earthmoving

The materials for carrying out the landfills will come from the cuts made, which must be deposited in a previously chosen place for later use, or from loans, when the material is not enough.

It is considered as the final earthwork layer, the material located up to 0,60 m below the level corresponding to the earthwork level and the body of landfill is the entire mass that constitutes below the final layer.

In the compaction corresponding to landfill body services, the compaction energy recommended minimum is 90% of the Modified AASHTO and the final layers, which must be executed with material with better geotechnical characteristics, the recommended minimum compaction energy is 93% of the Modified AASHTO (Source: QG Konstruktion GmbH).

The construction of landfills shall consider specific requirements, in particular:

- Observe the geotechnical qualification of the material;
- Be free of organic materials;
- For the purpose of the execution of the ISC landfill body >= 2% and expansion <=4%;
- For the purpose of the execution of final layer of landfill ISC >= 10% and expansion <=2%;
- Maximum compaction thickness of the landfill body = 30cm;
- Maximum compaction thickness of the final layer = 20cm.

5.1.3.3. Borrowed Land and Spillways

Borrowed land are understood to be areas indicated in the project, where materials to be used in the execution of the highway platform must be excavated, in the landfill segments. Such areas are used to supply the deficiency or insufficiency of materials extracted from the cuts. Borrowing will also be used when the origin of the cuts related to the target segment is at a high distance.

Borrowed land (loans) can be concentrated or lateral, when executed outside the domain range or contiguous to the road body, giving preference to lateral loans, in order to optimize the distribution of materials and reduce transport distances. It is important to mention that no side loans are foreseen for this project. Concentrated loans are excavations carried out in areas outside the domain range, in places that contain materials in adequate quantity and quality for the execution of the landfills. The locations of these loans (deposits) must be close to the landfill to which the material will be destined (Source: QG Konstruktion GmbH).

With the aim of optimizing the distribution of materials and reducing transport costs, an area should be provided for a dump to receive the excess volumes of the services of earthmoving. Thus, spillways must receive the material from the cuts not used in the landfills that exceeded the lateral compensation and have excessive distance of transport or to receive material from the "sanitation" (loose or poor-quality materials that do not comply with technical specifications). After the deposition of the material, the area of the spillway should be

signposted and protected with native vegetation to prevent stormwater runoff from dragging the deposited material (Source: QG Konstruktion GmbH).

5.1.4. Paving Project

The paving project aims to rehabilitate the structural and functional conditions of the existing pavement, providing safety and comfort to users thus ensuring the satisfactory performance of the pavement until the end of its useful life.

5.1.4.1. Technical Parameters

The criteria for defining the solutions for rehabilitation of the pavement structure should be based on the specifications of the Southern Africa Transport and Communications Commission (SATCC) Method. The SATCC sizing catalogue is based on the definition of the number of equivalent standard axle passes of 80 kN (Source: QG Konstruktion GmbH).

According to the specifications, the suggested paving structures are classified into several categories of accumulated traffic according to the number of passages. The project traffic estimate is thus used to decide which category will be applicable for the projected section. Thus, the following table (*see* **Table 11**) presents the predicted traffic classes.

Table 11 – Predicted traffic classes (Source: QG Konstruktion GmbH)

Traffic classes								
Number of standard axles equivalents of 80 KN(x10)	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**
	<0,3	0 3 to 0 7	0,7 to 1,5	1,5 to 3	3 to 6	6 to 10	10 to 17	17 to 30

As mentioned above, the estimated useful life for the flexible pavement project is 10 years and a traffic increase of 3% per year is expected. According to the initial study carried out, the pavement should be dimensioned to meet the traffic class T5 (SATCC) with number of ESAs of 3 to 6 million standard axles (Source: QG Konstruktion GmbH).

5.1.4.2. Pavement Structure

For the definition of the pavement structure, the SATCC Catalog of pre-defined structures will be considered, through which the necessary structure is obtained for the pavement to reach resistance, to guarantee its durability until the established project lifespan. The typologies of structures foreseen in the catalog of structures are also based on project data, such as, for example, the traffic load, the study of the resistance of the subgrade and humidity conditions.

During the previous study stage, laboratory tests were carried out, namely granulometric tests, Atterberg, Proctor and CBR limits, and the characterization for road purposes of the foundation site.

According to the results obtained it is possible to conclude that there is a certain uniformity of the levels of compaction, which allow to admit a foundation soil of the structure of the pavement of the type S5 (SATCC). However, in some places these values are not reached, and it is necessary to adopt solutions for treatment, e.g., soil replacement (Source: QG Konstruktion GmbH).

According to the initial evaluation and starting from the structures traditionally applied in Angola, it was considered in the indication of the structure 5.0 cm of thickness more in the structural layers (Source: QG Konstruktion GmbH). In this sense the pavement structure for this project will be formed by:

- Wear layer: Bituminous concrete 5 cm thick;
- Base in crushed stone with 20 cm thickness;
- Sub-base in granulometrically stabilized soil with 20 cm thickness.

5.1.5. Drainage Project

The drainage system is essential to ensure an adequate behavior of the works, but also to ensure safety conditions in the circulation of the road, namely:

- Allow, safely, the crossing of the road system over the natural drainage lines located in the area of influence of the aforementioned project;
- Intercepts surface, deep and/or subsurface waters affluent to the body of the road, leading them to the nearest natural drainage lines and allowing free flow of water within the floodplain area;
- Guide the flow of rainwater precipitated over the beds and the platform of the road system and conduct them to the point of delivery and discharge safely and appropriately.

The indicated devices, their location, extension, typology, and the like can be adjusted in loco, through the final conformation obtained from the earthmoving stage (earthmoving).

It should be noted that the registration and analysis of the existing system was also carried out in order to identify the deficiencies and/or inadequacies of the implanted devices that subsidize the solutions adopted in the drainage project. For the project in question, we sought to evaluate the existing drainage system, its state of conservation and operation.

Through field inspections and checks in the topographic register, it was observed the absence of surface drainage devices in section 2 of the road section. Along section 1 it was verified the

existence of two side ditches on average with 3.00x0.80m for stormwater runoff in order to protect the existing road. During the visit that took place in August 2022, the existing aqueducts were registered and inspected externally, and the existence of erosions, obstructions, and state of conservation of the mouths and wings was verified. In this process, 32 aqueducts were identified in section 1 and 40 in section 2 (Source: QG Konstruktion GmbH). The registration forms can be found in **Annex XVIII** – Registration of existing aqueducts.

5.1.5.1. Technical Parameters

The design of the project's drainage system should be sized according to the parameters presented in the following table (*see* **Table 12**).

Table 12 – Technical parameters of the drainage system (Source: QG Konstruktion GmbH)

Technical Parameters	
Surface Drainage	10 years
Subsurface Drainage	10 years
Tubular aqueducts	15 (as channel) / 25 years (as hole)
Cellular aqueducts	25 (as channel) / 30years (as hole)
Pontoons	50 years
Bridges	100 years

5.1.5.2. Surface Drainage

The surface drainage system will be designed to route stormwater runoff on the road, leading it to safe drainage sites. This procedure aims to avoid flooding located at low points and to contain the onset of erosive processes near the road body or in the descent of slope or "foot" of embankment, where passage or release of drainage structure may occur (Source: QG Konstruktion GmbH).

In the previous study, the following types of devices were indicated:

- Water descents from rapid landfills, type DAR-01 (*see* **Figure 22**);
- Energy sinks applicable to ditches, water descents and aqueduct outlets (types of DES-02, DES-03 and DES-04, DEB-01, DEB-02 and DED-01);
- Cut protection trenches with coating, type VPC-04 (*see* **Figure 23**);
- Uncoated landfill foot protection trenches, types VPA-01 (*see* **Figure 24**);
- Concrete Lancil, LB-03 (*see* **Figure 25**).

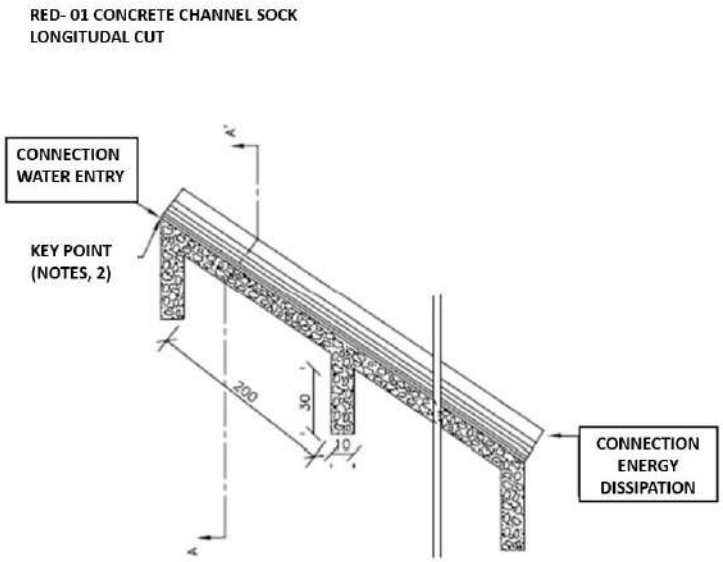


Figure 22 – Illustration of rapid embankment water descents from fast landfills, type RED-01 (Source: QG Konstruktion GmbH).

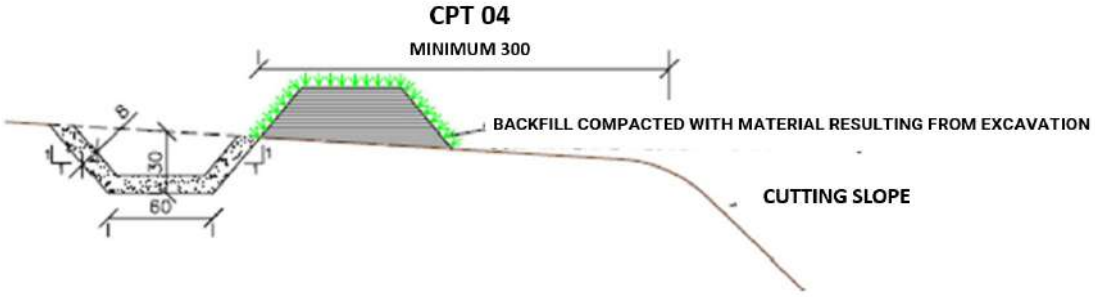


Figure 23 – Illustration of uncoated cut protection trenches, type CPT-04 (Source: QG Konstruktion GmbH).

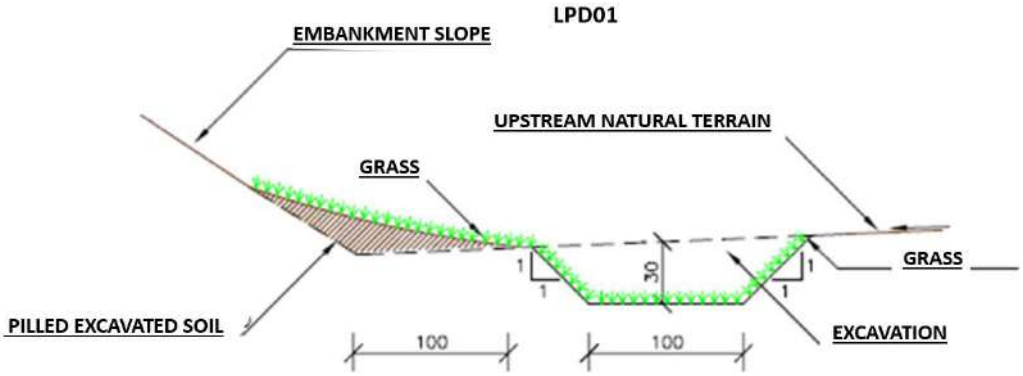


Figure 24 – Illustration of uncoated landfill foot protection ditches, types LPD-01 (Source: QG Konstruktion GmbH).

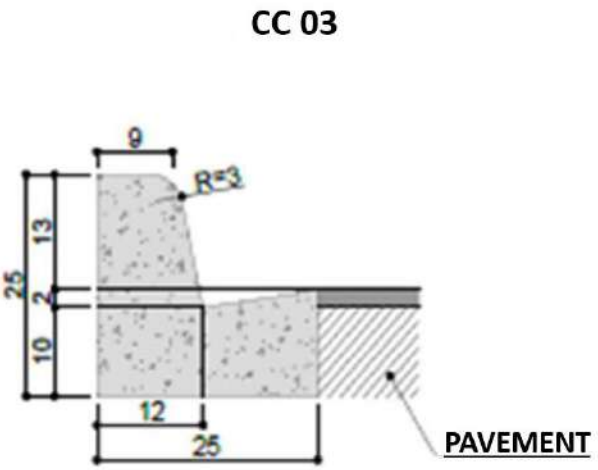


Figure 25 – Illustration of Concrete curb, CC-03 (Source: QG Konstruktion GmbH).

5.1.5.3. Subsurface Drainage

During the previous studies, it was possible to assess the presence of water in the soil. In this sense, it was planned to use a Deep Longitudinal Drain, type DPS07 (*see* **Figure 26**) in the sections in cutting profile (Source: QG Konstruktion GmbH).

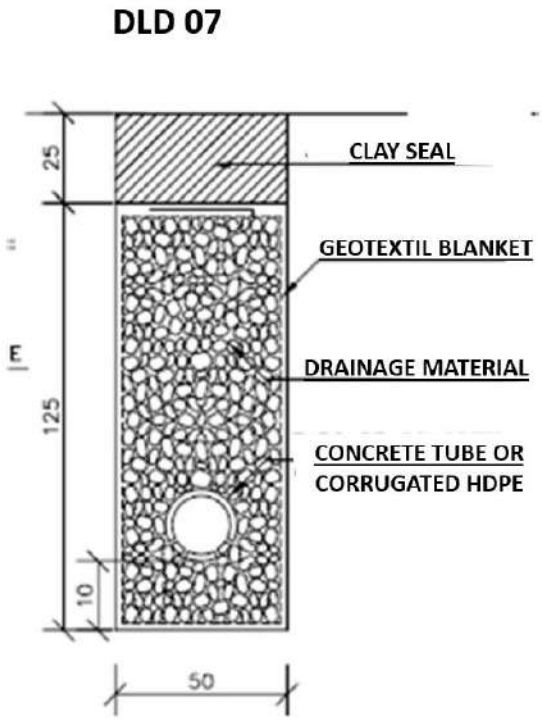


Figure 26 – Illustration of a Deep Longitudinal drain, type DLD07 (Source: QG Konstruktion GmbH).

5.1.5.4. Transversal Drainage

The premise of the drainage project was the analysis of the existing aqueducts, regarding their hydraulic sufficiency and positioning along the highway route. The existing aqueducts had their hydraulic sufficiency evaluated for recurrence times of 15 and 25 years, for the case of tubular aqueducts, and of 25 and 30 years, for the case of cellular aqueducts, admitted hydraulic loads limited by the height of the landfill on the works or upstream flood area (Source: QG Konstruktion GmbH).

It is noteworthy that during the previous study a pre-dimensioning of tubular and cellular aqueducts was performed. The following were planned:

a) Tubular type:

(i) Single c/ D=1,0m = 1,150 m;

ii. Single c/ D=1,2m = 15m;

iii. Duplo c/ D=1,0m = 400m;

b) Cell Type:

i. PK 50+600: 4 *Box Culvert* (10 células) 20m x 11m;

ii. PK 62+900: 1 *Box Culvert* (3 células) 9m x 11m;

iii. PK 65+800: 1 *Box Culvert* (3 células) 9m x 11m;

iv. PK 69+400: 1 Box Culvert (3 células) 9m x 11m.

The following figure (*see* **Figure 27**) shows a type of illustration of the cell type section - *Box Culvert* (3 cells).

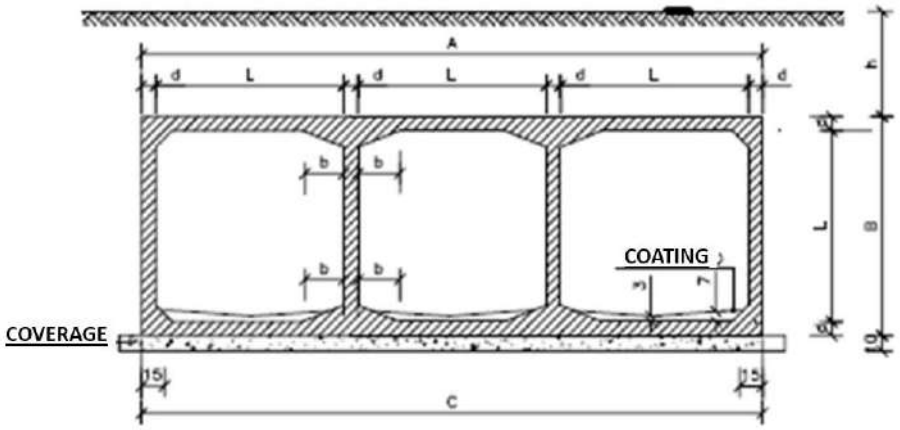


Figure 27 – Illustration of the Cell Type Section (3 cells) (Source: QG Konstruktion GmbH).

5.1.6. Artwork Project

5.1.6.1. Existing Bridges

During the technical visits it was found that the existing bridges were of the temporary/military type supported by wooden columns, or "archaic bridges" made entirely of wood. These are in a high state of degradation and pose a threat to locals. It has also been found that some of them are submerged during the rainy season and need to be replaced by new, sturdier bridges with larger spans and higher elevation to ensure traffic during periods of heavy rain and to ensure compliance with the new design standards (Source: QG Konstruktion GmbH).

5.1.6.2. Design of New Bridges

The scope of the contract includes the construction of seven bridges, 12 m wide, in the two sections of the road section that will be rehabilitated, namely:

Section 1:

- Bridge 1 - PK 79+400 (11°11'42.97"S; 22°42'50.19"E) - Total span = 23 m;
- Bridge 2 - PK 86+400 (11°14'37.02"S; 22°45'17.19"E) - Total span = 27 m;
- Bridge 3 - PK 118+500 (11°29'45.58"S; 22°51'2.83"E) - Total span = 25 m.

Section 2:

- Bridge 4 - PK 27+450 (12° 6'18.55"S; 22°47'35.57"E) - Total span = 30 m;
- Bridge 5 - PK 37+400 (12°10'13.30"S; 22°43'0.02"E) – Total span = 27 m;
- Bridge 6 - PK 37+750 (12°10'1.87"S; 22°43'5.28"E) – Total span = 60 m;
- Bridge 7 - PK 52+700 (12°14'1.91"S; 22°36'47.61"E) - Total span = 15 m.

The transverse profile shall have a total width of 12,0 m, which allows to accommodate the tracks' platform, which includes a carriageway comprising two lanes of traffic of 3,50 m wide each, two berms of 1,00 m wide and two walkways of 1,10 m wide, and guardrails. The walkways will be in reinforced concrete, raised in relation to the upper face of the board, and include the supports of the security guard and the guardrail. The carriageway and berms have a transverse slope of 2.5 % along the site, according to its layout in plan (Source: QG Konstruktion GmbH).

Figure 28 shows the plane and cross-section of the bridges and **Figure 29** shows a 3D modeling illustration of a type bridge.

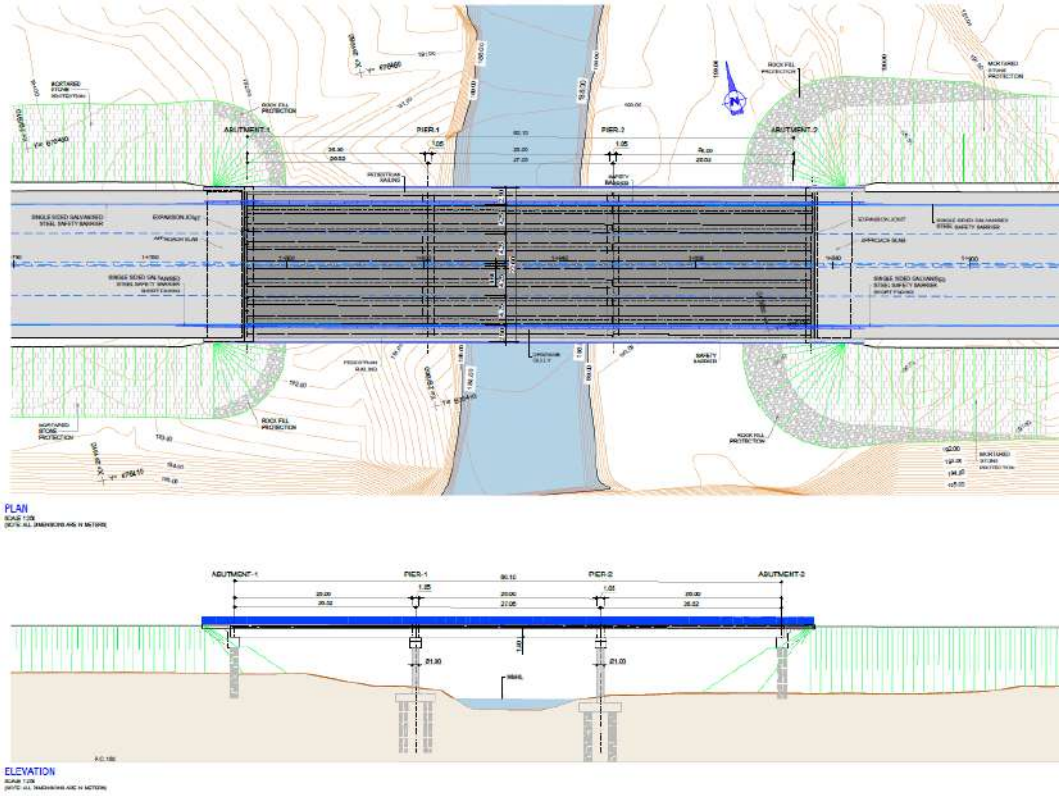


Figure 28 – Plan and planned cross-section for the bridges (Source: QG Konstruktion GmbH, 2023).

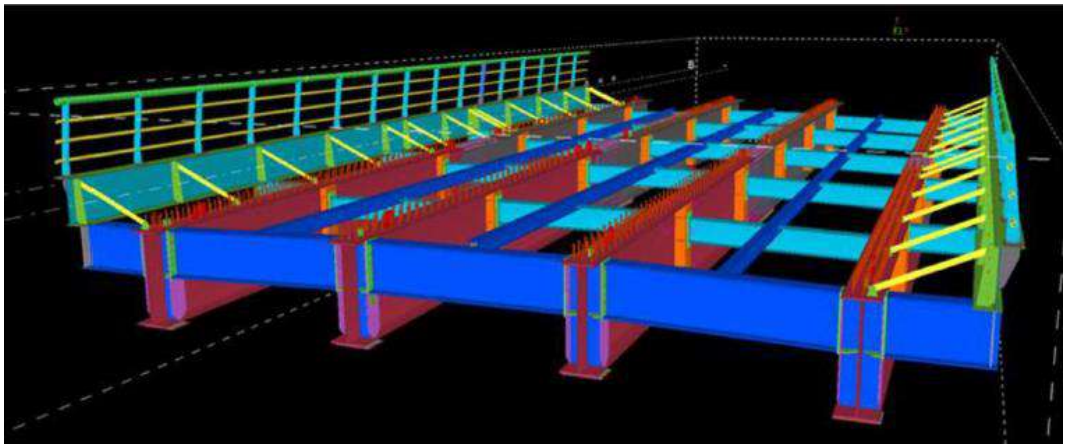


Figure 29 – Illustration of 3D modeling of a type bridge (Source: QG Konstruktion GmbH, 2023).

Finally, the following figure (*see* **Figure 30**) shows the geographical location of the bridges, previously illustrated and to be built/rehabilitated within the scope of the project under analysis in this ESIA.

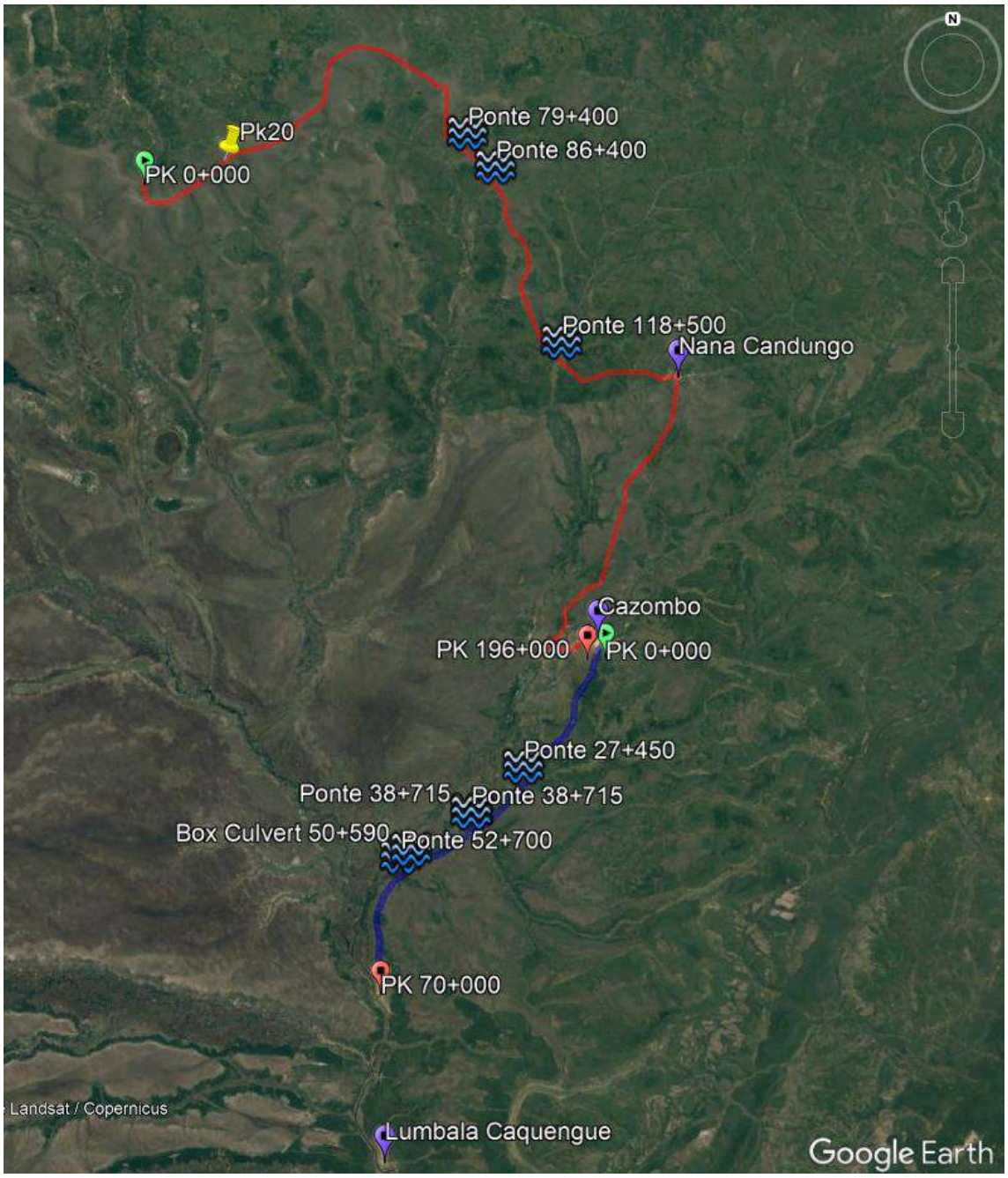


Figure 30 – Geographical location of the bridges to be rehabilitated under the project, with section 1 of the road represented in red and section 2 represented in blue (Source: adapted from *Google Earth*).

5.1.7. Signaling Project

5.1.7.1. Technical Parameters

The sizing parameters obeyed the determinations contained in the Regulation on Traffic Signaling, Republic of Angola (May/2017), harmonized with the SADC Road System. In the event of no specific signage, the recommendations of the SADC Manual Road Traffic will be used (Source: QG Konstruktion GmbH).

In this sense, the Signaling Project will consist of:

- Horizontal signs: road markings and additional provisions;
- Vertical signalization: code vertical sings, panels and system information arrows.

5.1.7.2. Horizontal Signage

Horizontal Signaling is a subsystem of road signage composed of lines, arrows, symbols, and legends, in various types and colours, demarcated on the carriageways' pavement, in order to transmit messages to drivers and pedestrians, enabling their perception and understanding, without diverting attention from the roadbed (Source: QG Konstruktion GmbH).

For this project, the horizontal signage will consist of:

- Longitudinal marks;
- Transversal Marks;
- Traffic directions guiding marks;
- Miscellaneous brands and guides.

5.1.7.3. Vertical Signage

The vertical signaling system comprises danger signs, regulation signs, indication signs and variable message signaling and aims to regulate the use of the road, warn of potentially dangerous or operationally problematic situations, and provide indications, guidance, and information to users (Source: QG Konstruktion GmbH).

The vertical signs shall include:

- Danger signs;
- Signs of regulation: assignment of passage, prohibition, obligation, and signs of specific prescription;
- Indication signs: information, identification of localities, tourist-cultural and complementary signs;
- Variable message signaling.

5.2. Description of Construction Activities

The main construction activities to be carried out in the construction phase of the project under analysis concern those necessary for the rehabilitation of the road section, which includes the rehabilitation of several bridges. Thus, and in order to identify potential impacts

arising from the construction activities necessary for the implementation of the project, the macro activities planned to be carried out within the scope of the contract are detailed below:

1) Assembly of support yards (jobsites) and respective infrastructures;
2) Earthworks and preparatory work:
    - Preparatory work and excavation:
        - Land clearing;
        - Excavation with mechanical means;
        - Survey and replacement of pavements, when existing;
    - Removal of the initial organic layer of the soil.
3) Drainage:
    - Execution of hydraulic crossings and concrete pontoons;
    - Execution of longitudinal drainage organs;
    - Execution of complementary drainage bodies.
4) Paving:
    - Sub-base and base placement;
    - Impregnation and bonding irrigation;
    - Paving with bituminous concrete.
5) Signaling and Safety Equipment:
    - Vertical signage;
    - Road markings (longitudinal and transverse), including pre-marking and other markings;
    - Guidance, marking and demarcation equipment (directional markers and bays);
    - Security guards, including deployment, supply and placement.
6) Rehabilitation of Bridges:
    - Bridge PK 79+400;
    - Bridge PK 86+400;

- Bridge PK 118+500;
- Bridge PK 27+450;
- Bridge PK 38+715;
- Bridge PK 39+175;
- Bridge PK 52+700;
- *Box Culvert* 50+590 (precast concrete).

7) Various construction processes:
   - Temporary diversions, assembly and disassembly work, eventual temporary signs and protection structures;
8) Execution of rainwater networks:
   - Verge drainage channel.

In the Exploration Phase of the project, the main planned activities, in addition to using the road, will be those related to the maintenance of road infrastructure and rehabilitated/built bridges.

5.2.1. Intervention Schedule

The construction phase of the project, with greater relevance within the scope of this ESIA, will start in 2023 and is estimated to last 48 months (4 years).

5.2.2. Human Resources

The manpower load will show significant variability throughout the construction phase, being eminently associated with the pace of evolution of construction activities and active work fronts, as defined in a specific manpower load plan. However, it should be noted that priority will be given to the integration of local labor.

The expected staff for the period in which the execution of the project will be in full operation is around 500 workers. These values are of the utmost importance for the socio-economic environment of the region, if one considers the forecast of creation of indirect jobs.

It should be noted that regular training will be given to the contract's workers, in order to comply with the project's Management Policies and the quality, environment and safety requirements of the contract.

5.2.3. Materials and Equipments

This subchapter intends to present the materials, accessories and equipment that will be used in the project's construction activities and that will also serve as a basis for the socio-environmental impact assessment of the environmental and social descriptors and the respective risk analysis.

The following table (*see* **Table 13**) lists the main materials that will be used within the scope of the project, during the construction phase.

Table 13 – List of materials to be used during the construction phase of the project

Materiais e Acessórios
Earth and rock
Sand
Tout-venant
Crushed Aggregates
Ink
Geotextile
Concrete, Cement and Prefabricated concrete products (pipes, pipes, curbs, box-culverts, etc.)
Miscellaneous building materials
Chemical Products
Iron and Steel
Impregnation/bonding glue
Bituminous mixtures
Fencing and signage material
Lamps
Miscellaneous electrical equipment
IT consumables
Administrative materials (support yards/jobsites)
Miscellaneous materials for building construction sites (e.g. pipes, cement, bricks, blocks, containers, etc.)

For the exploration phase of the project, it refers only to the production of materials associated with the maintenance and cleaning of the track, involving globally reduced quantities, whether of new materials or degraded materials.

With regard to the type of equipment expected to be used within the scope of construction activities, they are presented in the following table (*see* **Table 14**). **Annex III** presents the list of equipment to be used throughout the construction phase of the project.

Table 14 – List of Equipment to be used during the construction phase of the project (Source: QG Konstruktion GmbH)

Equipments	Maximum amount (peak)
Dump truck (6×4/16 m^3)	200
Grader (160 to 190 hp)	22
Fixed crushing plant (80 to 120 m^3/h)	3
Hydraulic crawler excavator (35 t/2,2 m^3)	15
Sprinkler tanker truck (6×4/20.000 L)	25
Crawler tractor with ripper (200 hp)	12

Equipments	Maximum amount (peak)
Smooth-Paw self-propelled vibrating cylinder (12t)	26
Fixed gravimetric bituminous concrete plant (120 to 140 t/h)	1
Front tire loader (18 t/3,0 m^3)	7
Truck (Mechanical horse – 6×4)	9
Front tire loader (12 t/3,0 m^3)	8
Aggregate Finisher/Distributor (160 hp, 700 ton/h)	3
Semi mobile crusher (500 t/h)	3
Agricultural tire tractor (120 hp/5 t)	14
Backhoe loader (7t/0,8 m^3)	9
AT tire crane/Telescopic Lance Cap. 80 t/Lance = 50,0 m	2
Tire self-propelled vibrating drum (27 t with ballast)	7
Bituminous concrete distribution truck (6×4) + EHR 600 spreader tank	3
Concrete mixer truck (6×4/8 m^3)	4
Hydraulic drilling jumbo (13 t/ 2” to 4” holes	2
Semi-trailer (Plank - 3 axles, 45 t)	9
Generator group (500 KVa)	3
Crane truck (Cap. = 15 tm)	3
Body truck (Cap. charge = 7 t)	4
Bituminous concrete glass-finisher on tracks, 700 t/h	1
26 t Cement tanker truck with compressor	2
CS 4×4 pick-up utility vehicle (Cap. charge = 1.000 kg)	4
Generator group (125 KVa)	4
Hydraulic hammer, 2.500 kg	2
Towable light tower (4×1.000 W)	15
Concrete plant, stationary mixer (60 m^3/h)	1
Generator group (275 KVa)	1
Generator group (40 KVa)	3
Hot asphalt tank (10 to 30 m^3)	4
Vibrating plate compactor (20 kN)	4
Tandem static road roller (10 t)	1
Motor pump set (exit = 3”)	5
Self-propelled mechanical broom	3
Concrete pump truck (40 to 60 m^3/h)	1
Gasoline chainsaw, 3.1 CV	7
Reinforced water tank (20 to 30 m^3)	7
Curb extrusion machine IMB 900-G	1
Rectifier welding machine	1
Diesel portable air compressor (200 to 300 pcm)	1
Silo for complete concrete plant, 70 t	1
Crushing plant (500 t/h)	1
Oxy-cut set	1
Grupo generator (75 KVa)	1
Iron bending machine (CA50 until 38 mm)	1
Iron bending machine (CA50 until 50 mm)	2
Gasoline immersion vibrator (diameter = 105 mm)	2
Crane truck (Cap. = 23 tm)	--
Fixed crushing plant (80 to 120 m^3/h)	--
Total Heavy Equipment	**133**
Total light equipment	**255**
Total Industrial Equipment	**8**
Total Miscellaneous Equipment	**74**
Total	**470**

It should be noted that the mobilization of equipment for the project's various work fronts and administrative facilities and jobsites will be adjusted throughout the contract in order to comply with the deadlines defined in the intervention schedule of the construction phase of the project.

5.2.4. Description of the Support Infrastructures Planned for the Construction Phase

In general, the support structures planned for the execution of the contract will include the Jobsites (plant and life base), the concrete and bituminous plant, the fixed crusher and the borrow land (sand pits, deposits and quarries) where part of the raw material that will be incorporated in the rehabilitation of the road section (base layer and sub-base) will be extracted. These infrastructures will be described in the following subchapters.

5.2.4.1. Jobsites

The Main Jobsite is located in the Municipality of Cazombo (UTM: 702422.90E; 8682697.10S) and will have about 134.000 m^2 (*see* **Figure 31**). It should be noted that this location was chosen on the basis that this area, already fenced, was used as a jobsite in an old contract in the region, whose existing buildings will be rehabilitated for use during the contract.

Figure 31 – Location of the projects' main jobsite in Cazombo (Source: *Google Earth*).

The second project support site (*see* **Figure 32**) will be located at PK 86+000 of the span/section 1 of the road section (UTM: 690877.85E; 8757612.44S), with an approximate area of 100.000 m^2.

Figure 32 – Location of the project support site located at PK 86 (Source: QG Konstruktion GmbH).

The design of the facilities of both sites will be sized to meet the peak manpower, both in terms of offices and accommodation. It should be noted that it is planned to install the operational bases of support in existing buildings rehabilitated and/or new, composed of the following areas/sections:

- Lobby;
- Administrative offices;
- Living base (Staff accommodation, social area, etc.);
- Locker rooms;
- Kitchen and dining hall;
- Sanitary facilities:
- Vehicle parking, circulation area and vehicle refueling;
- Solid Waste and Effluent Management System;
- Tool Depot ("Tooling");

- Warehouse;
- Warehouse Areas (*Stock* of Materials);
- Mechanical Workshop;
- Equipment Park;
- Water and fuel tanks;
- Among others.

Figure 33 shows an aerial photograph of a QGMI type jobsite and **Figure 34** shows an example of the *layout* of the type jobsite.

Figure 33 – Aerial photograph of a type jobsite (Source: QG Konstruktion GmbH).

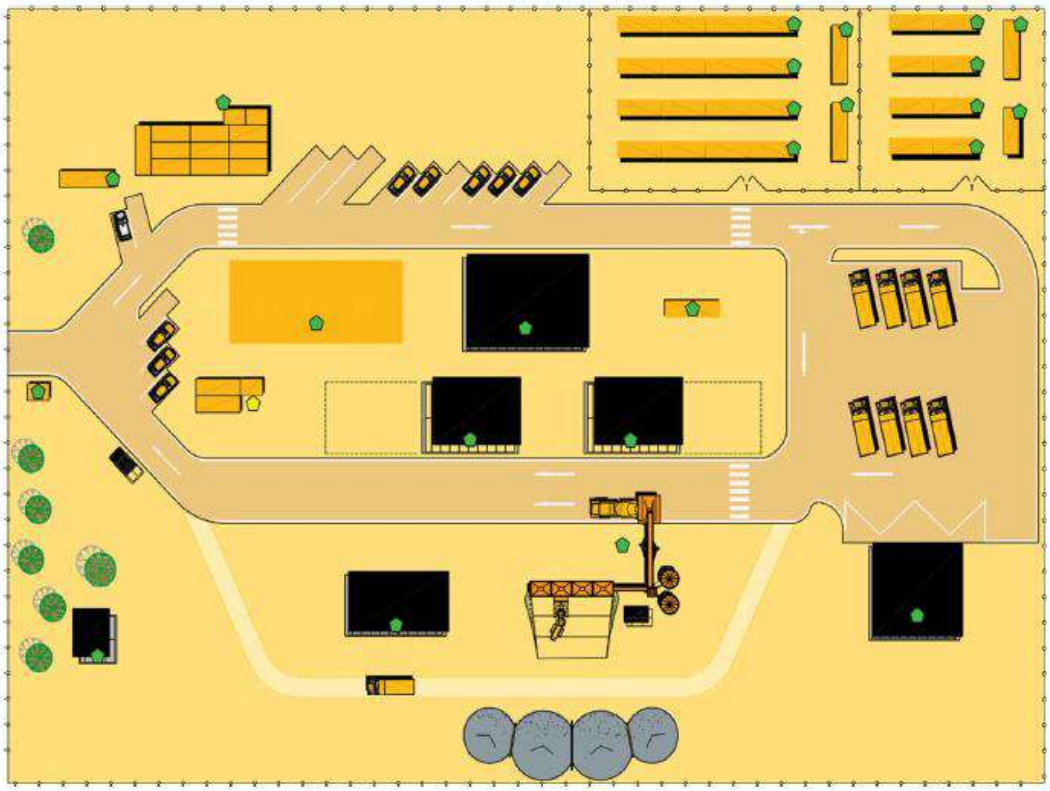


Figure 34 – *Layout* of a jobsite type (Source: QG Konstruktion GmbH).

The different areas/sections of the project sites (central and support) are described below.

The purpose of the lobby (*see* **Figure 35**) will be to control access and movement of vehicles, equipment and people to the internal area of the construction sites and to control the frequency of employees, in addition to maintaining the safety of the construction sites. This area will have proper signage, employee passage bays and time clocks. With regard to the administrative offices (*see* **Figure 35**), this area will have the purpose of meeting the needs of the teams responsible for the technical-administrative work. This area consists of a single-story building and will contain rooms for the technical-administrative sectors, meetings, sanitary facilities and a pantry for employees of the sector.

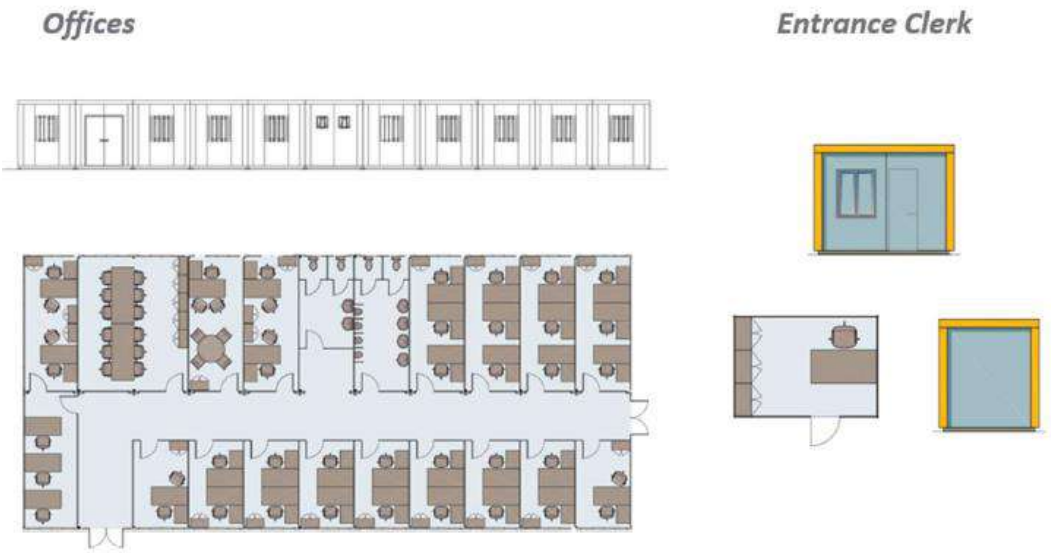


Figure 35 – Example of *Layout* of the administrative offices (left) and concierge (right) (Source: QG Konstruktion GmbH).

The kitchen and cafeteria (*see* **Figure 36**) are designed to serve meals to project employees. The cafeteria was sized with 1.0 m² per employee and per shift and can work in up to three shifts of service. This area has been arranged in such a way as not to interfere with the operation of the remaining units/areas of the jobsite.

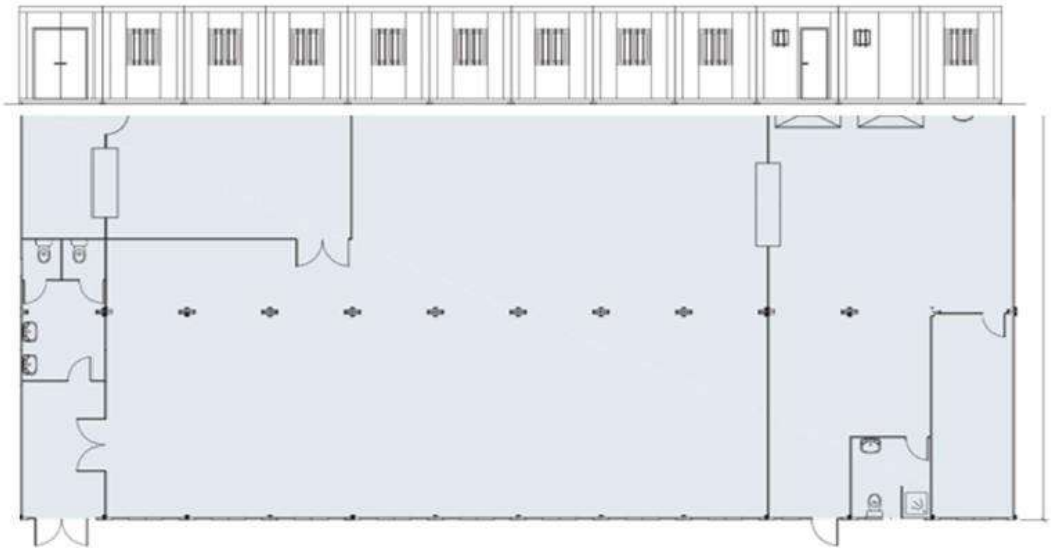


Figure 36 – Example of *kitchen* and cafeteria layout (Source: QG Konstruktion GmbH).

The sanitary facilities will be sized considering the use of a toilet, a washbasin, in addition to individual lockers and circulation areas, for each group of 20 employees, in addition to a shower for each group of 10 employees, resulting in approximately 7.0 m² for each group of 10 employees. This area will correspond to a building of a ground floor peak, containing sanitary basins, washbasins, urinals, showers, and individual lockers for each group of employees.

Sanitary facilities shall be constructed of resistant and washable materials, waterproof and non-slip floors, adequate lighting, and ventilation in order to provide better well-being to users. These facilities will be divided by gender.

The objective of the medical station is to meet the needs of the QSE (Quality, Safety and Environment) team assigned to the project, within safety, hygiene, and comfort standards. This area will have sanitary facilities, a waiting room, a medical infirmary, and rooms for work safety.

The warehouse area was planned for the storage and control of entry and exit of the materials to be used in the contract. It consists of closed and covered buildings, sized enough to meet the needs of the work, containing shelves, service desk, tooling, and room for the warehouse. Externally, it will have a patio for the storage of non-perishable materials. This area should be insulated through a fence in order to promote greater safety and control of the stored materials.

With regard to the Mechanical Workshop (*see* **Figure 37**), this area will consist of a closed and covered building, sized enough to meet the needs of the service, containing shelves of parts, place for storage of tools and room for the person in charge of maintenance.

Figure 37 – Illustration of the machine shop area (Source: QG Konstruktion GmbH).

Regarding the accommodation of employees (*see* **Figure 38**), because it is a work away from the urban area, it is planned to implement the accommodation of employees in the jobsites. Thus, buildings with necessary insulation and implanted in an appropriate place will be made available, equipped with sanitary facilities, showers, washbasins, etc., and dimensioned to

meet the needs of the employees housed, within the provisions of the current Standards and Specifications. The facilities will be cleaned daily, and the change of bed linen will be weekly.

Figure 38 – Illustration of employee accommodation (Source: QG Konstruktion GmbH).

With regard to the location of the fuel storage tanks (*see* **Figure 39**) that will ensure the supply of existing fixed equipment, as well as mobile equipment assigned to the execution of the project that are distributed along the work fronts, it should be a waterproofed place and the tanks should be placed on a retention basin in order to avoid contamination of the soil and / or water resources.

Figure 39 – Fuel tanks at the project support site (Source: QG Konstruktion GmbH).

It should be noted that all filling stations and / or fuel tanks with a volume greater than 10 m^3 are subject to prior licensing, in accordance with Presidential Decree No. 173/13 of 30 of October.

In short, the jobsites/life bases must have the facilities and basic infrastructure necessary to guarantee the proper execution of the contract, adequate sealing and security of the same, availability of firefighting means and response to accidental spills of chemical products in accordance with the Emergency Plan to be drawn up for the jobsites and adequate social conditions for all workers.

It should be noted that QG Konstruktion GmbH has an operating procedure (OP 02) that establishes basic rules for coexistence in the jobsite facilities, including accommodation (*see* **Annex IV** - OP 02 Coexistence Rules_EN_Rev03).

For this purpose, the jobsites must be equipped with rainwater drainage networks, wastewater drainage, water supply and respective effluent and water treatment infrastructures, as well as a properly sized waste park.

It is also mentioned that all necessary infrastructure systems (supply, including catchment areas, and sanitation network) must be implemented with protection devices against contamination, being protected by fences, locks, covers and other interventions that make necessary.

At the end of the contract's civil construction works, the jobsites must be duly dismantled and restored to the initial conditions of the land. Whenever possible, some infrastructure and/or materials expected to be discarded will be offered to the local community.

5.2.4.2. Bituminous Concrete Plant

As part of the project, a gravimetric asphalt plant will be set up next to Quarry 2, which will be located close to the Cazombo jobsite. This plant will be of the Ammann brand, model ABC 140 SOLIDBATCH, with a production capacity of 140 to 240 tons per hour.

5.2.4.3. Concrete Plant and Crusher

The project also foresees the installation of a concrete plant and fixed crusher that will be located next to Quarry 2, which is located close to the Cazombo jobsite. This plant will be of the Lintec-ixdn brand, model LX SCM MIXER, with a fully automated mechanism that will allow the production of cold mixes with or without the addition of additives and cement. The concrete plant will have a production capacity of 200 to 500 tons per hour.

5.2.4.4. Quarries, Deposits and Sand Pits

As part of the previous studies, QGMI proceeded to identify potential areas that could possibly be used for the supply of materials in adequate quantity and quality for the execution of landfills, giving priority to sites that were already previously intervened and/or areas that are currently degraded in order to mitigate the negative impact of the use of these areas and enhance the positive impacts inherent in the activities of landscape restoration (remodeling and recovery) of these same areas (degraded), during the phase of dismantling/deactivation of the project, since the restoration of the initial conditions of the land / support areas that will be used in the scope of the contract will be ensured. In addition, geological studies and laboratory tests are being carried out in order to identify and evaluate deposits, quarries and sands, where the material may eventually be removed for the rehabilitation of the road between Luau-Cazombo-Lumbala Caquengue, in particular for the granular base, pavement and concrete.

For the extraction of the material, the dismantling method that best applies will be evaluated, similarly, evaluating the technical characteristics of the equipment used in the dismantling and loading, the stability of the massifs and the safety conditions. The exploitation of all quarries in this project will be carried out directly by QGMI and not through subcontracting. This will eliminate operational, safety, and neglect risks such as child labor or forced labor.

In this sense, during the previous studies carried out by QGMI, three quarries were identified (PK -41+300; PK 0+000; PK 11+900) that meet the intended requirements.

The first quarry (*see* **Figure 40**) is located around the road between Luau and the Sapo River, 41 km before PK 0+000 of this project. This is an area that has been the subject of a previous exploration, by another contract and whose site has not been recovered. The quarry has a total area of 46.376 m^2, divided into area allocated to exploration, 27.224 m^2 and area assigned to *stockpile* (*stock* of inert and heaps) of 19.152m^2. In **Annex XIX** the Tests of the Quarries carried out in the scope of the previous studies are presented.

Figure 40 – Location of Quarry 1 (PK -41+300) (Source: adapted from *Google Earth*).

The second quarry is located in Cazombo (*see* **Figure 41**), near the main jobsite (703195.54E; 8682692.32N). It is estimated that the exploration could affect an area of about 5 hectares (56.380 m^2).

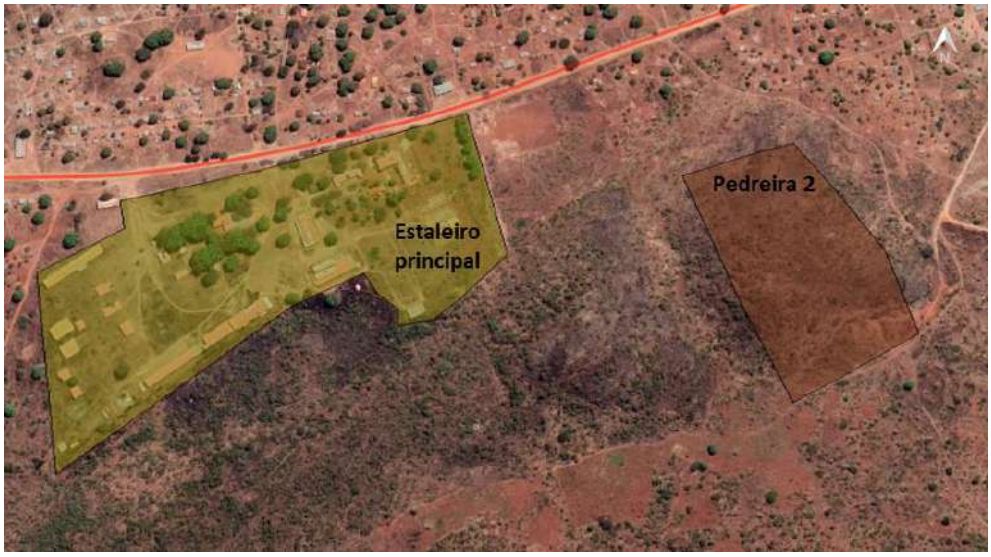


Figure 41 – Location of Quarry 2 (Source: adapted from *Google Earth*).

The following figure (*see* **Figure 42**) shows a picture of the current state of Quarry 2 (PK 0+000), with a predominance of undergrowth.

Figure 42 – Photographic record of Quarry 2 (Source: QG Konstruktion GmbH).

The third quarry (*see* **Figure 43**) is located about 11 km (PK 11+900) after the city of Cazombo towards Lumbala (705845.95E; 8680561.92N). It is estimated that the exploration could affect an area of about 5 hectares (53,267 m^2).

Figure 43 – Location of Quarry 3 (Source: adapted from *Google Earth*).

The following figure (*see* **Figure 44**) shows a picture of the current state of Quarry 3.

Figure 44 – Photographic record of Quarry 3 (Source: QG Konstruktion GmbH).

Although not only a visual survey was carried out, several deposits/reservoirs for landfill material and sand were identified. This project should have 10 to 20 deposits for this purpose. Thus, the following figures (*see* **Figures 45** and **46**) present the photographic record of some of the pre-identified deposits in the area of influence of the project that appear to have already been intervened, in other works, and/or that are degraded.

Figure 45 – Photographic record of Reservoir 1 located at PK 5+700.

Figure 46 – Photographic record of Reservoir 10 located at PK 132+400.

Thus, the exploration of deposits and sands pits must comply with the following procedures:

- Initially, the pickling and cleaning services of the terrain, foreseen and quantified in the Earthmoving Project, should be performed. The vegetal layer, derived from this cleaning of the land, must be removed for stock in previously chosen areas and be protected from the elements, in order to avoid its carriage, for later use in the environmental recovery of the area itself. Access services should also be executed and signaled, if necessary, for the proper circulation of equipment. It should be noted that some of the identified areas are already deforested and with access paths;
- The material to be extracted will have its thickness varying according to the usable layer of soil and the specifications of the project.

As the work front progresses, the area will become more susceptible to erosive processes and, in order to avoid these interferences, before each advance of the excavation, the surface drainage system of the area must be readjusted in order to order the flow of surface water and protect the exploited area from erosive processes and material harvesting.

As in the other occurrences, the quarry operation begins with the execution of the cleaning services of the land, as well as the opening of the access paths. In the case of the quarry identified in PK-41+300, it will not be necessary to clean and open access paths, since it is an

area that has already been the target of an exploration, in another contract, as already mentioned above.

For the extraction of the material, the dismantling method that best applies should be evaluated, evaluating the technical characteristics of the equipment used in the dismantling and loading, the stability of the masses and the safety conditions. The stability of the benches should be continuously monitored in order to verify potential situations of instability on the slopes. Where there is instability, activities should be immediately halted and should only be resumed after corrective measures have been taken and formal action by the responsible technical supervision has been released.

Large-scale exploitation should be avoided, especially with the creation of depressions, in order not to accumulate rainwater in an inaccessible place.

The exploitation of all quarries in this project will be carried out directly by QGMI and not through subcontracting. This will eliminate operational, safety, and neglect risks such as child labor or forced labor.

5.2.4.5. Safety Equipment

The work fronts must be duly signposted and access limited for safety reasons in order to prevent access by people outside the intervention. This situation may cause some constraints to the population since the interventions take place on one of the main roads. However, the signaling of the interventions will also serve to inform the population, always trying to ensure that the interventions take place in the shortest amount of time.

The area allocated to the jobsites will be properly fenced and access will be controlled by security guards in order to prevent the entry of people outside the contract.

Employees assigned to support facilities and work fronts will have personal protective equipment (PPE) available to ensure their protection in the performance of their duties, namely boots, gloves, vests, masks and helmets.

Firefighting and response to accidental spills of chemicals will also be present.

5.3. Environmental Information of the Construction Phase of the Project

Considering the type of project and respective construction activities, it is possible to predict which effluents, solid waste, atmospheric and noise will potentially be produced in the construction phase of the contract.

5.3.1. Consumption of Natural Resources

According to the United Nations (UN), the civil construction sector consumes 40% of all energy, extracts 30% of materials from the natural environment and generates 25% of solid waste. Considering the activities planned for the entire life cycle of the project, it is expected that the phase that will be most relevant in environmental terms will be the construction phase, with an estimated duration of 48 months.

Throughout the construction phase, the most relevant consumption of natural resources will be those related to the construction activities to be developed within the scope of the project and described in **Chapter 5.2.** In the following subchapters, the information inherent to the natural resources that will be used during the contract is presented, estimating, whenever possible, the consumption of these resources, as well as presenting some relevant environmental information that should be considered when carrying out the construction activities.

5.3.1.1. Soils

During construction activities, the Principle of Waste Prevention and Reduction should always be adopted. In this sense, the Executing Entity must implement waste management measures that give priority to reduction operations, followed by reuse/reincorporation, recycling (when feasible) and finally, the disposal operation (landfill). Thus, whenever technically possible, the material resulting from the excavation should be reincorporated into the ditch, in order to prevent the amount of construction and demolition waste produced during the road rehabilitation activities. However, the need to borrow material is also estimated. The leftover material, which cannot be reincorporated into a trench bed, will, whenever possible, be reused in other construction activities of the contract, landscape restoration of support areas and/or in the rehabilitation of public roads and access to work jobsites.

It should be noted that during the preliminary studies carried out by QGMI the following amounts of earthmoving were estimated:

- Embankment: 2.650.000m^3;
- Sanitation (soils without technical specifications to be used in landfill): 350.000m^3;
- Excavation: 130.000m^3.

5.3.1.2. Water

The need for water is one of the main criteria to consider in this type of project, which can condition the work and make the undertaking unfeasible. For this reason, it is absolutely necessary to adapt the operation and its interaction with water.

For water supply, it is essential to consider the distribution of needs for different operations, installations, irrigation and dust control, among others.

For the construction phase, the project will need to supply water to carry out the construction activities described in **Chapter 5.2.**, as well as for the facilities and support infrastructure described in **Chapter 5.2.4.** In this sense, it is planned to use water for social and support facilities, for irrigation of accesses, for the production of concrete and bituminous concrete, for work fronts, among others.

The origin of the water (non-potable/non-controlled) for use in the contract's construction activities will be acquired and later stored in 7 reservoirs (20 to 30 m^3) in the jobsites for the project. The water will mostly be used to irrigate the accesses, for the concrete and asphalt plants, as well as for the activities to be carried out on the work fronts. If it becomes necessary to capture water in the public water domain, the executing entity will be responsible for ensuring the licensing of this use, in accordance with the provisions of Presidential Decree No. 82/14 of 21 April. If you want this water to be used in social facilities, the Executing Entity must also ensure that it is treated beforehand in order to ensure its potability.

Water consumption (non-potable) during the contract will be very variable since it will be inherent to the activities planned for the rehabilitation of the road section and to the weather conditions recorded during this phase, however based on the history of water consumption recorded in contract works similar projects, consumption is estimated at around 94.000 m^3 for the entire contract. It should be noted that this value is merely an estimate and may vary depending on the factors mentioned above.

With regard to the consumption of potable water, it will be limited to the use of employees who will inhabit the base of life (social jobsite) and the consumption of potable water by employees on the work fronts. Drinking water consumption of around 6.500 m^3 is expected for the entire contract. The consumption of potable water will be limited to the use of employees who will inhabit the base of life (social jobsite) and the consumption of potable water by employees on the work fronts. Drinking water consumption of around 6.500 m^3 is expected for the entire contract. Regarding water supply, it is planned that the Main Jobsite will use water from the Sapo River, which will be stored in a reservoir in the area of the yard. In the case of

the Secondary Jobsite (support yard), collection through an artesian well or collection from the river at PK 86+400 is foreseen.

In order to ensure adequate environmental management, during the contract, consumption monitoring and the adoption of mitigation and reduction measures must be ensured in order to avoid wasting water and ensure adequate management of this natural resource.

5.3.1.3. Energy

During the construction phase, the origin of the energy consumed will come from fossil sources (diesel and gasoline) for the operation of machines and equipment, mainly on the work fronts, given that the project site does not have energy from the public network. Thus, there will be groups of backup generators in order to guarantee the supply of energy, namely, three 500 Kva generators, four 125 Kva generators, one 275 Kva generator, three 40 Kva generators and one 75 Kva generator.

For the construction phase of the project, and considering the type and quantity of equipment planned for the construction phase (*see* **Table 14**), a total consumption of around 23.000.421 L of fossil fuels is estimated, which resorting to the GHG Protocol tool will represent annual greenhouse gas emissions of around 14.019.63 t CO_{2eq}.

5.3.2. Liquid Effluents

5.3.2.1. Industrial Liquid Effluents

With regard to industrial water, during the construction phase of the project, it is considered the existence of wastewater arising from the support facilities for the work, namely from washing equipment and vehicles in the yards, technical areas for the storage of materials, equipment and parking of vehicles and machines, installation site of generators and fuel tanks, workshops and areas for refueling vehicles and machines, and concrete and bituminous concrete plants. Wastewater from this source should be sent to hydrocarbon separators and, if necessary, be subjected to a treatment system before discharge into the receiving environment. Hydrocarbon separators - HS (water-oil separators) are used to receive effluents and water contaminated with oils and fats. These work through a physical separation resulting from the difference between the density of water and oil. The HS can consist of a sand box (sand filter), oil-water separator system and oil collection box.

With regard to the storage area for chemical products and fuel supply, this should be properly waterproofed, with spill containment kits available, consisting of a bucket containing absorbent material, namely sand, given its good capacity for absorbing liquids, and a shovel, to

spread and remove the contaminated absorbent, whenever necessary. The sand, after use, must be sent as contaminated waste by a Waste Management Operator (WMO), duly licensed and trained, and delivered to a final destination for proper treatment. However, this entire area must be surrounded by a retaining wall, in order to contain any small spills that may occur, resulting from a fuel leak. At the same time, installed generators must have retention basins to contain any small oil/fuel spills that may occur, functioning as a first containment tool.

It should be noted that in the event of spillage onto the ground, employees must have specific training to know how to act in this situation, and the spillage site must be immediately contained, slatted/cleaned and the resulting material subsequently deposited and stored in specific container to be collected and forwarded to the authorized final destination.

With regard to the production of concrete, wastewater will be related to the manufacturing process and washing of self-concrete mixer trucks leading to the production of concrete grout. This wastewater will be stored in dedicated wash wells and after dehydration, the material can be reused.

The water resulting from washing the gutters of the concrete mixers, on the work fronts, must be sent to retention basins built for this purpose. The interior of the basins must be protected with geotextile and the bottom lined with crushed aggregate, allowing the water to be filtered and freely infiltrate into the soil (*see* **Figure 47**). Retention basins must be properly marked. When the washing basin is at its storage limit, the solidified concrete will be cleaned.

With regard to the construction of the drainage ditch (*see* **Figure 47**), initially the opening of the ditch should be carried out, then the placement of the geotextile screen and finally the placement of a layer of crushed aggregates about 60 cm thick. In this way, the undue deposition and washing of waste/effluents from washing concrete mixers will be avoided.

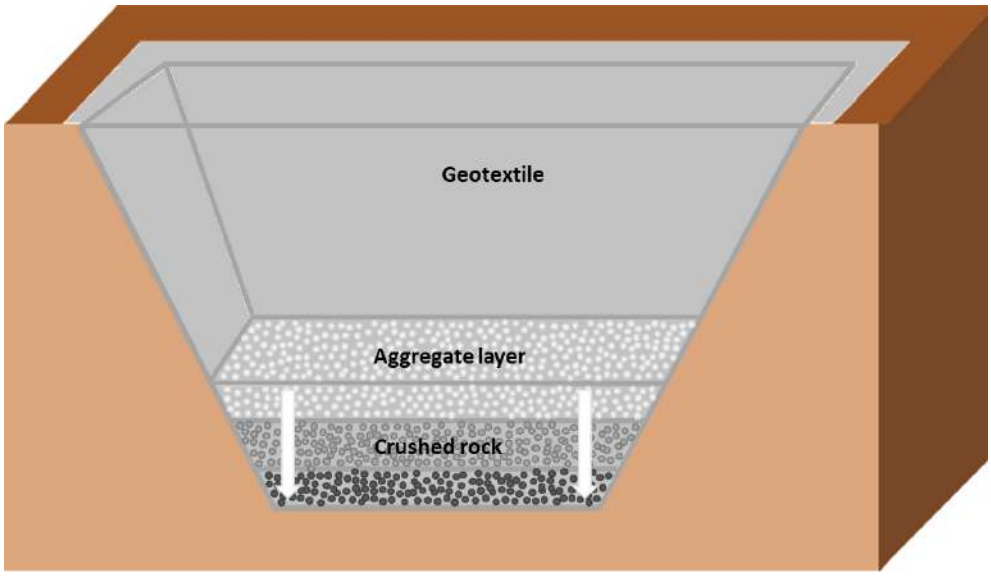


Figure 47 – Schematic representation of the profile and constitution of the site for washing concrete mixers (Source: Resurb Ambiente, Lda.).

Once dry, priority will be given to the reuse/reutilisation of concrete waste as inert, namely as a *tout-venant* mixture or they can also be reused in the recovery of rural roads or private accesses or, even, sent to crushing plants in order to be crushed and incorporated into other works or even in the landscape recovery of areas supporting the work.

5.3.2.2. Domestic Liquid Effluents

Within the scope of the construction of the project, the production of domestic wastewater from social and administrative facilities, namely sanitary facilities, changing rooms, canteen, etc., which will be sent to septic tanks for the storage of domestic wastewater or similar, through the combination of decantation and anaerobic digestion processes. The first stage corresponds to the sedimentation of the sludge, with separation of the solid phase from the liquid phase, followed by digestion of the sludge with the mineralization of organic matter.

The treated effluent may subsequently be discharged into a receiving medium as long as they comply with what is defined in Annex VI of Presidential Decree No. 261/11, or subsequently collected by a duly licensed waste management operator.

The following table (*see* **Table 15**) presents the typical theoretical composition of a low, medium and high load domestic effluent, according to Metcalf & Eddy.

Table 15 - Typical composition of a low, medium and high load domestic effluent (Source: Metcalf & Eddy, 1998)

Parameters	Units	Low	Mwdium	High
TSS	mg/L	100	220	350
BOD_5	mg O_2/L	110	220	400
COD	mg O_2/L	250	500	1000

Parameters	Units	Low	Mwdium	High
Total nitrogen	mg N/L	20	40	85
Total phosphorus	mg P/L	4	8	15
Total coliforms	N.º/100 mL	10^6 - 10^7	10^7 - 10^8	10^7 - 10^9

Based on the values in the table above, and the maximum number of workers foreseen during the construction phase (4 years), a theoretical value is estimated for the volume of domestic effluent that will be produced, resulting from the sanitary facilities and canteens of the jobsites. Thus, considering an assumption of an average annual number of 125 workers who will use the social facilities and a capitation, the volume of domestic effluent produced during the construction phase is determined (*see* **Table 16**).

Table 16 – Estimate of the volume of daily and weekly domestic effluent produced by workers - construction phase of the contract

Number of workers	Capitation (L/(day inhabitant))	Days/week
125	45	6

In short, it is estimated the production of a volume of domestic liquid effluent of about 33,75 m^3 between Monday and Friday (working days), which leads to an approximate annual production of 2.053,13 m^3. Regarding the qualitative component, it is expected to be a medium load effluent.

Taking into account the amount of TSS considered for a medium load effluent and the estimated volume of domestic effluent produced, it is expected that the amount of septic tank sludge will be approximately 375 kg/year.

With regard to the kitchen and cafeteria of the support jobsites, the implementation of grease separators is suggested. Grease separators are watertight containers intended for the reception and treatment of greasy waste water from domestic or industrial use, originating from food handling.

The operation of grease separators does not require energy consumption, based on the gravitational separation of materials with a density different from water. The heaviest materials (eg sludge, sand, etc.) settle in the pre-settlement compartment and are retained there. This compartment also retains fats that are found in easily floatable forms. Only water and substances lighter than water pass into the separation zone, namely the fats to be separated. Fats accumulate on the surface, while clean water comes out at a level that does not allow the phases to mix.

5.3.2.3. Rainwater Effluents

In the project under analysis there is no reuse of rainwater. These effluents are only drained and routed through natural drainage ditches.

5.3.3. Waste

The Waste Policy is based on objectives and strategies that aim to guarantee the preservation of natural resources and the minimization of negative impacts on public health and the environment. In pursuit of these objectives, it is important to encourage the reduction of waste production and its reuse and recycling. To a large extent, this involves identifying, designing and adopting cleaner products and technologies and recyclable materials, as well as proper management of the waste produced.

Analyzing the Project in particular, it appears that the waste produced will generally be oil, plastic packaging, paper and cardboard packaging, wood, metal packaging, undifferentiated waste and biodegradable (organic) waste, scrap metal, concrete and bituminous waste and waste resulting from clearing and pickling activities. This type of waste will result from the activities inherent to the rehabilitation of the road section as well as activities carried out in the support areas for the contract and inherent to the social component (meal area, among others).

Since the Project's main activity is the rehabilitation of a road section, it will produce a varied type of waste, inherent to its activity, and as such it is expected that the waste generated will be, for the most part, non-hazardous. The most relevant residues in terms of quantity will eventually be the surplus soil resulting from the opening of ditches that may be reincorporated within the scope of the contract and/or in the landscape recovery of the support areas at the end of the project, as referred to in **Chapter 5.3.1.1.**

With regard to hazardous waste, this will be related to possible accident situations (spills) and others associated with cleaning and maintenance of equipment used in the construction activities of the contract.

Table 18 presents the type of waste and respective AWL (Angolan Waste List) codes expected to be produced during the construction phase of the project.

It should be noted that during construction activities, the Principle of Prevention and Reduction of Waste must always be adopted in order to ensure a good environmental performance of the contract. In this sense, the Executing Entity must implement waste management measures that give priority to reduction operations, followed by

reuse/reincorporation, recycling (when feasible) and finally, the disposal operation (landfill), thus reducing the carbon footprint of the project in the forwarding of waste to final destination. It should also be noted that waste prevention is the adoption of measures to reduce the amount of waste produced, namely by reusing products or extending the lifespan of products. Waste prevention also seeks to reduce adverse impacts on the environment and human health resulting from the waste produced and the content of hazardous substances present in materials and products.

The waste produced must be stored in a specific place, duly waterproofed and covered, in the jobsites, until it is forwarded to a recovery destination and/or for final disposal by a Waste Management Operator (WMO) duly licensed by the National Waste Agency (NWA). The following table (*see* **Table 17**) presents the alternatives of competent and duly licensed companies, at the time, in the Provinces closest to the location of the project, for the collection and management of waste that will be produced in the different phases of the project under analysis in the present report.

Table 17 – List of Licensed Waste Management Operators in the Provinces closest to the project implementation site (Source: ANR, 2023)

Company	Location	Type of Waste
Resurb Ambiente Lda.	Huambo, Toyota Monte Car	Solid waste management
Street Limpa	Huambo	Solid waste management Wastewater Treatment
JGNM, Limitada	Huambo	Solid waste management
Ambiáfrica, S.A.	Huambo	Solid waste management
P.J.C, Lda.	Bié	Solid waste management Wastewater Treatment

It should be noted that the information, presented above, in the table above is merely indicative since there are Waste Management Operators in the Licensing Phase, with the National Waste Agency, who may not be included in it. If there are Waste Management Operators in the Province of Moxico who are not duly licensed by the Guardian Entity, they must proceed with the registration and licensing process before formalizing any contract for the management of waste produced by the project.

With regard to the final destination to which Waste Management Operators may direct waste that cannot be recovered, when characterizing the reference situation, a survey of possible solutions was carried out in the Provinces of Moxico and Bié, and it was found that currently, there are no Municipal landfills to properly treat the waste produced in these Provinces.

The following figure (*see* **Figure 48**) presents a schematic representation of the existing solutions in the surroundings of the project and respective distances from the same to the

nearest Sanitary Landfill, located in Sacaála Neighborhood, in the Province of Huambo and disposal site authorized by the local Administrations, which is an "uncontrolled dump" located in Kunge in Bié Province.

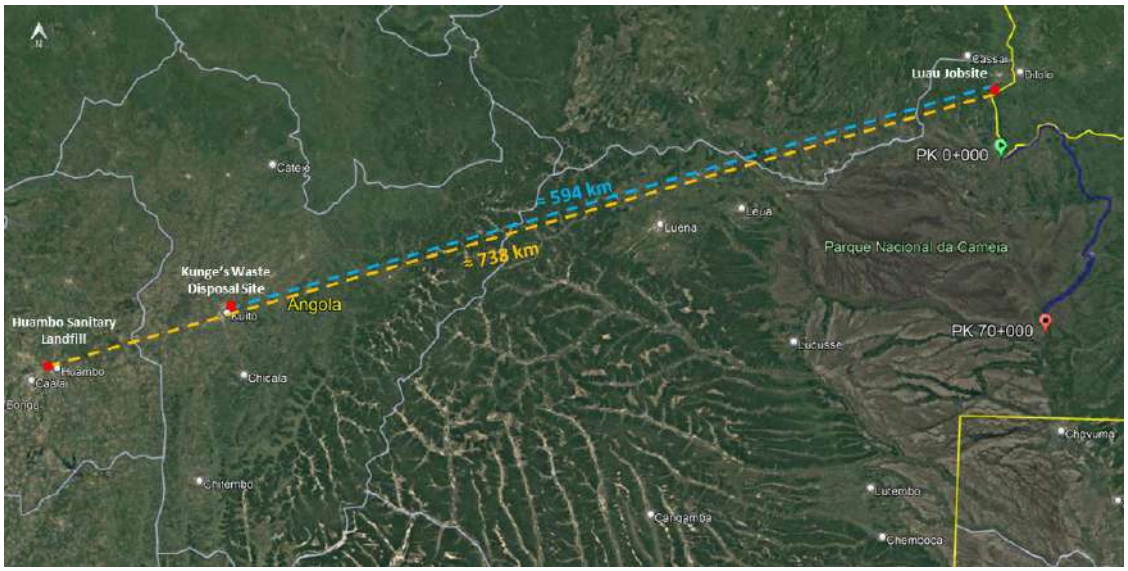


Figure 48 – Representation of the distance from the Huambo Sanitary Landfill and the uncontrolled waste disposal site ("dump") in relation to the project (Source: adapted from *Google Earth*).

As can be seen from the previous figure (*see* **Figure 48**), the Sanitary Landfill closest to the project is located around 738 kilometers from the site of the Luau jobsite and 594 km from the "uncontrolled dump", which is why it should be, whenever possible, considered the best environmental solution, in order to reduce the amount of waste produced, which cannot be recovered, reduce the carbon footprint inherent in transport and thus reduce the environmental footprint of the project.

As the landfill closest to the project is quite far away, as mentioned above, it may be necessary to handle or treat the waste on site. However, there are several techniques that can be applied for proper waste management, namely:

- Segregation of waste on site: waste can be segregated on site, separating recyclable and non-recyclable materials, which will reduce the volume of waste that needs to be transported to the final destination and will also facilitate the forwarding of waste in an environmentally more sustainable way;
- Reuse: reuse materials from the jobsites, such as bricks, stones, concrete and asphalt, which can be reused and used in the project, or even transferred to the local population;

- Composting: organic waste can be composted and used as a natural fertilizer for gardens and landscaping activities;
- Incineration: incineration could be an alternative to the disposal of waste in landfills for certain types of waste.

The following table (*see* **Table 18**) specifies the waste expected to be produced during the construction phase of the contract.

Table 18 - Typology of waste produced, its origin, waste management operation and estimated amount in the construction phase of the project

Area/Sector	LAR	Designation	Origin/production	Photographic Record/Illustrative Image	Final Destination	Waste Management Operation	Quantities Produced (estimated)
Jobsites - Social Facilities/administrative area	**08 03 18**	Waste print toner (containing no hazardous substances)	Jobsites offices/life bases (multifunction printers)		1st Reuse 2nd Recycling 3rd Sanitary Landfill	R12/D1	1 toner/month
	16 05 04*	Gases in a pressure vessel (including halons) containing hazardous substances	Refrigerant gas cylinders resulting from AC maintenance		1st Reuse 2nd Sanitary Landfill (Hazardous Waste)	R1/D1	Residual amount (Delivered to the service provider for reuse/filling)
	18 01 03*	Waste whose collection and disposal are subject to specific requirements with a view to preventing infections	Residues resulting from pest control, namely residues of eliminated pests		1st Energy Valuation 2nd Sanitary Landfill	R1/D1	2 Kg/month
	20 01 35*	Disused electrical and electronic equipment	Lamps, fuses and other equipment, resulting from office and warehouse activities containing hazardous substances		1st Recycling 2nd Sanitary Landfill	R13/D1	Residual
	20 01 36	Disused electrical and electronic equipment	Lamps, fuses and other equipment, resulting from office and warehouse activities non containing hazardous substances		1st Recycling 2nd Sanitary Landfill	R13/D1	It will result from the failure of electrical and electronic equipment (≈10kg/year)
	20 01 08	Biodegradable kitchen/dining waste	Cooked food scraps and organic scraps		1st Organic Enhancement/ Composting 2nd Sanitary Landfill	R3/D1	1.074 Kg/month

Area/Sector	LAR	Designation	Origin/production	Photographic Record/Illustrative Image	Final Destination	Waste Management Operation	Quantities Produced (estimated)
	20 03 01	Other municipal and similar waste, including mixed waste	Waste equivalent to urban, not liable to be sorted at source, resulting from toilets and geotextile		1st Organic Enhancement 2nd Energy Valuation 3rd Sanitary Landfill	R3/R1/D1	570 kg/moth
	13 05 02*/ 13 05 07*	Sludge from oil/water separators Water with oil from oil/water separators	Separator sludge/water made up of oils and fats, resulting from cleaning the HS		1st Organic Enhancement 2nd Sanitary Landfill	R1/ D1	10 m^3/month
	20 03 04 / 20 03 06	Septic Tank Sludge/Sewage Cleaning Waste	Social facilities (changing rooms/changing rooms, sanitary facilities)		1st Organic Enhancement 2nd Sanitary Landfill	R3/D1	- Domestic liquid effluent: 2.053,13 m^3/year - Septic tank sludge 375 kg/year
	19 08 09	Mixtures of fats and oils, from oil/water separation, containing edible oils and fats	Dining room/kitchen		1st Energy Valuation	R1	7,6 m^3
Construction Sites/Jobsites/Technical Areas/Workshops	**13 02 08***	Other engine, transmission and lubricating oils	Oils resulting from minor repairs and maintenance of equipment and generators		1st Energy Valuation 2nd Hazardous Sanitary Landfill	R1/D1	55 L/month
	15 01 01/20 01 01	Paper and cardboard	Cardboard used in the packaging of materials and products used in the contract		1st Reuse 2nd Recycling 3rd Valuation 4th Sanitary Landfill	R13/R1/D1	35 kg/month
	17 02 03 / 15 01 02 / 20 01 39	Plastic Plastic Packaging	Plastic packaging, resulting from the consumption of employees, cleaning, as well as plastic waste resulting from construction activities, packaging of materials and products and contract signage (tapes)		1st Reuse 2nd Recycling 3rd Valuation 4th Sanitary Landfill	R13/R1/D1	40 kg/month

Area/Sector	LAR	Designation	Origin/production	Photographic Record/Illustrative Image	Final Destination	Waste Management Operation	Quantities Produced (estimated)
	15 01 05	Composite packaging	Resulting from the packaging of materials and products (eg cement bags)		1st Reuse 2nd Recycling 3rd Valuation 4th Sanitary Landfill	R13/R1/D1	65 kg/month
	15 01 03/ 20 01 38	Wood and derivatives	Wood resulting from the conditioning of materials used in the construction activities of the contract (eg formwork)		1st Reuse 2nd Recycling 3rd Valuation 4th Sanitary Landfill	R13/R1/D1	30 kg/month
	15 01 04	Metal packaging	Used beverage cans, food cans or other metal packaging as well as emulsion glue drums		1st Reuse 2nd Recycling 3rd Valuation 4th Sanitary Landfill	R13/R1/D1	90 kg/month
	15 01 07	Glass packaging	Glass bottles, resulting from consumption by employees. Glass resulting from the maintenance of support infrastructures and equipment		1st Reuse 2nd Recycling 3rd Valuation 4th Sanitary Landfill	R13/R1/D1	130 kg/month
	15 01 10*	Packaging containing or contaminated by residues of hazardous substances	Resulting from maintenance of equipment and materials		1st Recycling 2nd Sanitary Landfill	R13/D1	25 kg/month
	15 02 02*	Absorbents, filter materials, cleaning cloths and protective clothing contaminated by hazardous substances	Resulting from protective clothing used by employees and from cleaning and maintenance of equipment and materials		1st Sanitary Landfill (Hazardous Waste)	D1	950 kg/month
	15 02 03	Absorbents, filter materials, cleaning cloths and protective clothing (not containing hazardous substances)	Resulting from protective clothing/equipment used by employees and from cleaning and maintenance of equipment and materials		1st Recycling 2nd Sanitary Landfill	R13/D1	
	17 04 05	Iron and Steel	Coming from constructive activities		1st Reuse 2nd Recycling 3rd Energy Valuation 4th Sanitary Landfill	R13/R1/D1	100 ton/entire Contract

Area/Sector	LAR	Designation	Origin/production	Photographic Record/Illustrative Image	Final Destination	Waste Management Operation	Quantities Produced (estimated)
	17 05 03*	Soils and Rocks containing hazardous substances	Contaminated soils resulting from contamination by accidental spillage of fuels and potentially contaminating materials		1st Sanitary Landfill	D1	Will only result from emergency situation
	17 09 03*	Other construction and demolition waste (including waste mixtures) containing hazardous substances	Coming from the mixture of non-segregated waste inherent to the construction activities of implantation of jobsites/infrastructures		1st Sanitary Landfill	D1	Residual
	17 09 04	Mixture of construction and demolition waste not covered by 17 09 01, 17 09 02 and 17 09 03	Coming from the mixture of non-segregated waste inherent to the construction activities of implantation of jobsites/infrastructures		1st Sanitary Landfill	D1	Residual
	17 05 04	Soils and rocks not mentioned in 17 05 03	Soil from excavation activities		1st Reuse (reincorporation contract)	R13/R1	350.000 m^3/total of the contract, which will be reincorporated into the work, whenever possible
	20 02 01	Green waste	Green waste from possible pickling and clearing activities		1st Organic Enhancement / Composting 2nd Sanitary Landfill	R3/D1	Residual
Concrete Plants/Work Fronts	**17 01 01**	Concrete	Coming from concreting/formwork/works of art activities		1st Reuse (reincorporation in construction activities)	R13/R1	200 ton/entire Contract
	17 03 01*	Bituminous mixtures containing tar	From paving activities (ripping bituminous concrete containing tar)		1st Reuse (reincorporation in construction activities)	D1	Residual - will be reincorporated into the contract

Area/Sector	LAR	Designation	Origin/production	Photographic Record/Illustrative Image	Final Destination	Waste Management Operation	Quantities Produced (estimated)
	17 03 02	Bituminous mixtures not covered by 17 03 01	From paving activities		1st Reuse (reincorporation in construction activities)	D1	Residual - will be reincorporated into the contract
Medical Post	**18 01 04**	Waste for which collection and disposal are not subject to specific requirements for the prevention of infections (e.g. dressings, swabs, bandages, plasters, clothing, disposable clothing, diapers)	Health Service Waste resulting from the medical post from the jobsite		1st Sanitary Landfill	D1	Residual amount
	18 01 01	Sharps and piercing objects (except 18 01 03)	Health Service Waste resulting from the medical post from the jobsite		1st Sanitary Landfill	D1	Residual amount
	18 01 09	Medicines not covered in 18 01 08	Health Service Residues (eg, expired medicines		1st Sanitary Landfill	D1	Residual amount

* - Identifies waste with hazardous components.

5.3.4. Gaseous Effluents

The main source of pollution identified will be the use of vehicles and other equipment associated with construction activities, concrete and asphalt plants, as well as generators to supply electricity. With regard to vehicles, equipment and concrete and bituminous concrete/asphalt plants, their constant use leads to a large release of pollutants into the atmosphere. The burning of fossil fuel (diesel) into the atmosphere generates emissions of CO_2, NO_x, CO, among other gases, which contribute to the greenhouse effect and to the degradation of air quality. It is therefore suggested that the main mitigation measures include using equipment and machines in good condition and implementing and enforcing an equipment maintenance plan, ensuring correct and optimized operation.

The mitigation of the emission of dust and particles will pass through the Awareness, Information and Training (AIT) of workers, in order to carry out the activities of carrying loads, lifting and unloading powdery materials, in order to reduce the dispersion/production of dust, through the adoption of good practices (eg respect for transport and unloading regulations for raw materials in bulk, through the placement of gates when transporting pulverulent materials, and unloading at a lower height). On the work fronts, regular watering of the access routes to and around the work fronts should be ensured, in order to reduce the production of dust.

In the construction jobsites, which also include the project's social and administrative facilities and technical areas, there are generators, powered by diesel, which also contribute to the emission of greenhouse gases, as mentioned above. In order to reduce the impact of emissions on the health of people/workers who are in their surroundings, it is recommended the good practice of chimneys having at least a height greater than 4 m, as well as the installation of filters in the mouth of the chimneys of generators. Whenever possible, priority should be given to the use of equipment that uses a cleaner fuel instead of diesel. On the other hand, when purchasing new equipment, one should opt for manufacturers that use the best techniques available in their products in order to reduce the levels of pollutant emissions generated in the fuel burning process.

With regard to the social and administrative installations of the construction jobsites, it is also foreseen the use of air conditioning equipment whose refrigerant gases used could affect the quality of the air. In this sense, it is important to control the type of refrigerant gas included in the equipment, since they generally deplete the ozone layer, if these substances are included in the list of substances regulated by Presidential Decree n.º 153/11, of 15 June. In this

context, it is recommended the adoption of other refrigerant gases, which are not regulated gases, or the acquisition of new refrigeration equipment that use non-regulated gases, given that regulated HCFC (Hydrochlorofluorocarbons) gases must be eliminated by 2030, according to with the Elimination Schedule stipulated by the Montreal Protocol and HFCs (hydrofluorocarbons) by 2050.

Finally, it is important to mention the emissions from bituminous concrete and concrete plants which, essentially, consist of dust resulting from the concrete production processes and crushing activity. The operations for filling scales, mechanical mixing and loading cement silos, as well as transport and unloading of inert materials, are also responsible for emitting significant amounts of particulate matter into the atmosphere. On the other hand, the action of the wind on the surfaces of these stored materials also causes the raising of dust which, given the diversity of factors that characterize these diffuse emissions, makes their quantification quite difficult.

According to several studies carried out and described in specialized literature, the load of a cement silo can emit about 100 grams of particles for each ton of cement into the atmosphere. However, the use of filtering systems and control of the operation of the plants could substantially reduce this value (COBA Portugal, 2016).

According to the UN, the cement industry is responsible for 5% of CO_2 emissions that go into the atmosphere. At the same time, during the manufacturing process, it releases sulfur oxide, nitrogen oxide, carbon monoxide and lead compounds into the atmosphere. The main raw materials are clay and limestone, whose extraction of these materials in nature can lead to collapse in deposits, erosion, deepening of riverbeds, damaging the local fauna and flora.

The bituminous concrete production activity that will be used to cover the road platform on the section between Luau and Cazombo will also produce gaseous emissions, since the production process involves heating and mixing inert materials and liquid asphalt at high temperatures (in around 150°C), releasing gaseous effluents directly into the atmosphere (particles, polycyclic aromatic hydrocarbons, volatile organic compounds - VOCs - and aerosols resulting from the cooling process) (Gaudefroy *et al*. (2008)). From a more occupational point of view, it is important to mention that “asphalt fumes” may cause respiratory problems, headaches, nausea, dizziness, skin and eye irritations, among others, in workers, so that, while carrying out the various activities construction works, the contract workers must use all the necessary PPE, as defined in the identification of hazards and risk assessment to be carried out,

in order to ensure the protection of workers and avoid accidents at work and/or risks of occupational diseases (NIOSH, 2000).

Values considered in the literature point to a conventional bituminous plant, without emission control, releasing 22.5 kg of particles per ton of asphalt produced. The use of efficient filtering systems can substantially reduce these quantities, although around 70% of the particles in question have a diameter of less than 20 mm, so only a highly efficient filtering system allows positive results (even above 99%) (COBA Portugal, 2016).

Regarding the Exploration Phase (use of the road), the expected impacts on air quality will be mainly associated with emissions of atmospheric pollutants generated by the circulation of motor vehicles, presenting a permanent and progressive nature (as traffic increases). The pollutants released by the combustion processes of vehicle engines are: carbon monoxide (CO) and nitrogen oxides (NO_x), among the most important, and hydrocarbons (HC), particles (TSP), carbon dioxide sulfur (SO_2) and black smoke, of lesser significance. Asbestos particles (highly toxic substance) are also released from the wear of tires and brakes, albeit in small quantities, most of which are deposited on the pavement of the road.

The quantities emitted from the various pollutants are variable and depend on numerous factors, such as the type and composition of the fuel used (gasoline or diesel), the type of vehicle (power), age and state of conservation, speed of circulation and mode of use of the vehicle, as well as the characteristics of the route itself, in terms of development of the longitudinal profile (greater inclinations), tight radius of curvature and pavement in poor condition.

The concentrations in the atmosphere of the various pollutants generally depend on the amounts emitted. However, they are also influenced by a variety of phenomena that occur after their release into the atmosphere, specifically dispersion mechanisms (wind speed, turbulence) and natural purification (sedimentation and deposition phenomena).

5.3.5. Noise and Vibrations

In the construction phase of the project, noise and vibration emissions resulting from the construction activities foreseen within the scope of the project will be taken care of. The noise and vibration levels generated will result from the type and number of machinery used, activities carried out and circulation routes carried out by vehicles (light and heavy), which will require careful planning of the places where activities are expected to be carried out, as well as the adjustment of working hours on the different work fronts, in order to mitigate noise pollution in the intervention area and surroundings.

In order to reduce noise and vibrations, during the construction phase, some measures will be adopted, such as:

- Ensure that the equipment used has CE marking or another international regulation that attests to its proper functioning and compliance in terms of noise emissions;
- It should be foreseen the execution of the noisier activities in a less critical period (daytime);
- Limit noise on construction sites supporting the work that could disturb local residents in the vicinity, either for an excessively long duration or for its extension outside normal working hours;
- Ensure regular maintenance of all vehicles and equipment, in order to reduce noise and vibration levels and thus minimize exposure risks;
- Limit the speed of circulation (20 to 30 km/h) in order to reduce the noise associated with the circulation of vehicles on construction sites and construction sites;
- Implementation of a Noise Monitoring Program, as described in **Chapter 10.2.2.7**.

It should be noted that according to the work's Safety and Health Plan, all workers will be provided with the necessary PPE, based on the risk assessment carried out, for the different construction activities, hearing protectors being provided for the noisiest activities.

5.4. Background

For the project under analysis, no relevant antecedents were identified to be considered in the present Environmental and Social Impact Assessment.

5.5. Associated or Complementary Projects

The associated or complementary projects will be projects that are related to the project under analysis in this ESIA, thus, it can be considered that the various construction/improvement projects of the national road network, which may be carried out following the Rehabilitation Contract road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo, based on the current national strategy, will be complementary projects and should therefore be considered when assessing the impacts, since they will eventually contribute to the cumulative of socio-environmental impacts of some descriptors.

It should be noted that new projects for the rehabilitation of road sections that may be implemented in the project's area of influence, must take this ESIA into account.

5.6. Project Influence Areas

5.6.1. Directly Afected Area

The Directly Affected Area (DAA) defined for the study of the physical, biotic and social environment corresponds to the area where the rehabilitation activities of the road section between Luau-Cazombo-Lumbala Caquengue will be carried out, as shown in red in the following figure (*see* **Figure 49**).

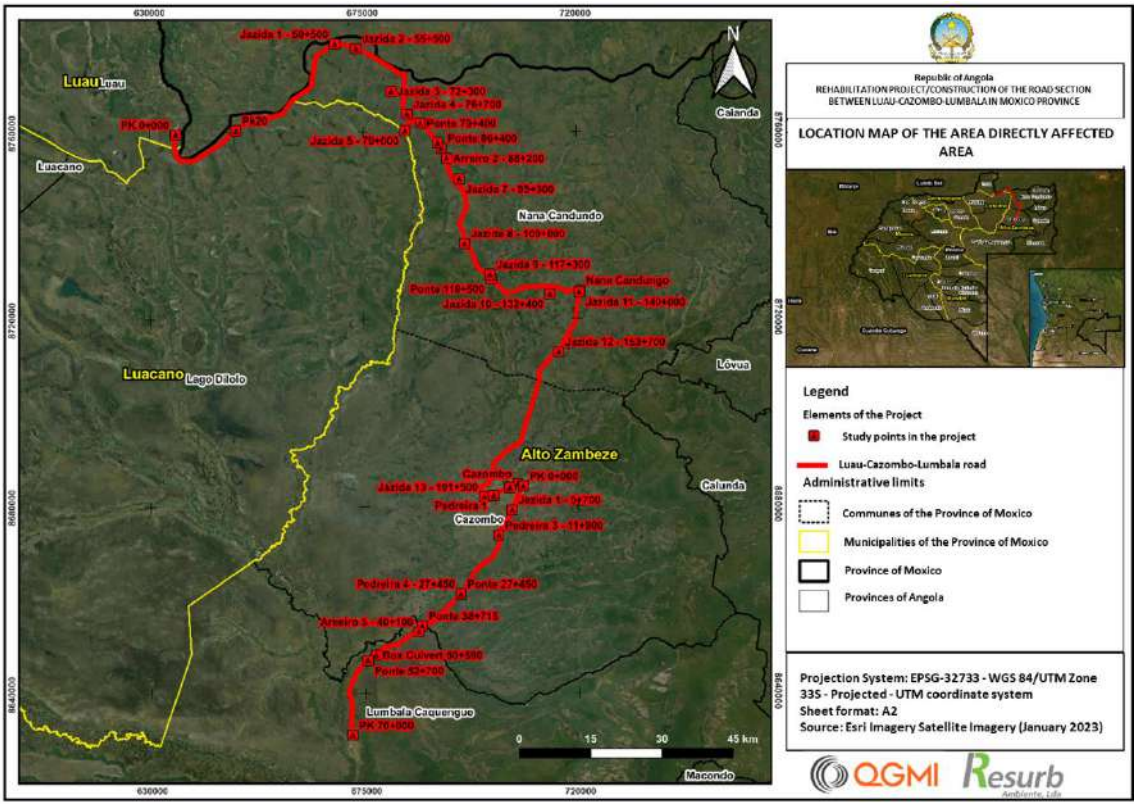


Figure 49 – Schematization of the directly affected area (DAA) represented in red color.

5.6.2. Direct Influence Area

The Project's Direct Influence Area (DIA) (*see* **Figure 50**) is the area that could be affected by the Project's direct impacts. Such impacts may occur in the physical environment (eg, noise, reduction in air quality due to dust emission, soil compaction, erosion processes, etc.), in the biotic environment (eg, destruction of habitats of flora and fauna) and the socio-economic environment (eg, the increased flow of vehicles in the area), in the construction/installation, exploration/operation and deactivation phases of the project. It is to be expected that this type of impacts will be observed with greater incidence in the area directly intervened by the Project, that is, the project area and in the areas closest to this location. In this way, the DIA for the studies of the physical environment and the biotic environment, was defined as a radius of 1.000 m around the directly affected area, which corresponds to the cities of Luau,

Cazombo and Lumbala Caquengue and the existing villages/districts in surroundings closest to the constructed/rehabilitated section, as it is the inhabitants who may directly experience the impacts generated during the construction, exploration and deactivation period of the project (mainly impacts such as the increased flow of vehicles and equipment in the area, the increase in noise and vibration levels, as well as possible unplanned events, such as spills, among others).

The DIA for the socioeconomic component was defined taking into account the relevance that the project will have in the surrounding community, since the main beneficiaries of the rehabilitated road section will be the population of the Municipalities of Luau, Luacano and Alto Zambeze, given that the road rehabilitation project will cross these three municipalities and will contribute to local socio-economic dynamism.

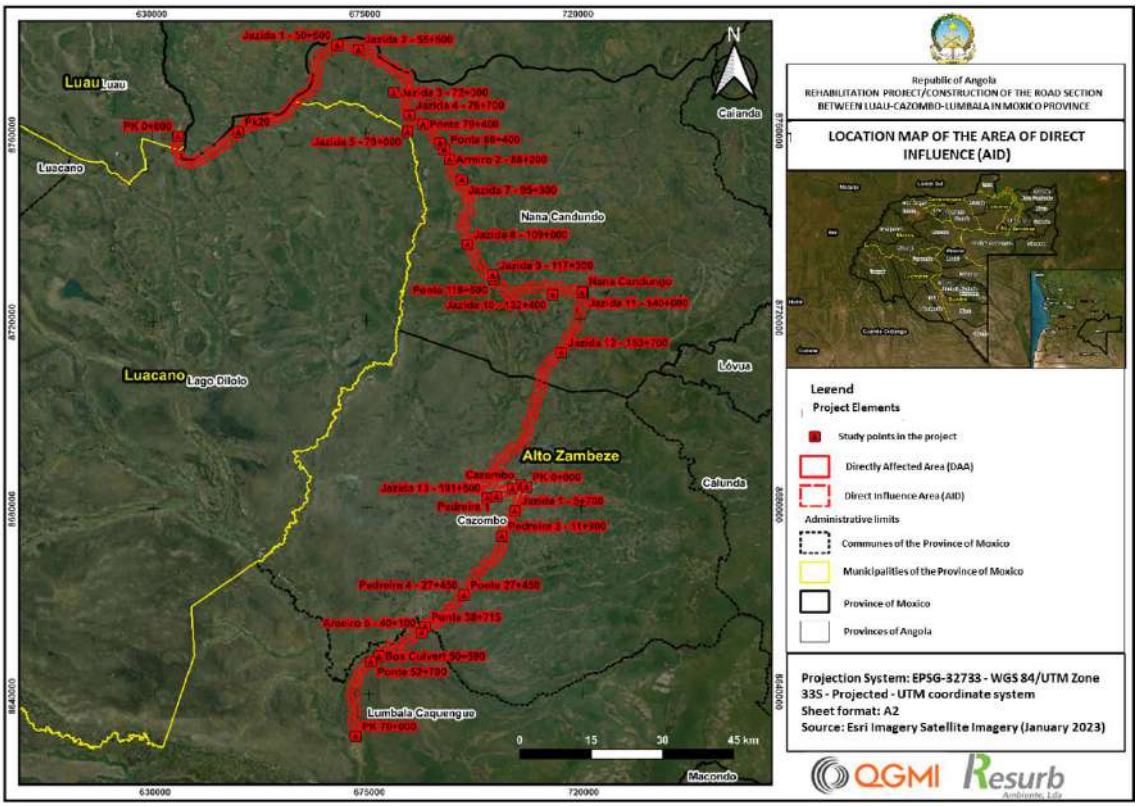


Figure 50 – Schematization of the direct influence area (DIA) represented in red color.

5.6.3. Indirect Influence Area

The Indirect Influence Area (IIA) (*see* **Figure 51**) constitutes a broader area, as far as the influences of the Project can be felt in the physical and biotic environment and, not in a direct way, but through the possible secondary effects resulting from the various activities and typology of the project. Thus, for the purposes of assessing the socio-environmental impact,

for studies of the physical and biotic environment, the area corresponding to a radius of 3 km around the direct influence area is considered as an indirect influence area.

With regard to the socio-economic environment, the Province of Moxico is considered as an indirect influence area, since it will be the one that will most benefit from this project, since it will allow the creation of road corridors in the Province.

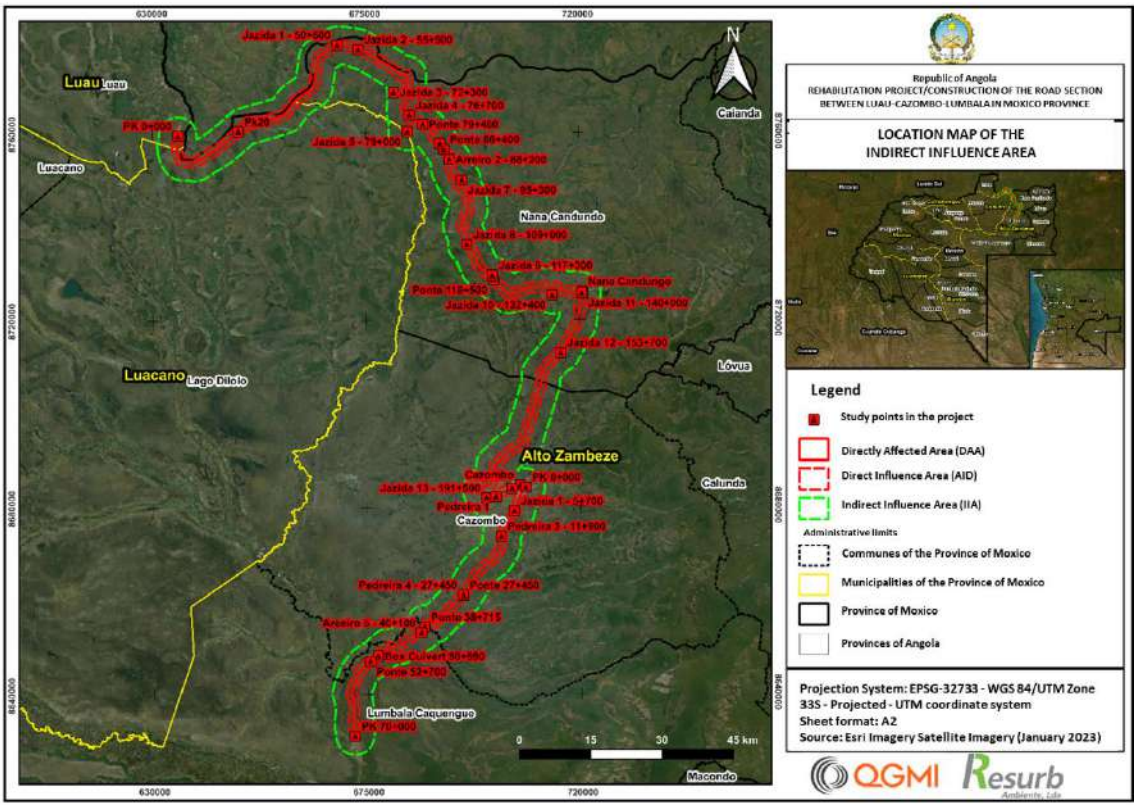


Figure 51 – Schematization of the indirect influence area (IIA) represented in red color.

5.7. Project Management Policies

The contract's technical commission established a set of principles and guidelines for the project aimed at the continuous improvement of the integrated system, environmental protection and the fight against climate change, the adoption of anti-corruption mechanisms and the prevention and management of occupational risks and the well-being and protection of its workers, compliance with human and labor rights and prevention of sexual harassment, in order to embody responsible management that aims to satisfy the various stakeholders.

The Project Management Policies also include the objective of participation and social inclusion, handling complaints and grievances, ensuring compliance with legislation, World Bank, International Finance Corporation and Equator Principles requirements throughout the project.

Thus, the project, and in order to ensure and disseminate its commitment to the various objectives mentioned above, developed the following policies:

- Code of Ethics and Legal Compliance;
- Secrecy and Confidentiality;
- Data Protection;
- Prevention Program of the Occupational Risk Management System;
- Environmental protection and the fight against climate change;
- Protection, Participation and Social Inclusion;
- Protection of Workers;
- Prevention of Sexual Harassment;
- Commitment to Respect Human Rights.

Annex XVI presents the Project Management Policies.

In **Chapter 10. Environmental and Social Management Plans**, some socio-environmental principles and measures that should be implemented throughout the project will be described, in line with the various Project Management Policies, good practices, conventions and international declarations.

VI.

CHARACTERIZATION OF THE REFERENCE SITUATION

Resurb
Ambiente, Lda

Henry David Thoreau

What is the use of having a good home
if we do not have a planet in conditions
to receive it.

6. CHARACTERIZATION OF THE REFERENCE SITUATION

This chapter presents the characterization of the current state of the environment in the area of implementation of the project considering the different environmental, social, economic and cultural heritage aspects that may be affected by the project under study. The characterization of the reference situation was based on the elements collected in the visits and fieldwork carried out, on the cartography available for the area under study, as well as on existing databases and other bibliographical elements. This characterization will allow the prevision of the possible future evolution of the areas affected by the project and its influence during the construction, operation and deactivation phases.

The documentation that supported the elaboration of this document was:

- Military charts (IGCA);
- Maps used by FAO;
- Dynamic Atlas of the Municipalities of Angola;
- Geographic Atlas of Angola;
- Other bibliographic elements.

The fieldwork allowed a deeper framing of the analyzed descriptors, which are presented in the following table (*see* **Table 19**).

Table 19 - Environmental descriptors/factors analyzed in the project under study

<table>
<tr><th colspan="3">Environmental Descriptors/factors</th></tr>
<tr><th>Physics</th><th>Biological</th><th>Social</th></tr>
<tr><td>Climate</td><td rowspan="4">Ecological Factors</td><td rowspan="2">Socio-Economy</td></tr>
<tr><td>Geology and Geomorphology</td></tr>
<tr><td>Water Resources (Water Quality and Polluting Sources)</td><td rowspan="2">Land Use and Social Planning</td></tr>
<tr><td>Environmental Noise</td></tr>
<tr><td>Air Quality</td><td rowspan="3">Landscape</td><td rowspan="3">Regional framework and Cultural Heritage</td></tr>
<tr><td>Soil</td></tr>
<tr><td>Waste</td></tr>
</table>

Throughout the classification of the various environmental descriptors/factors, we resorted to the consultation and analysis of information available in official entities.

In the following chapters, a description of the reference situation for each environmental descriptor considered relevant is presented. All considerations and assessments made regarding the evolution of the reference situation will always be carried out in order to understand the evolution of the descriptor considering the alternative hypothesis, that is, the

non-implementation of the project compared to its implementation. This approach will be relevant to the chapter on Environmental and Social Impact Assessment of the Project.

6.1. Climate and Climate Change

The climate of a region can be considered as the set of average values of atmospheric factors, and the climate of a place can be described over a certain period of time through the analysis of these average values and their corresponding statistical variations.

The analysis of climatological variables allows to characterize and summarize the climate of the region under study. This characterization assumes greater relevance in the analysis of other environmental descriptors, such as: air quality, environmental noise, water resources, etc.

With regard to air quality, the transport of pollutants, in particular the dispersion of suspended particles, is greatly influenced by the wind regime and the function of their predominant directions. Likewise, precipitation has a strong influence on the dispersion of pollutants, as it promotes their wet deposition.

Regarding the sound environment (noise), it is necessary to consider factors such as temperature, atmospheric humidity and the wind regime, since these will influence the propagation speed of sound waves. In fact, the increase in temperature leads to an increase in the propagation speed of sound waves, while an increase in atmospheric humidity causes a greater number of obstacles to the propagation of sound waves, reducing their energy and decreasing the reverberation time. Finally, the wind regime conditions the propagation of sound waves, since they are mechanical waves and are subject to a velocity field, which means that the noise coming from the construction will be felt with greater intensity whenever the wind blows in the receivers direction.

As for water resources, and consequent water quality, precipitation is responsible for dilution and entrainment phenomena, which can affect both surface and groundwater.

6.1.1. Framework

The climate of Angola fits into the patterns of a tropical climate due to its geographical location close to the Equator. This climate pattern has clear local variations due to the influence of the territory's topography and proximity to the sea, which means that different types of climate and climate classifications can be observed throughout the entire Angolan territory.

The climate of Angola is characterized by three distinct zones, with high rainfall and high temperatures in the North, typical characteristics of a frank humid tropical climate. On the

other hand, the Central Plateau, in the central area of the Angolan territory, has an arid tropical climate with high precipitation, which is due to the orogenic factor and a variation from dry season to rainy season, as well as average temperatures of around 19°C. Finally, in the South of the territory there are drier climates with very sharp thermal amplitudes, both due to the proximity of the Kalahari desert, as well as the influence of the Benguela current and the influence of air masses with little humidity (*in* www.climateandweather). In this region, in the zone closest to the coastline, annual average temperatures are above 23°C.

In general terms, the climate of the Province of Moxico is tropical, with an average temperature that varies between 22°C and 24°C. The rainy season in this Province lasts for nine months, between the months of August and May (INAMET).

According to the Köppen-Geiger Climate Classification, Moxico Province has two well-defined climate ranges, namely the humid subtropical climate (Cwa) and the tropical climate (Aw). The tropical climate (Aw) prevails in the project implantation site.

Thus, the following figure (*see* **Figure 52**) presents the Koppen-Geiger Climate Classification for the Angolan territory, with emphasis on the location of the project.

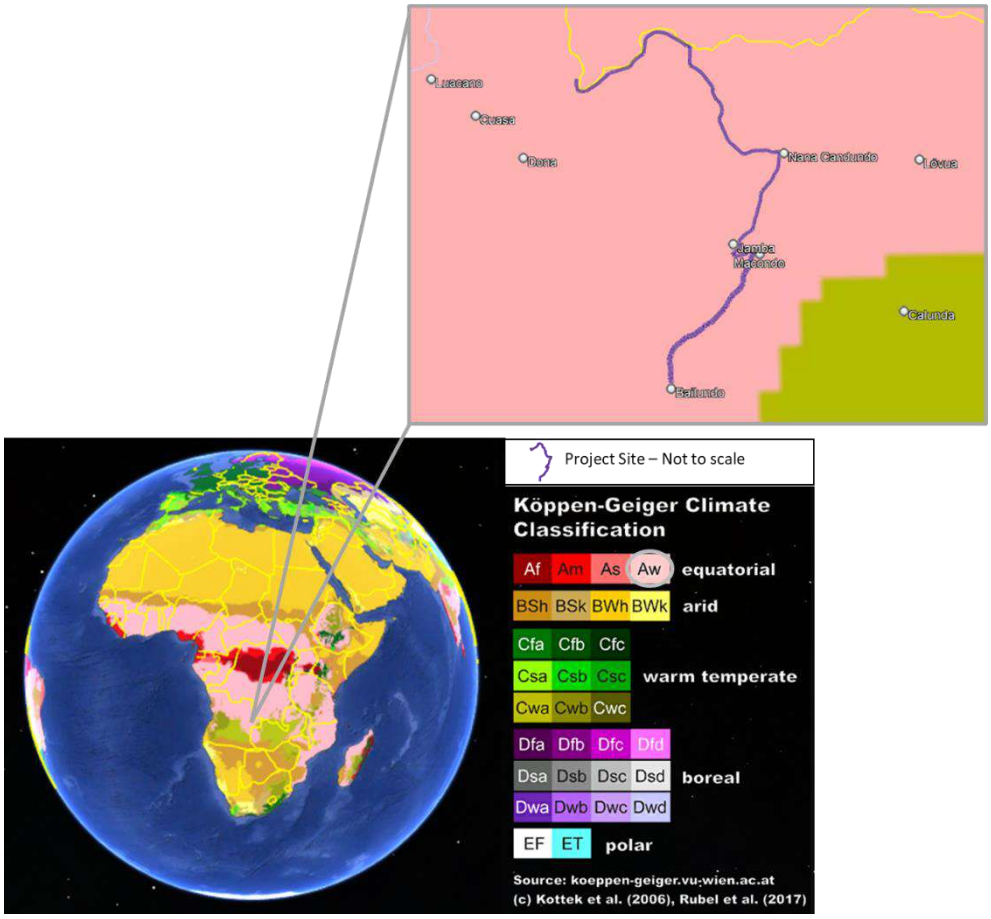


Figure 52 - Aerial image with the Koppen-Geiger Climate Classification of the project area (Source: adapted from *Google Earth*).

According to this classification and as can be seen from the analysis of the previous figure, the area where the project will be implemented is part of a region with an Aw climate (tropical climate with a dry winter season), as shown below:

Climate Aw:

- **Group A – Tropical climate**:
  - Megathermal climates;
  - Average temperature of the coldest month of the year greater than 18°C;
  - Absent winter season;
  - Heavy annual precipitation (greater than potential annual evapotranspiration).
- **Type w – Summer rains.**

The climate of the project's area of influence was characterized based on the records of the climate variables corresponding to the Climatological Standards from January 2014 to December 2022 from the SASSCAL WeatherNet at the Mwinilunga station (Zambia) with ID 856121, which is about 156 km from the Cavungo Village. It should be noted that the Angolan station closest to the Commune of Nana Candundo is located about 214.33 km away, however it has been inoperative since August 15, 2015.

The following table (*see* **Table 20**) presents the general characteristics of the considered weather station.

Table 20 - General features of the Mwinilunga weather station (in SASSCAL, 2023)

Station	Latitude (S)	Longitude (E)	Altitude (m)	Registration period
Mwinilunga	11º 39’ 11,347’’ S	24º 25’ 51,59’’ E	1360 m	2014 - 2022

6.1.2. Temperature

The spatial distribution of air temperature in a region is essentially conditioned by local physiographic factors, which are generally associated with relief (altitude and exposure), the nature of the soil and its covering, the proximity of large amounts of water and the wind regime.

The Angolan territory presents significant geographical differences in average annual temperatures with the lowest records in the Huambo and Lubango region and, with the highest temperatures being recorded between Luanda and N'Dalatando and, in part of the Zaire Province.

With regard to the location of the project, in the province of Moxico, the average temperature throughout the year is 23°C.

The following figure (*see* **Figure 53**) shows the distribution of maximum, minimum and average temperatures in the area of influence of the project.

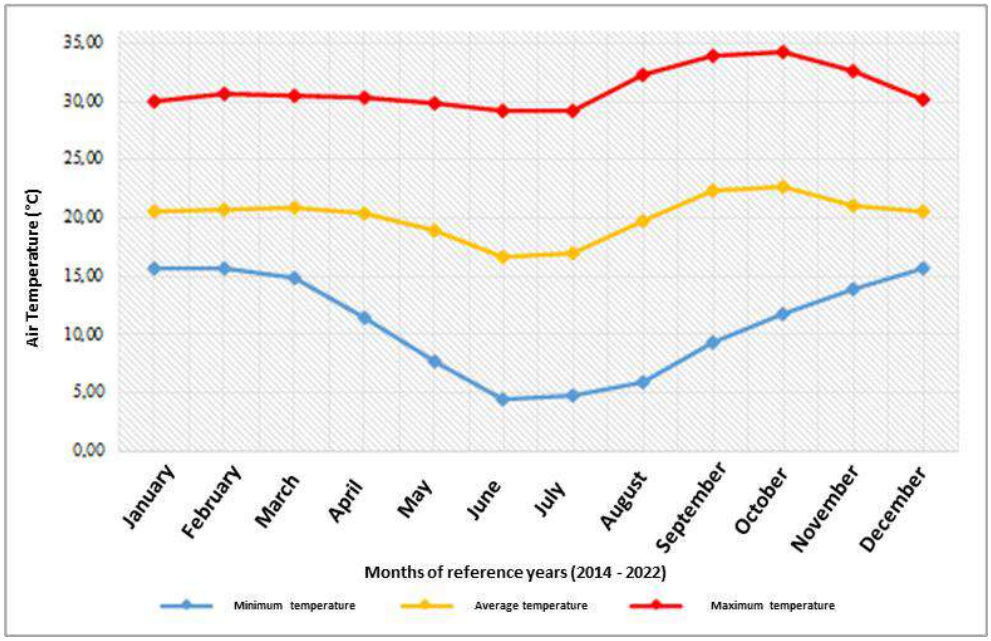


Figure 53 – Record of minimum, maximum and average temperatures in the area of influence of the project (*in* SASSCAL, 2023).

Through the analysis of the previous figure (*see* **Figure 53**) it can be seen that the project implementation area is characterized by lower temperatures in the months of June and July, where values vary between 4.37°C and 4.77°C, and by higher temperatures in September and October with values between 33.88°C and 34.20°C. The average monthly temperature of the annual series (2014-2022) is around 20.15°C.

6.1.3. Precipitation

Precipitation is the amount of water transferred from the atmosphere to the Earth in a liquid or solid state in the form of rain, drizzle, snow, hail or hail, per unit area of a horizontal surface, during a given period of time. It is expressed in mm.

Precipitation in Angola is influenced by the South Atlantic high pressure center, the cold Benguela current and altitude. The average annual precipitation decreases from North to South and increases with altitude and distance from the sea. The more mountainous regions north of Huambo and in the north of Angola have the highest rainfall values, above 1.000 mm per year (Source: adapted from INAMET).

The average annual precipitation in the Northeast of the Province of Moxico is over 1.300 mm, while in the South the Province receives only 900 mm, on average. This North to South trend is part of a broader trend across the country, between tropical northern areas and more subtropical and semi-arid southern areas. Given that seasonal rains generally start in October, the Province receives most of its rainfall between the months of November and March, with around 80% of all rainfall occurring during these five months (Source: Atlas e perfil do Moxico, Angola, 2015).

For the characterization of precipitation in the area of influence of the project, a baseline from 2014 to 2022 was analyzed, in which the variation of the average annual precipitation of the site of implantation of the project in the Province of Moxico was determined (*see* **Figure 54**).

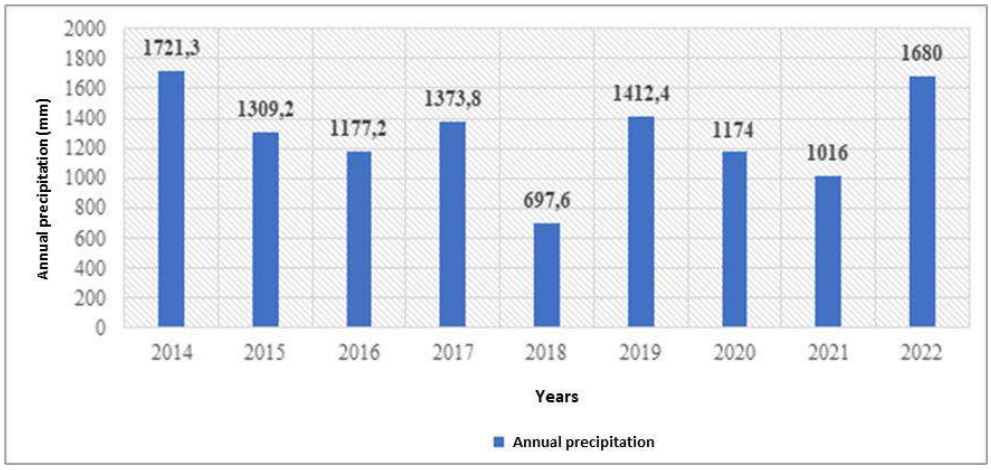


Figure 54 – Recording of the value of precipitation in the area of influence of the project (*in* SASSCAL, 2023).

From the analysis of the previous figure (*see* **Figure 54**) it can be seen that the area of influence of the project is characterized by an average annual rainfall of around 1.284,6 mm, with 2018 being the year with the lowest annual rainfall (697.6 mm) and 2014 was the year with the highest rainfall (1.721,3 mm). The year 2022 was the second year with the highest rainfall (1.680 mm).

At the same time, the project's area of influence during the dry and cool season (May to September) is characterized by average monthly precipitation values that vary between a minimum of 0.13 mm and a maximum of 18.23 mm. In the rainy season (October to April) precipitation values vary between a minimum of 36.20 mm and a maximum of 265 mm.

6.1.4. Relative Humidity

The relative humidity is the amount of water in the form of vapor that exists in the atmosphere at the moment in relation to the maximum total that could exist, at the observed

temperature. When relative humidity is at high levels, it increases our body's sensitivity to air temperatures. Thus, on the hottest days, people feel more warmer when the relative humidity of the air is higher. This sensation is due to the loss of efficiency of our skin in perspiring, which reduces the cooling capacity of our body.

Humidity comfort level is based on dew point. Lower dew points make you feel drier. Higher dew points cause a feeling of greater humidity. Unlike temperature, which often varies significantly from day to night, dew point tends to change more slowly. So while the temperature can drop at night, a dry day is usually followed by a dry night.

The relative humidity data analyzed for the area of influence of the project (*see* **Figure 55**) are characterized by values of minimum relative humidity of 52.89% (during the month of August) and maximum of 90.09% (during the month of December) and an average of 75.78%.

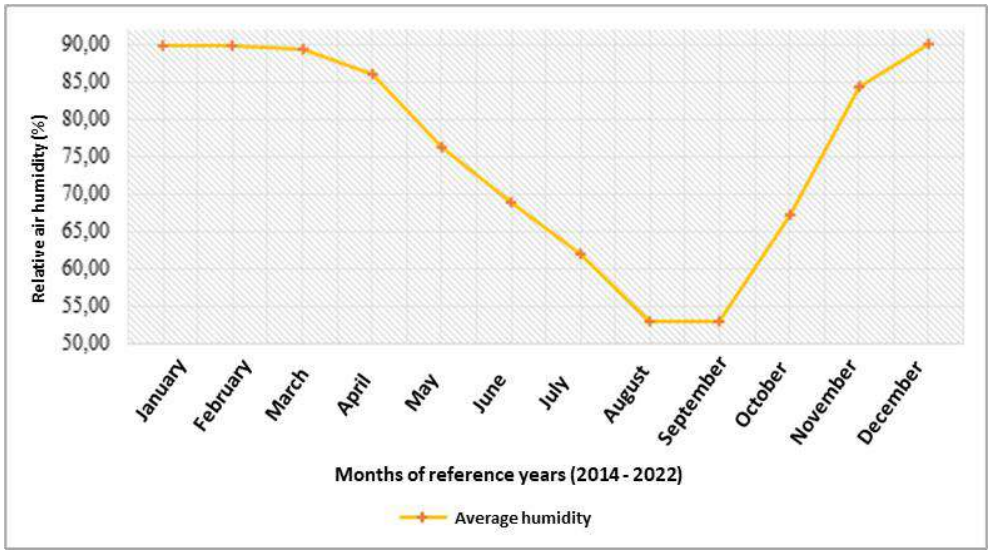


Figure 55 – Average relative humidity in the project's area of influence, annual series from 2014 to 2022 (*in* SASSCAL, 2023).

6.1.5. Atmospheric Pressure

Changes in atmospheric pressure can be observed over time. They can be established by regular diurnal variations associated with temperature variations (in tropical climate regions the amplitude of these variations is of the order of a few millimeters) and irregular variations superimposed on regular diurnal variations (these variations can present considerable amplitudes and are invariably associated with the passage weather disturbances).

The area of influence of the project is characterized by presenting lower pressure values in the months of February, with a value of 862.78 hPa, while the highest pressures are registered in the months of July and June with values between 866.78 and 866, 67 hPa. The monthly

average atmospheric pressure of the 2014 – 2022 annual series is around 864.30 (*see* **Figure 56**).

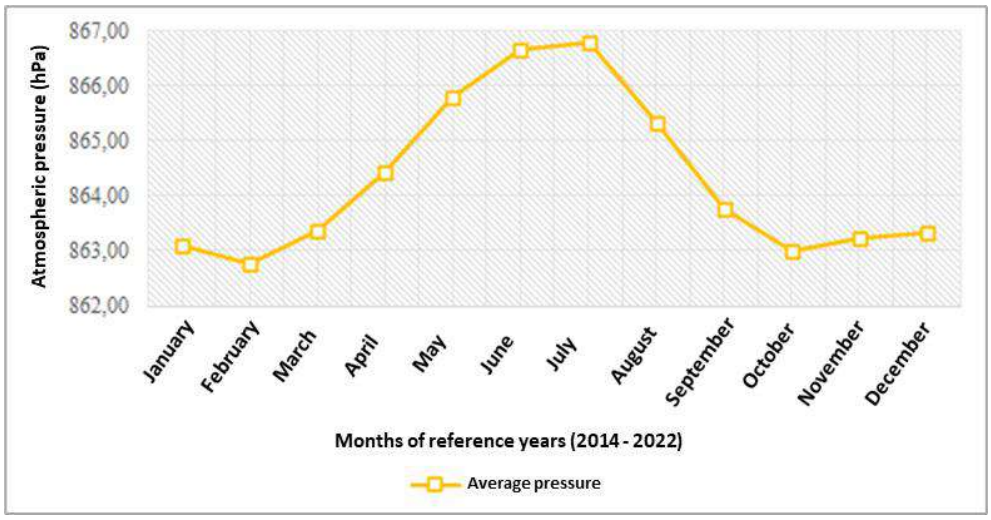


Figure 56 - Average atmospheric pressure in the project's area of influence, annual series from 2014 to 2022 (*in* SASSCAL, 2023).

6.1.6. Wind Regime

The wind in the Province of Moxico is caused by the displacement of cold air masses from the high zones (tropics) to the low pressure zones (equator).

According to the Beaufort Scale, 1830, the winds that blow over the Province of Moxico from January 2014 to December 2022 are characterized mainly by *moderate breeze* (71.3%) to *strong breeze* (13.9%) and rarely occur *cool winds or strong winds* (both 0.9%).

Moderate and strong breezes tend to be east-southeast (ES-SE), with moderate intensity. *Strong winds* have a preferential direction to the Northwest (NW), with low intensity and fresh winds have a preferential direction to the East (E), with very low intensity, as can be seen by analyzing the following figure (*see* **Figure 57**).

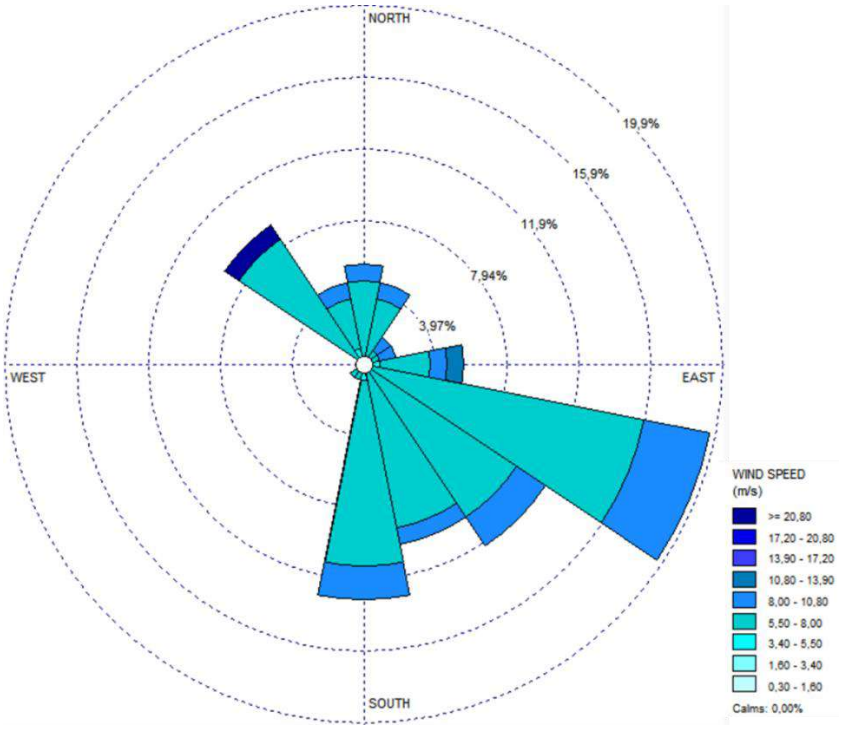


Figure 57 - Rosette of the winds that blow over the Province of Moxico (series from January 2014 to December 2022), according to the Beaufort Scale of 1830.

With regard to the prevailing average hourly wind direction at the project site, it varies throughout the year. The most frequent wind comes from the East for 6.5 months (from March to September), with a maximum value of 67% in April. During the remaining 5.5 months, the most frequent wind comes from the North (from September to March), with a maximum value of 53% in January.

6.1.7. Climate Change

6.1.7.1. Framework

Climate change is a natural phenomenon that has been occurring for a long time. However, during the last century, the changes registered have been more intense than in the past. One of the conclusions of the 1995 IPCC (Intergovernmental Panel on Climate Change) report indicates that these changes are the result of human interventions on the environment, with serious repercussions on the climate, which are reflected on a regional and global scale.

In the last century, there has been an increase in the concentrations of some gases in the atmosphere, which absorb part of the infrared radiation that the Earth radiates into space, causing heat retention. This phenomenon is usually called the “greenhouse effect” and the gaseous emissions that cause it “Greenhouse Gases – GHGs”.

This effect causes global warming, which is nothing more than an increase in the average temperatures of the Earth's atmosphere, which "*in the last century, recorded an increase of 0.76°C. The forecast is that at present it will rise between 1.1 and 6.4 °C, depending on the mitigating measures that are taken*" (*in* http://www.natureza-portugal.org). Changes in climate will have direct and negative impacts on terrestrial ecosystems and on the various socio-economic sectors.

The INC (Initial National Communication of Angola) points to a warming trend in Angola, with surface temperatures increasing between 0.2°C and 1.0°C between 1970 and 2004 in coastal areas and northern regions, and between 1.0°C and 2.0 °C in central and eastern regions (Source: Initial National Communication to the United Nations Framework Convention on Climate Change, 2012).

Climate models indicate that there will be a 3.0°C to 4.0°C rise in Angola's surface temperature in the East, and a slightly smaller increase in coastal and northern regions over the next 100 years. There is no consensus on future trends in precipitation in the region. In addition to high temperatures, climate models project more extreme climatic phenomena, an expansion of arid and semi-arid zones, seasonal changes in precipitation, localized flooding, greater incidence of uncontrolled fires, rising sea levels, increased rainfall in regions north of the country, changes in river flows and changes in sea and lake temperatures. Available projections indicate that there will be a shortening of the agricultural cultivation period in southern Angola and along the coast, while areas to the north that currently benefit from two growing seasons may in the future have only one.

The country's main vulnerabilities by sector include the loss of biodiversity, human health, infrastructure, fisheries, and agriculture and food security. While uncertainties in rainfall projections make it difficult to predict specific impacts, climate change is expected to make existing vulnerabilities more severe. Higher temperatures are expected to lead to a higher incidence of malaria over a wider area. Projections suggest that rising sea levels will have a significant impact on coastal settlements, where 50% of the country's population resides, as well as on road networks and industrial and commercial infrastructure. Sea level rise is also expected to reduce the potential for agricultural activities in coastal areas due to salinisation. Due to uncertainties in rainfall projections, it is not clear what the impact of climate change will be on food security in Angola (Source: Angola National Report - referring to the identification study "Climate Change Counts" by the Regional Association of Universities in Southern Africa (SARUA)).

Climate change especially affects the coastal zone of Angola, with implications related to the rise in sea level, the increase in air temperature that affects health because it promotes epidemics such as malaria, dengue and chikungunya, associated with food insecurity, with the rise in water temperature, with effects on marine currents and ecosystems, which will impact the production of fish and other marine resources.

In this sense, it is important to mention that Angola has been part of the United Nations Framework Convention on Climate Change since May 17, 2000, an act consummated during the 21st Conference of the Parties, the Paris Agreement. The Agreement marks a historic turning point in the world's response to climate change, with the aim of seeking to keep global temperature rise below two degrees Celsius and continuing efforts to limit it to 1.5 degrees. Adherence to this Agreement will facilitate Angola's access to climate finance for projects aimed at implementing measures to adapt and mitigate climate change, as well as guarantee compensation to the most vulnerable countries, when adaptation mechanisms are no longer able to prevent disasters from happening.

It should be noted that the Angolan Government ratified the Paris Agreement on climate, within the scope of the United Nations Framework Convention on Climate Change, on November 16, 2020, so the Project must adopt mitigation measures for the emission of GHGs, in order to also meet this commitment.

It should also be noted that the National Strategy for Climate Change 2018-2030 (ENAC 2018-2030) arises from the need to articulate objectives, instruments and institutions in the pursuit of the most recent challenges that the country is facing, both in terms of its economy and the improvement of the population's living conditions, such as in terms of the most recent global climatic events, resulting from the Paris Agreement and the Sustainable Development Goals of the 2030 Agenda. In response to these challenges, ENAC establishes the vision of Angolan national policy in the 2030 horizon, taking into account the need to articulate Angolan policy in terms of mitigation and adaptation to the impacts of climate change. ENAC, in turn, will give rise to the development of the National Emissions Plan (PNE) and the National Plan for Adaptation to Climate Change (PNAAC).

It should also be mentioned that during the exploration phase, the implementation of the project may, eventually, contribute to the reduction of emissions of greenhouse gases and particles inherent to road traffic, since to date, this occurs mostly on roads not paved and deteriorated, also promoting the emission of particles. Although the projections for the project's exploration phase are for an increase in road traffic, given that one of the objectives

of road rehabilitation is the socio-economic dynamism of the region and the social inclusion of vulnerable populations that are currently isolated, on the rehabilitated road, on the other hand, it will allow for safer and more efficient driving, which will have a positive and indirect impact in terms of vehicle combustion gas emissions.

6.1.7.2. Main Impacts of Climate Change in Agola

There is evidence that extreme events such as droughts, floods, heat waves, and other natural disasters have affected different parts of the planet, leading to changes in biodiversity, a decrease in polar ice caps and a consequent rise in sea water levels, impacts population health, agriculture, etc. (Source: Ecoangola, 2022).

In the specific case of Angola, some more relevant phenomena stand out:

- **Uncontrolled Fires**

Angola is on the list of countries with the highest number of forest fires on a global scale. According to data from the Aqua-Terra satellite, from the National Institute for Space Research in Brazil (INPE), a survey was carried out of the fires recorded in the last 5 years and it was found that some provinces in the country exceeded 25.000 fires in one year, with Cuando Cubango Province leading with around 80.97% of fires in the last 5 years, followed by Malanje Province (78.9%), Moxico (71.31%), Lunda Norte (64.67%), Bié (51.54%) and Uíge (47.8%). Although this time scale includes agricultural activities, legally permitted areas for fires, as well as the burning of waste, the number of recorded fires is still worrying. It should be noted that uncontrolled fire is a factor that influences the migration of several species, causes the loss of ecosystems and their biodiversity, increases atmospheric pollution and the emission of aerosols into the atmosphere, leading to a high rate of respiratory diseases. At the same time, it can also influence the extent of desertification and the migratory movement of people.

The following figure (*see* **Figure 58**) shows the map with the number of fires that occurred in the Province of Moxico, during a period of 10 years, between 2001 and 2010. It should be noted that some of the fires are extremely hot, burning even the tallest and densest forests. As a result, many of the trees are destroyed and the forest can take years to recover its previous density and altitude (Source: Atlas e perfil do Moxico, Angola, 2015).

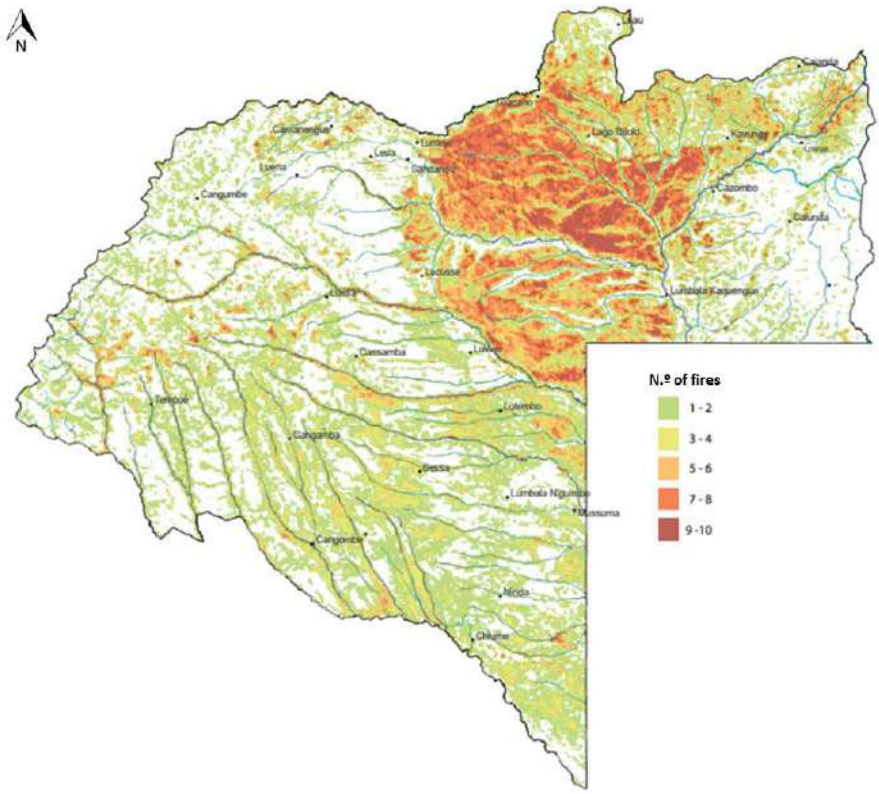


Figure 58 – Map with the number of fires that occurred in the Province of Moxico between the period 2001 to 2010 (Source: adapted from earthenginepartners.appspot.com).

Through the analysis of the previous figure (*see* **Figure 58**) it can be seen that the Municipalities where the most fires occurred during the period from 2001 to 2010 were the Municipalities of Camela, Lucano and Alto Zambeze.

It is also verified that the pastures burn more frequently than other areas of the Province of Moxico and the more open and dry forests in the South burn more frequently than the more humid and densely forested areas in the North of the Province (Source: Atlas e perfil do Moxico, Angola, 2015).

- **Arboreal Loss**

According to an analysis by Global Forest Watch, from 2002 to 2020, Angola lost about 129 Kha of primary moist forest. This figure represents 4.3% of your total tree cover loss. Thus, the total area of primary humid forest in Angola has decreased by around 5%.

The following figure (*see* **Figure 59**) shows the map of forest cover for the Province of Moxico evaluated over a period of 10 years, between 2001 and 2010. This map also shows the areas with loss of forest during this period.

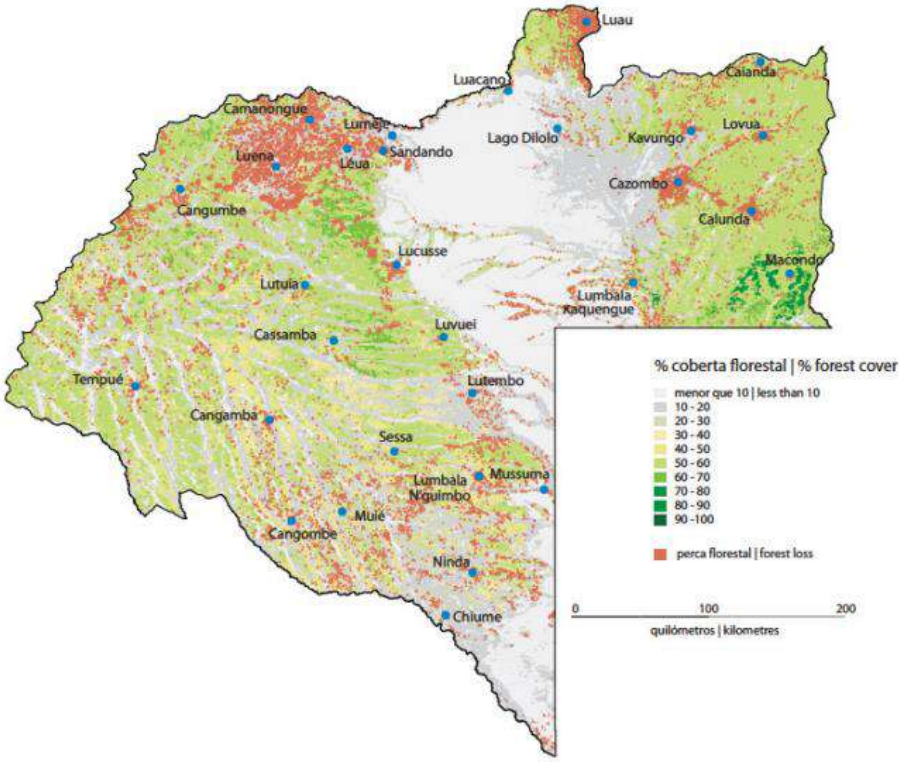


Figure 59 – Forest Cover Map of the Province of Moxico (Source: adapted from earthenginepartners.appspot.com).

By analyzing the previous figure (*see* **Figure 59**) it can be seen that particularly large areas around Luena, Cazombo and Luau were deforested, probably as a result of the increased demand for firewood by the refugees who settled in these cities in the end of the civil war in 2002. In other regions, especially those in the South, a large part of the forest losses were due to large fires (Source: Atlas e perfil do Moxico, Angola, 2015).

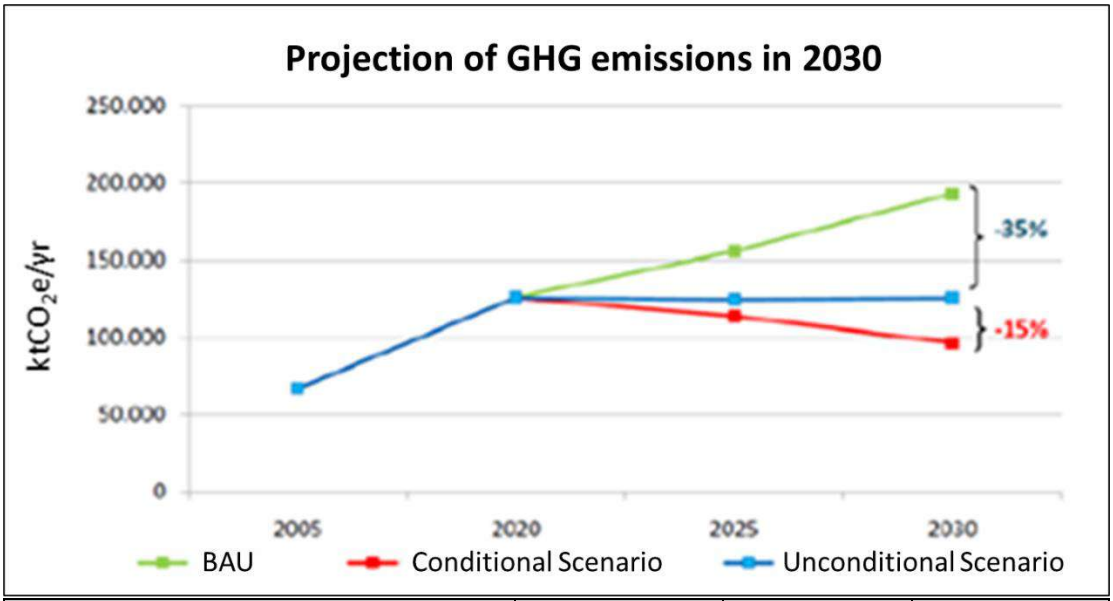
- **Increase in Drought Episodes**

Angola is among the countries that suffer most from drought episodes. There have been several prolonged droughts over the last 40 years, and the drought events that occurred in southern Angola and were more intense took place in the years 1992/1993, 1998/1999, 2012/2013, 2015/2016 and 2018/ 2019 according to data from UN ANGOLA (2019). The droughts that occurred in the years 2015 to 2016 and 2018 to 2019 affected more than 3 million people in the southern regions of the country. According to an article published by Mateus and António (2020), the drought from 2018 to 2019 was the most severe since the 1980s. and evaluation of the Standardized Precipitation Index, it was verified that despite the episodes of severe drought predominating in a large part of the southern region of Angola, these have spread to the central part of the country and some Northern Provinces.

6.1.7.3. Angola's Climate Change Policy

Based on the analysis of the emissions situation of the base year (2005), the Government of Angola declared to reduce by 2030 the emissions of Greenhouse Gases (GHG) by up to 50% in relation to the BAU (Business as usual) base year by implementing of unconditional and conditional actions for the target areas.

The following figure (*see* **Figure 60**) presents the projection of GHG emissions in 2030, as well as the baseline scenario and mitigation of projections of the unconditional and conditional scenarios in Angola.



Scenarios	Year 2005	Year 2020	Year 2030
Emissions - BAU Scenario ($ktCO_2e$)	66,812	125,778	193.250
Emissions - Unconditional Scenario ($ktCO_2e$)			125.612 (-35%)
Emissions - Conditional Scenario ($ktCO_2e$)			96.625 (-50%)

Figure 60 – Baseline scenario and mitigation of unconditional and conditional scenario projections in Angola (Source: *Draft INDC of the Republic of Angola*).

6.1.8. Forecast in the Absence of the Project

Climate change is related to some human activities (eg CO_2 and/or CH_4 emissions from industrial units) and to natural phenomena (eg large-scale natural fires). However, for the present ESIA, only human causes will be addressed, as they are those that can somehow be controlled/minimized. There is also the fact that many of the consequences of climate change are not felt locally, but in a generalized way, and changes originating in other regions of the globe can have repercussions in this region.

Climate change affects Angola, with implications related to sea level rise, the increase in air temperature that affects health because it promotes epidemics such as malaria, dengue and

chikungunya, associated with food insecurity, with the rise in water temperature, with effects on marine currents and ecosystems, which will impact the production of fish and other marine resources.

In the absence of the project, changes in the current state of the climate are expected, given that the region under analysis (as well as the country) is experiencing strong growth associated with the strong potential of the oil sector, extraction/processing of minerals, agro-livestock, industrial and the existence of airports. The predicted global impact is, however, long-term, and has a high degree of uncertainty, mainly due to the so-called "climate change", of a planetary scope.

In this way, it is expected that, in the absence of implementation of the Project, road traffic currently carried out on the road section between Luau and Cazombo, will promote the emission of greenhouse gases and particles resulting from difficult and inefficient road traffic, given the poor condition of the section, sometimes impassable, with the respective negative, indirect impact on climate change.

6.2. Geology and Geomorphology

6.2.1. Geomorphological Characterization

The Angolan territory has an enormous geomorphological diversity, ranging from coastal plain areas, transitional slope zones, mountain ranges and mountain ranges, different plateaus, hydrographic basins and desert regions.

The territory of Angola is divided into seven main geomorphological units, according to Marques (1977) (*see* **Figure 61**). These are characterized by a landscape identity and stability of the environment. Such units are characterized by their landforms, lithology, tectonics, hydrographic basins, climate, soils and particular vegetation.

The geomorphological units defined by Silva, A. (2005) are the following:

i. **Ancient Plateau** - corresponds to an extensive surface distributed over the regions of Bié, Huambo, Lubango in a narrow strip and close to the Cunene river. It represents an applanation residue from the Upper Cretaceous uplifted at the end of this period or at the beginning of the Cenozoic. It constitutes a physical environment that has been stabilized for a long time. The pedogenesis/morphogenesis relationship is favorable to pedogenesis.

ii. **Marginal Mountain Range** - is represented by very sharp uneven reliefs, a consequence of the movement of the flexure of the Atlantic flank. The highest

altitudes in Angola are identified here, reaching about 2.620 meters in Morro do Moco. This morphological unit occurs in a very unstable environment between the Southeast of Gabela and West of Huambo, near Lubango. The pedogenesis/morphogenesis relationship is favorable to morphogenesis.

iii. **Transition Zone** - constitutes a broad strip parallel to the Atlantic Ocean from the interior of Cabinda, S. Salvador, Uíge, N'Dalatando, West of Lubango, to the Cunene river. It represents several levels of a single possible applanation or more modern applanations. It probably results from the replay of the continental flexure and began to form from the geological surface of the Cenozoic.

iv. **Coastline** - is the region adjacent to the Atlantic Ocean which, north of Sumbe to Cabinda, has a width of 100 to 200 kilometers. It is a region of recent flattening due to marine abrasion to the west and the retreat of the coastal escarpment to the east. The pedogenesis/morphogenesis relationship is in balance. The Namib desert is also included in this geomorphological unit.

v. **Northern Rim of the Kalahari Basin -** presents a relief conditioned by the evolution of the endorheic Namibe basin. Drainage is carried out by the Cunene, Cubango and Cuito rivers. It is a residual region of the Cenozoic flatland, covered by thick sandy eolian deposits. The Cunene watershed is included. This basin corresponds to an area conditioned by the capture to the Atlantic Ocean in the ancient Quaternary of the Cunene river, which was previously also made for the Etosha and Kalahari depressions.

vi. **Southern Rim of the Congo Basin** - is related to the hydrographic basin of the Congo or Zaire river, which includes the Cuango and Cassai rivers, among others, although it includes part of the hydrographic basin of the middle and upper Cuanza river. It is located east of Uíge, in Malange, Saurimo and east of Bié. This unit includes the Cassanje and Cassai depressions.

vii. **Zambezi Basin** - encompasses the entire eastern region of Angolan territory. This unit is delimited by the hydrographic networks of the Zambezi, Pungo and Cuango rivers. It is characterized by stable reliefs, where pedogenesis predominates over morphogenesis.

According to the geomorphological units of the territory of Angola (*see* **Figure 61**), the project implantation area falls within the *Zambezee Basin unit (VI)*.

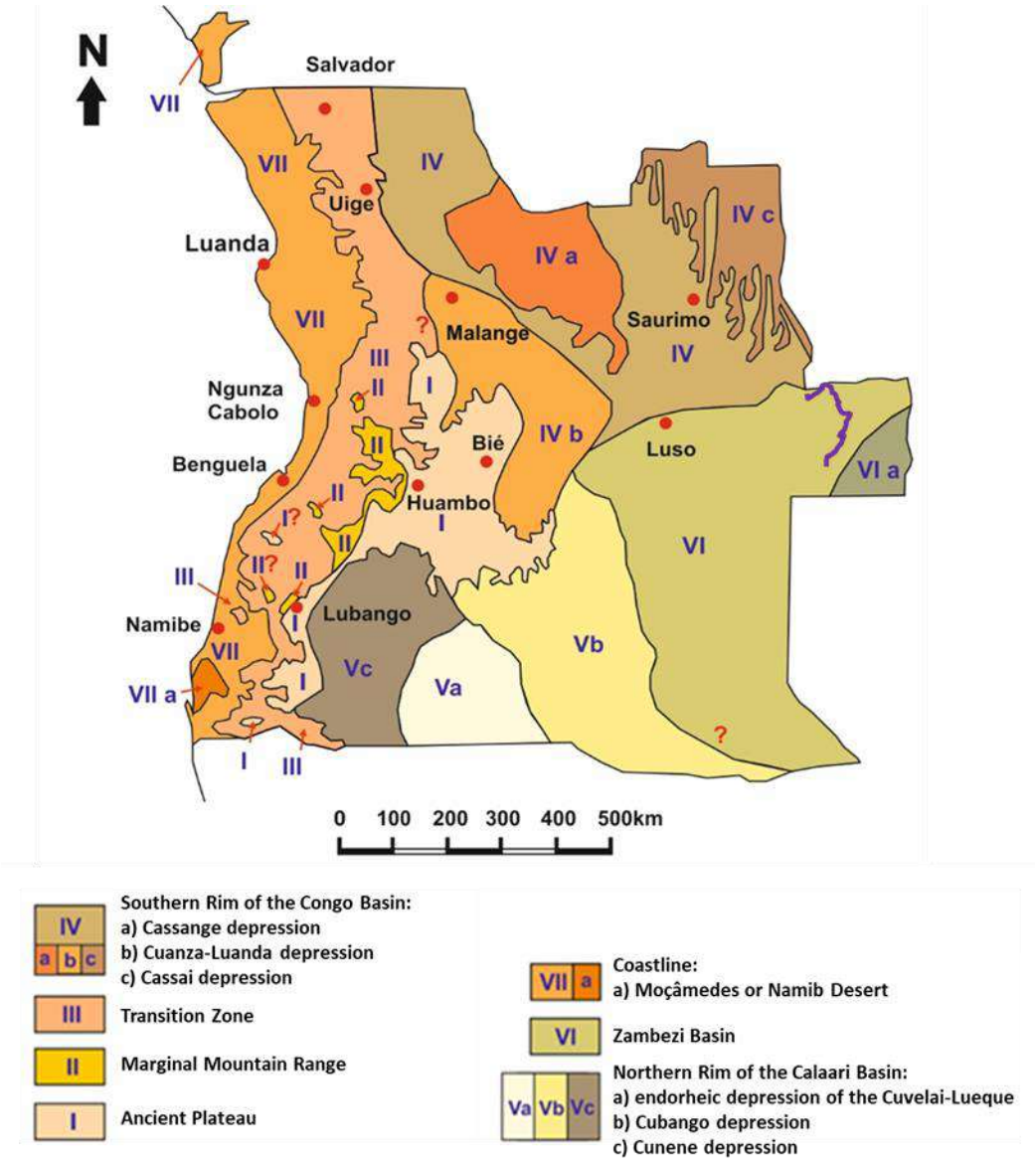


Figure 61 - Main geomorphological units of Angola, according to Marques (1977) with emphasis on the location of the project (marked in purple).

The physiology of the Province of Moxico is dominated by three main zones, namely, the Central Plateau of Angola between the Northwest, West and Southwest, including the highlands of Wet Sands and Dry Sands and the Bié Escarpments; the Katanga-Chambezi Plateau, in the extreme east (more specifically the extreme of the Upper Zambezi) and across the northeastern border to Luau (*in* Journal of Zoology, 2005), and the Barotse plains (as well as its extensions Liuva, Luena and Lungué-Bungo), to the southeast and center (*in* Southern Africa, 2022). The Upper Zambezi is the westernmost portion of the Central African copper belt, which is a very important industrial mining area on the continent (*in* Exploration potential for copperbelt, 2018 and Novo Jornal, 2017).

6.2.1.1. Local Geological Framework

Much of the Angolan territory is situated at an altitude between 1.000 and 1.600 meters and the highest point is in the central region, namely Morro do Moco (above 2.000 meters), in the Province of Huambo.

The Province of Moxico is a hinterland that fits into the vast African plateau, of homogeneous relief, in general. It is an old relief zone with small elevation variations. The Province is located in an area with altitudes ranging between 1.200 and 1.400 m (except in the Alto Zambeze massif where it reaches 1.800 m, being the highest area) (*in* wordpress.com).

The highest areas are to the west, close to Tempué and Chipoia, where the hills exceed 1.500 m. To the east, near Calundo and Maconda, there is a belt of rocky hills composed largely of dolarites, with some hills reaching 1.600 m in height. The lowest areas of the Province, with less than 1.000 m, are located along the Luau and Casai rivers, on the border with the Democratic Republic of Congo, while the vast southern extension of the Várzea do Bulozi reaches about 1.000 to 1.100 m (Source: Atlas e perfil do Moxico, Angola, 2015).

In the morphological aspect, the area of influence of the project corresponds to a vast surface that is apparently flat, but in reality it is wavy to very smooth. The existing rivers do not introduce alterations to this general type of relief, drawing very wide valleys that only mark slight differences in level. There are no signs of erosion on the entire surface, or even, at a higher level, no residue can be detected that testifies to the existence of an older peneplain. The entire landscape of the area reflects a smoothness and uniformity of relief, which is characteristic of very stable flattening (Diniz, 1973).

The following figure shows the topography of the project's location (*see* **Figure 62**).

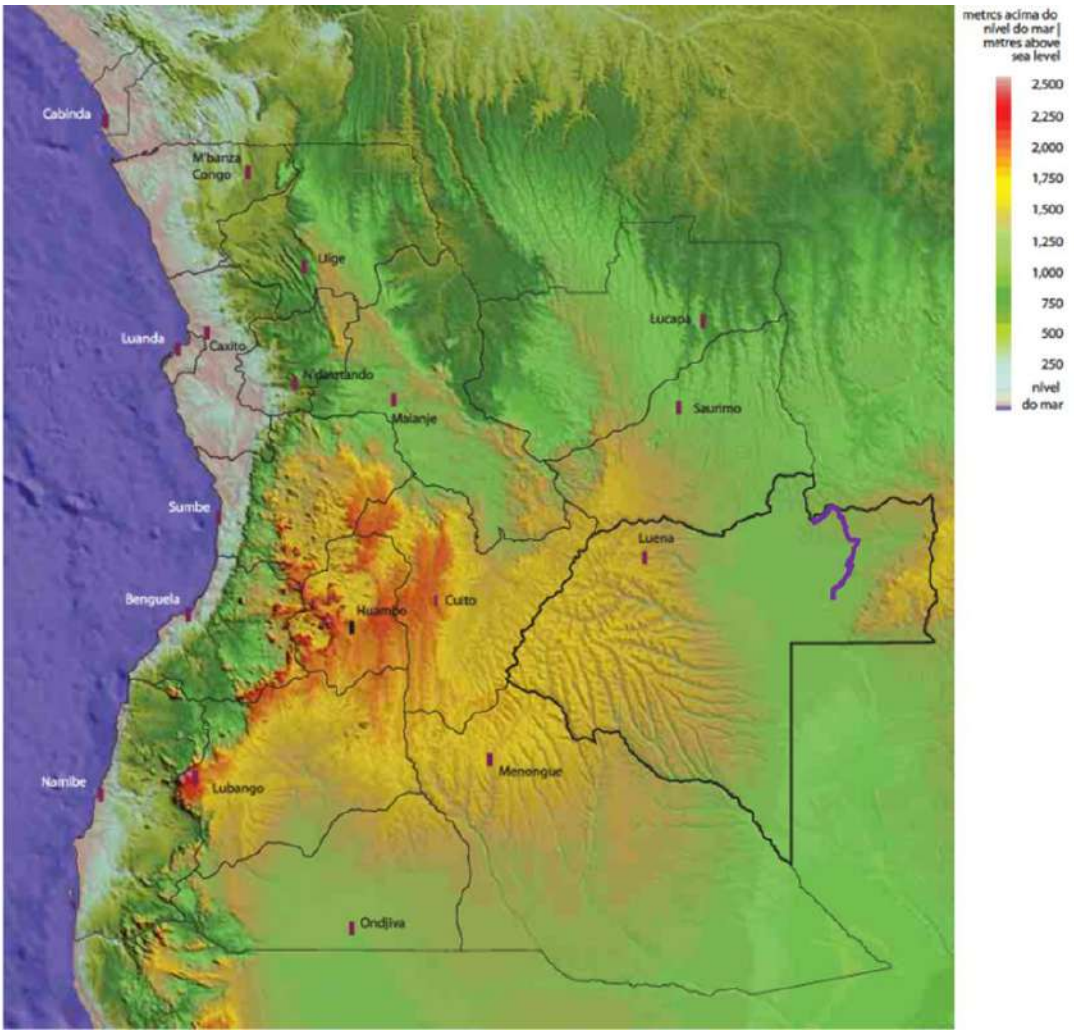


Figure 62 - Topography of Angola with emphasis on the Province of Moxico and the layout of the project represented in purple (Source: adapted from Huntley, B.).

At a more local level, it should be noted that the section of the road between Luau-Cazombo-Lumbala Caquengue that will be rehabilitated, within the scope of the project under analysis, is generally characterized by an altitude that varies from 1.055 m to 1.296 m in the Northwest to Southeast, with a flat slope (0 to 3%) to strongly undulating (20 to 45%), according to the Embrapa classification (1979), with the slopes oriented mainly to the East and South. These are distributed as follows:

- The area of the road section between PK 0+000 and PK 86+400 (Luau-Nana Candundo), has an altitude that varies between 1.094 m and 1.157 m in the NW – SE direction (*see* **Figures 63** and **64**), with a slope that ranges from flat (0 – 3%) to gently undulating (3 – 8%) and an average slope of 0.4 to -0.5% (*see* **Figure 65**).

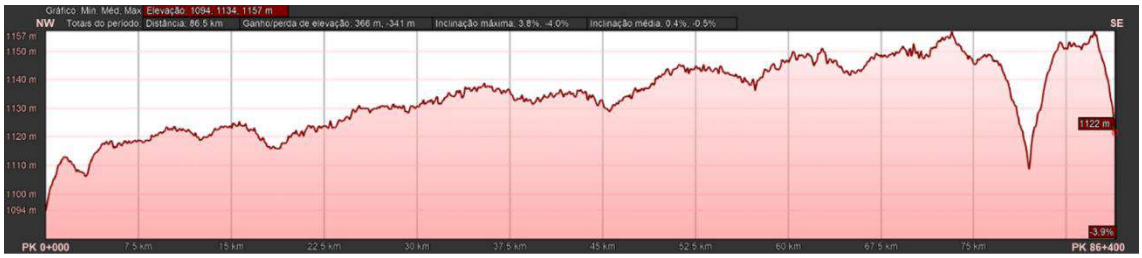


Figure 63 - Topographic profile of the area PK 0+000 to PK 86+400 (Luau-Nana Candundo), in the NW-SE direction.

- The biggest slopes in this area are registered at points PK 79+400 and PK 86+400, and the crossing is only possible by the two existing bridges in the area. It should be noted that at some points in the DIA and IIA, the terrain is undulating. The slopes of the relief under study have a preferential orientation towards the South (S) and East (E) (*see* **Figure 66**).

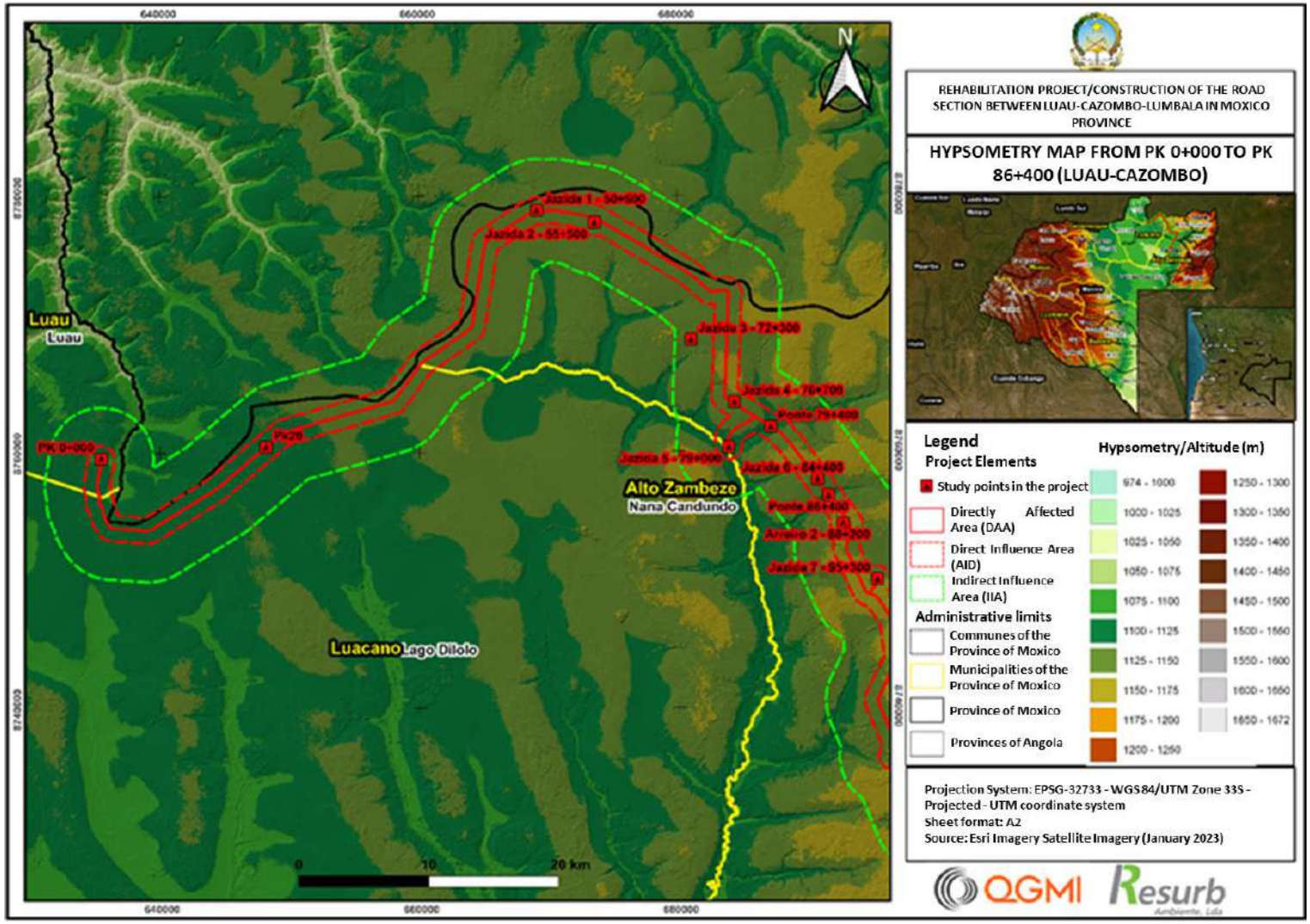


Figure 64 - Hypsometry map of the area PK 0+000 to PK 86+400 (Luau- Nana Candundo).

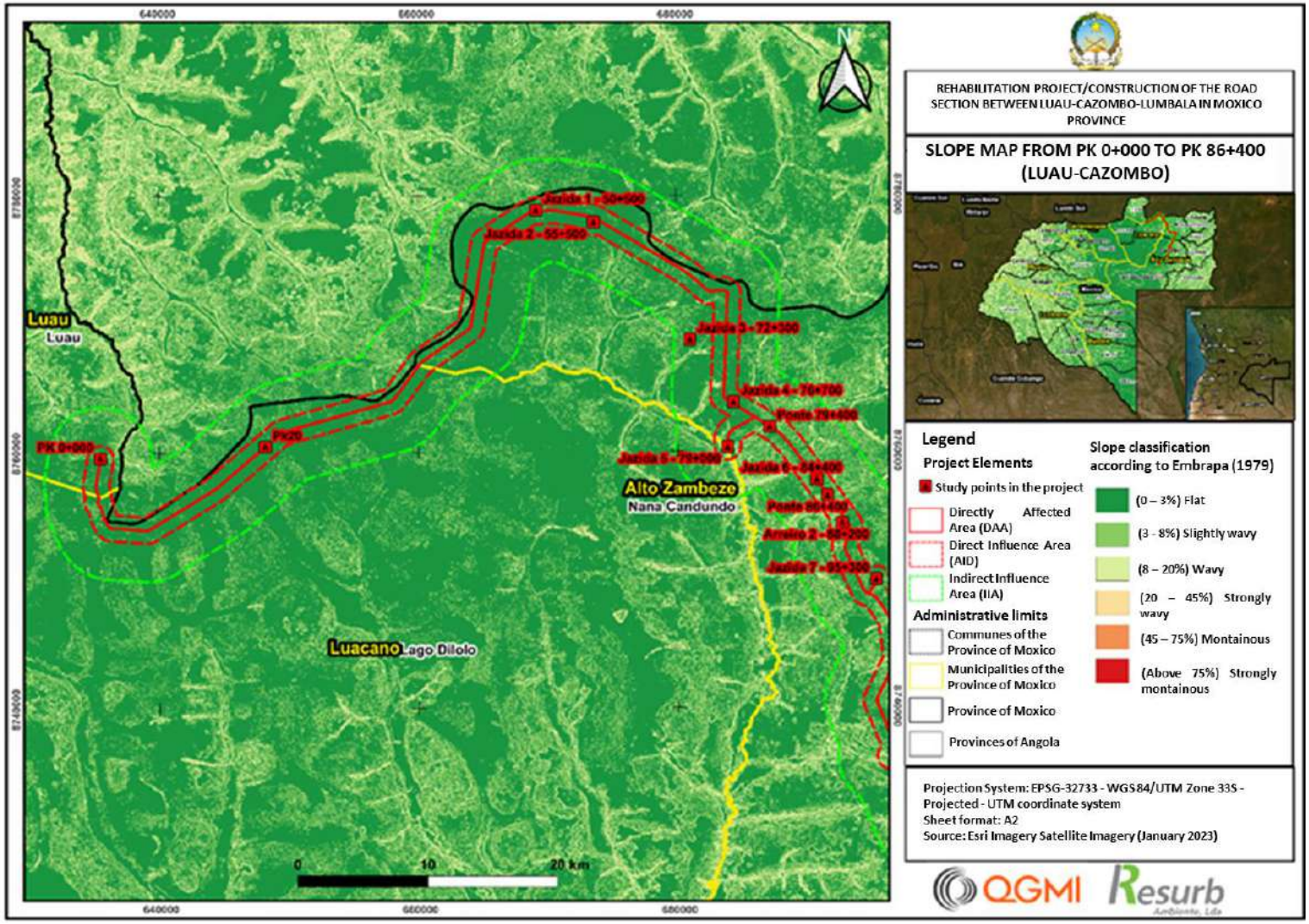


Figure 65 - Slope map of the area PK 0+000 to PK 86+400 (Luau-Nana Candundo).

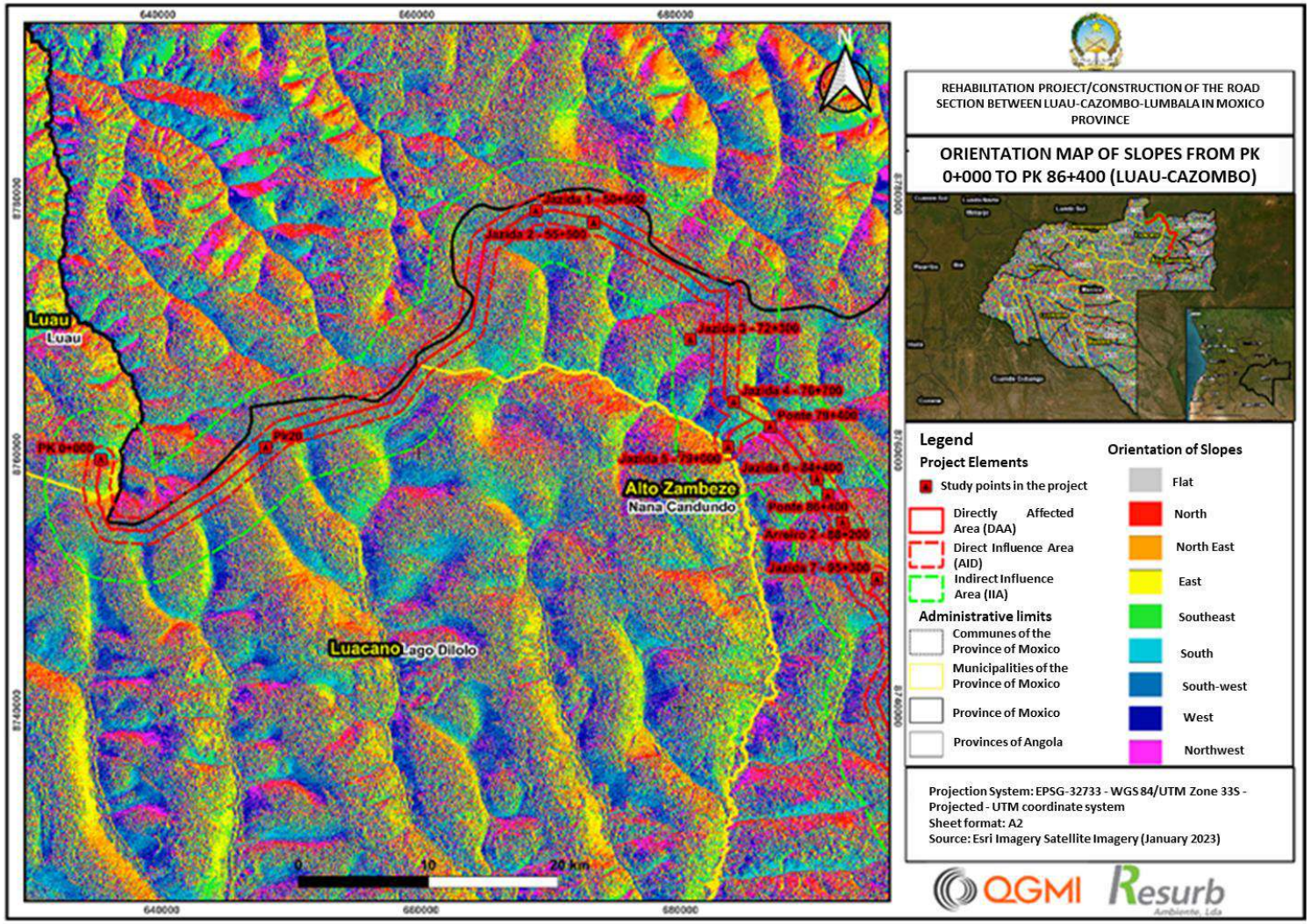


Figure 66 - Slope orientation map of the area PK 0+000 to PK 86+400 (Luau- Nana Candundo).

- The area of influence of the road section between PK 86+400 to PK 140+000 (Nana Candundo), has an altitude that varies from 1,096 m to 1,182 m in the NW – SE direction (*see* **Figures 67** and **68**), with a slope that ranges from gently undulating (3 – 8%) to flat (0 – 3%) and an average slope of 0.8 to -0.8% (*see* **Figure 69**). The steepest slope in this area is recorded at point PK 118+500, and crossing is only possible via the existing bridge in the area. It should be noted that in some points of the DIA and IIA, it presents undulating and strongly undulating terrain. The slopes of the relief under study have a preferential orientation towards the South (S) and East (E) (*see* **Figure 70**).

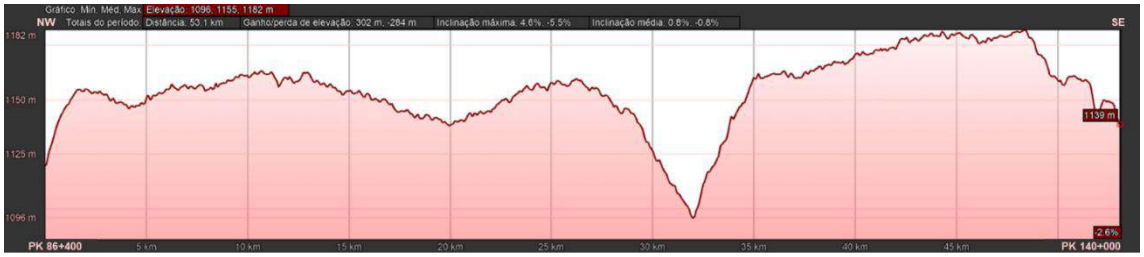


Figure 67 - Topographic profile of the area PK 86+400 to PK 140+000 (Nana-Candundo), in the NW-SE direction.

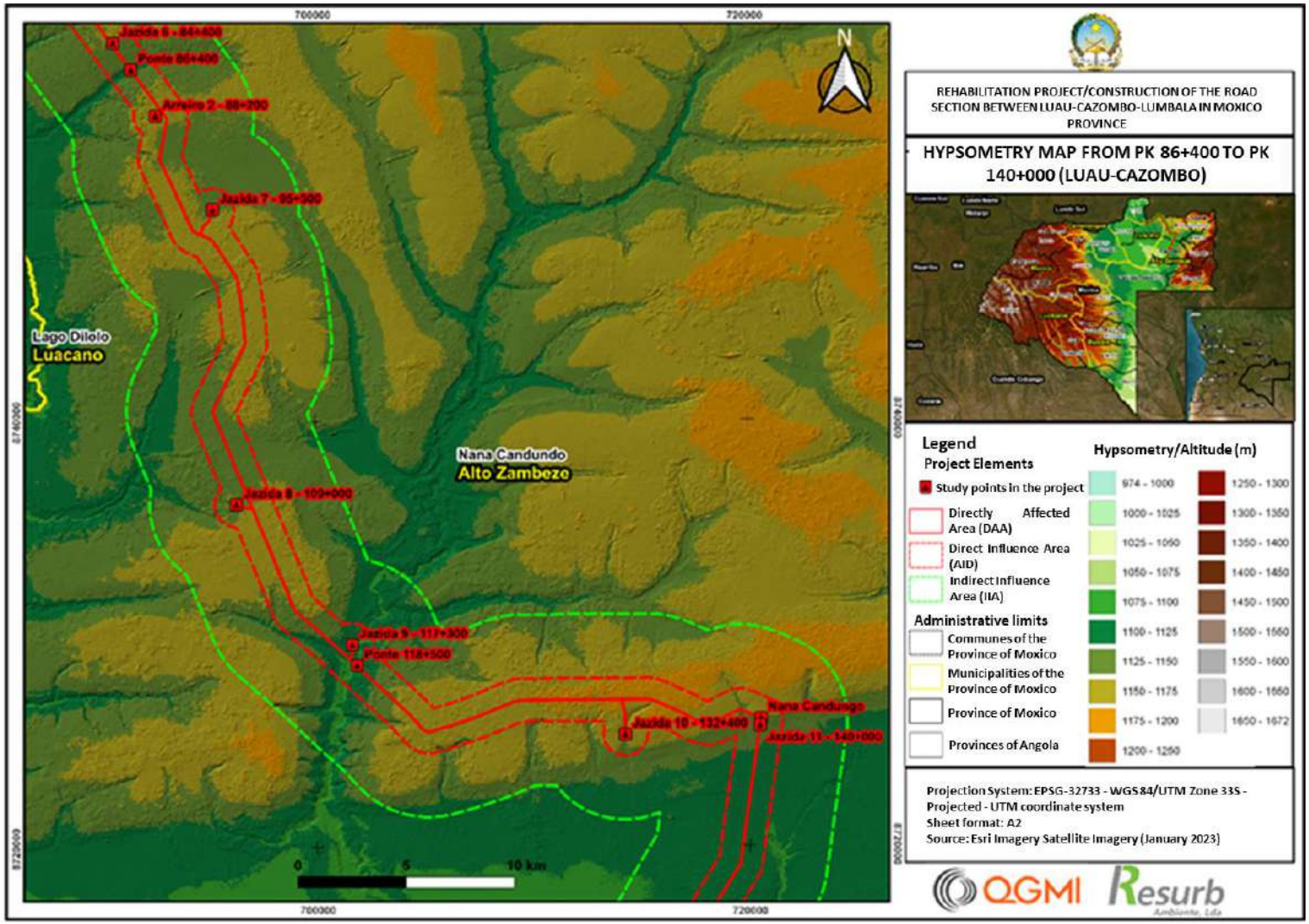


Figure 68 - Hypsometry map of the area PK 86+400 to PK 140+000 (Nana Candundo).

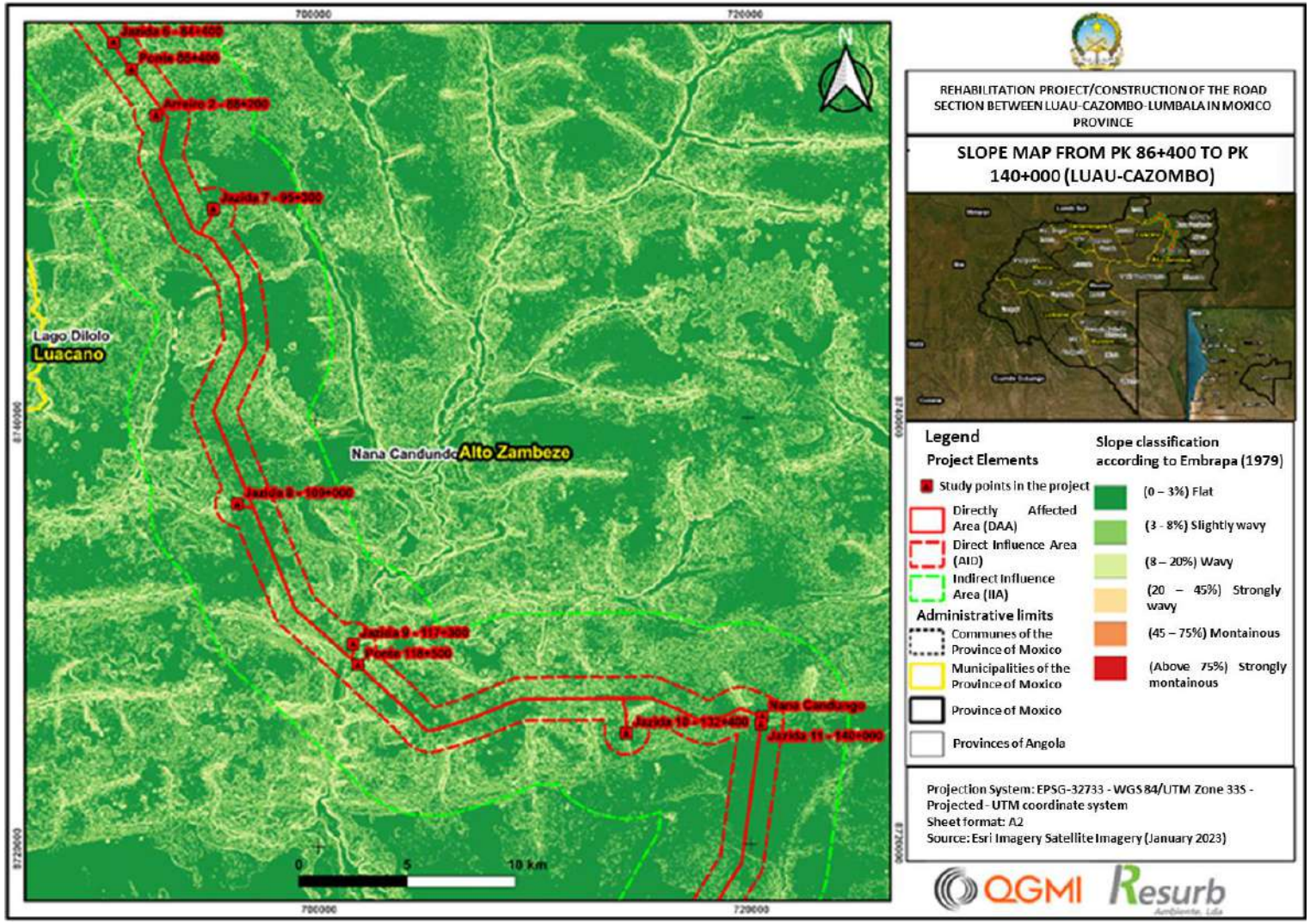


Figure 69 - Slope map of the area PK 86+400 to PK 140+000 (Nana Candundo).

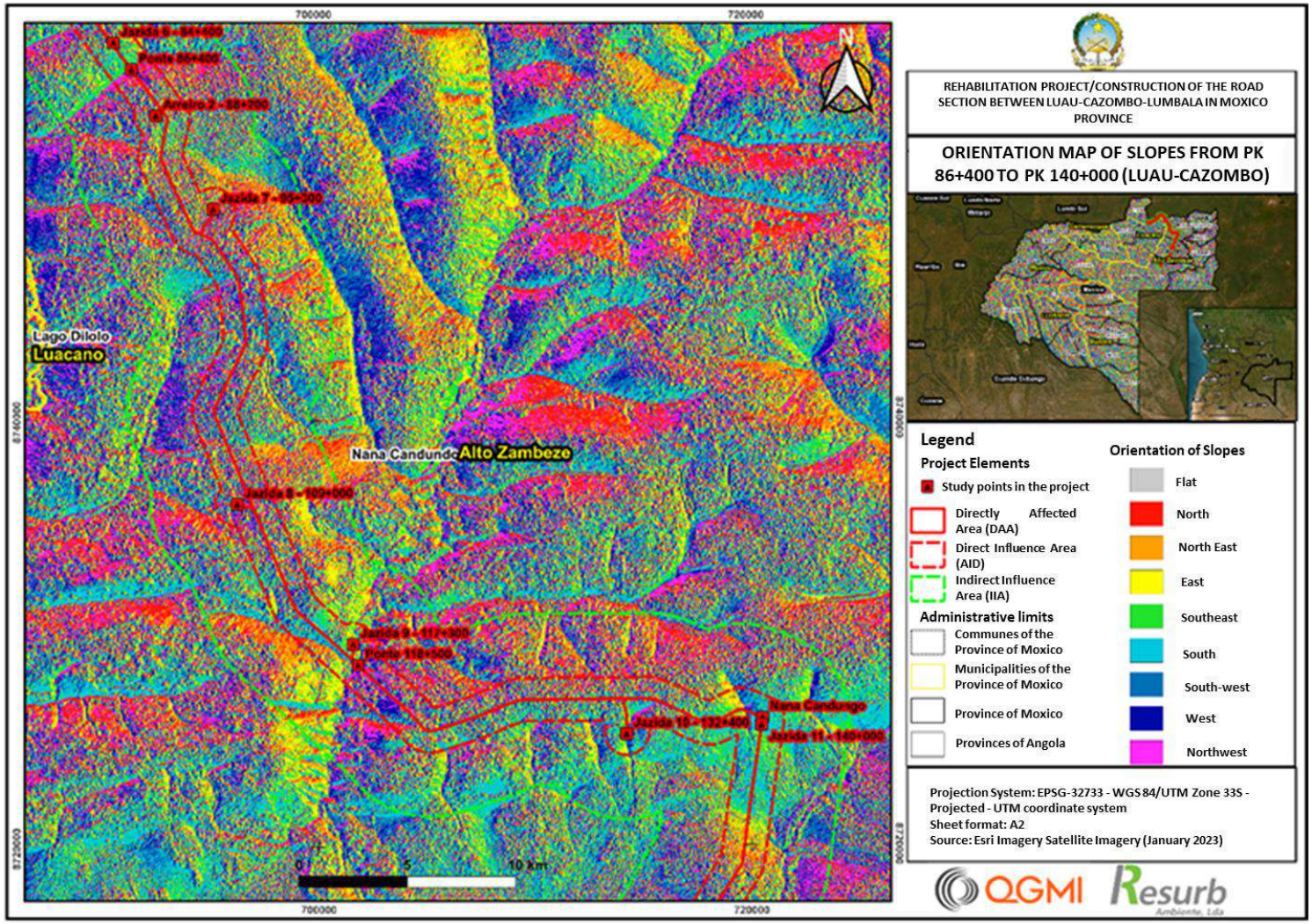


Figure 70 - Slope orientation map of the area PK 86+400 to PK 140+000 (Nana-Candundo).

- The area of influence of the road section between PK 140+000 to PK 196+000 (Nana Candundo - Cazombo), has an altitude that varies from 1.072 m to 1.138 m in the NE - SW direction (*see* **Figures 71** and **72**), with a slope ranging from flat (0 – 3%) to gently undulating (3 – 8%) and an average slope of 0.7 to -0.7% (*see* **Figure 73**). The steepest slope in this area is recorded at point PK 190+000, and crossing is only possible via the existing bridge in the area. It should be noted that in some points of the DIA and IIA, it presents undulating to mountainous terrain. The slopes of the relief under study have a preferential orientation towards the South (S) and Northwest (NW) (*see* **Figure 74**).

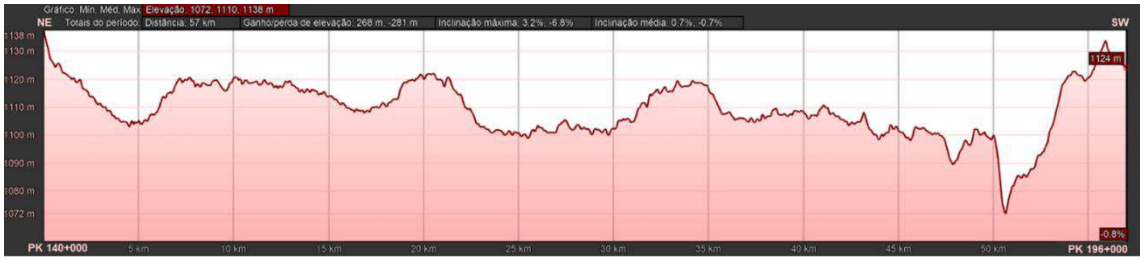


Figure 71 - Topographic profile of the area PK 140+000 to PK 196+000 (Nana Candundo - Cazombo), in the NE-SW direction.

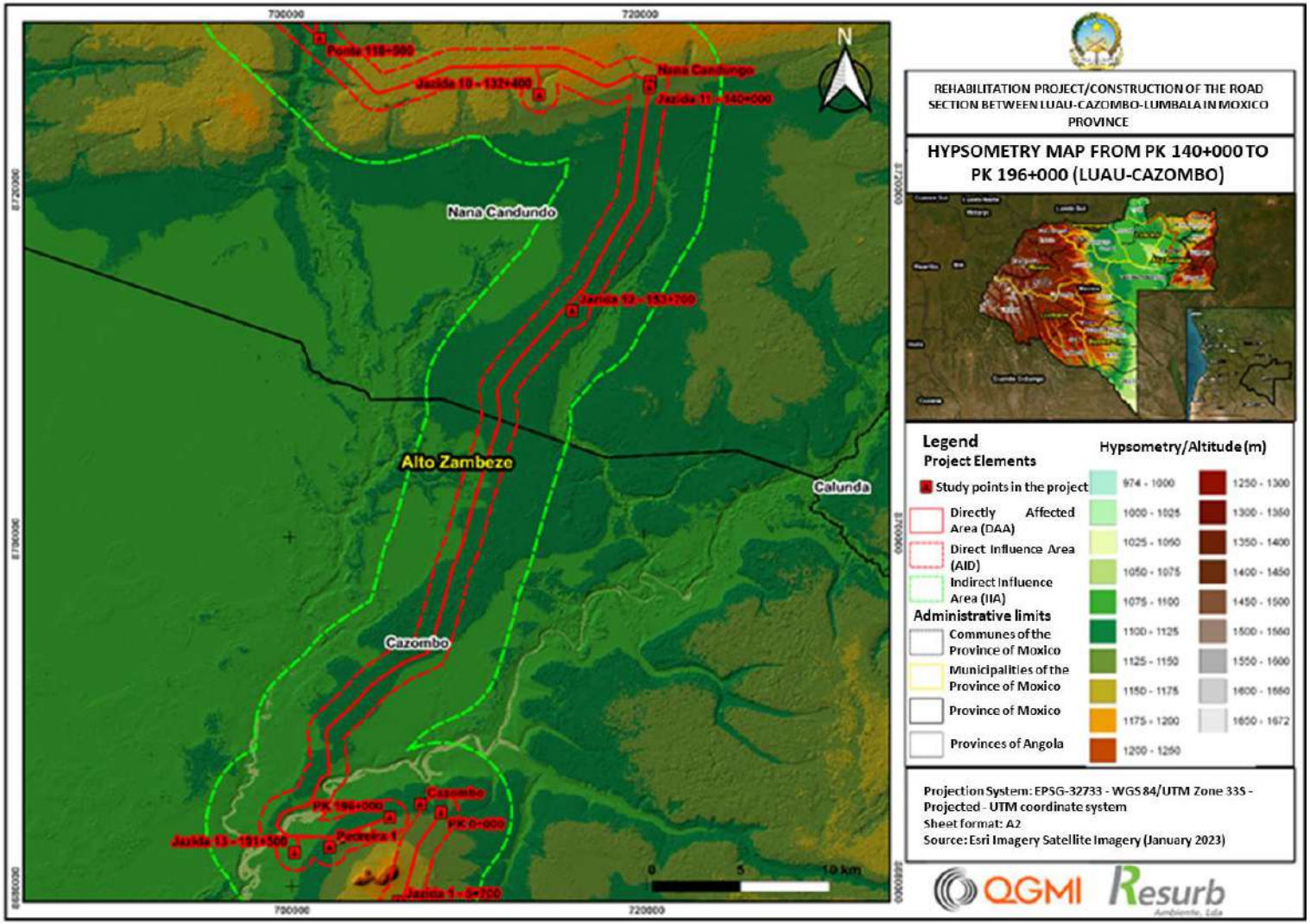


Figure 72 - Hypsometry map of the area PK 140+000 to PK 196+000 (Nana Candundo - Cazombo).

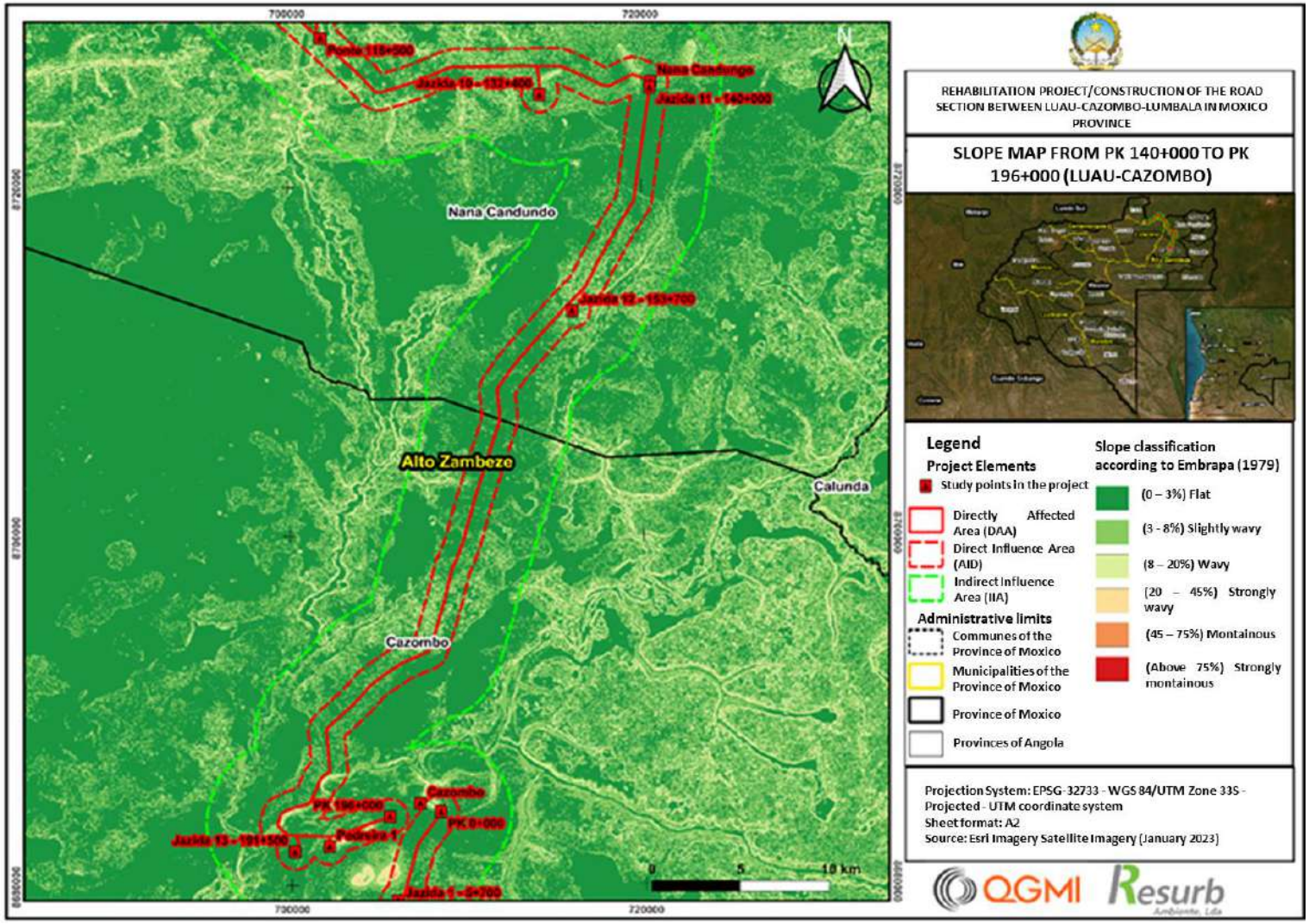


Figure 73 - Slope map of the area PK 140+000 to PK 196+000 (Nana Candundo - Cazombo).

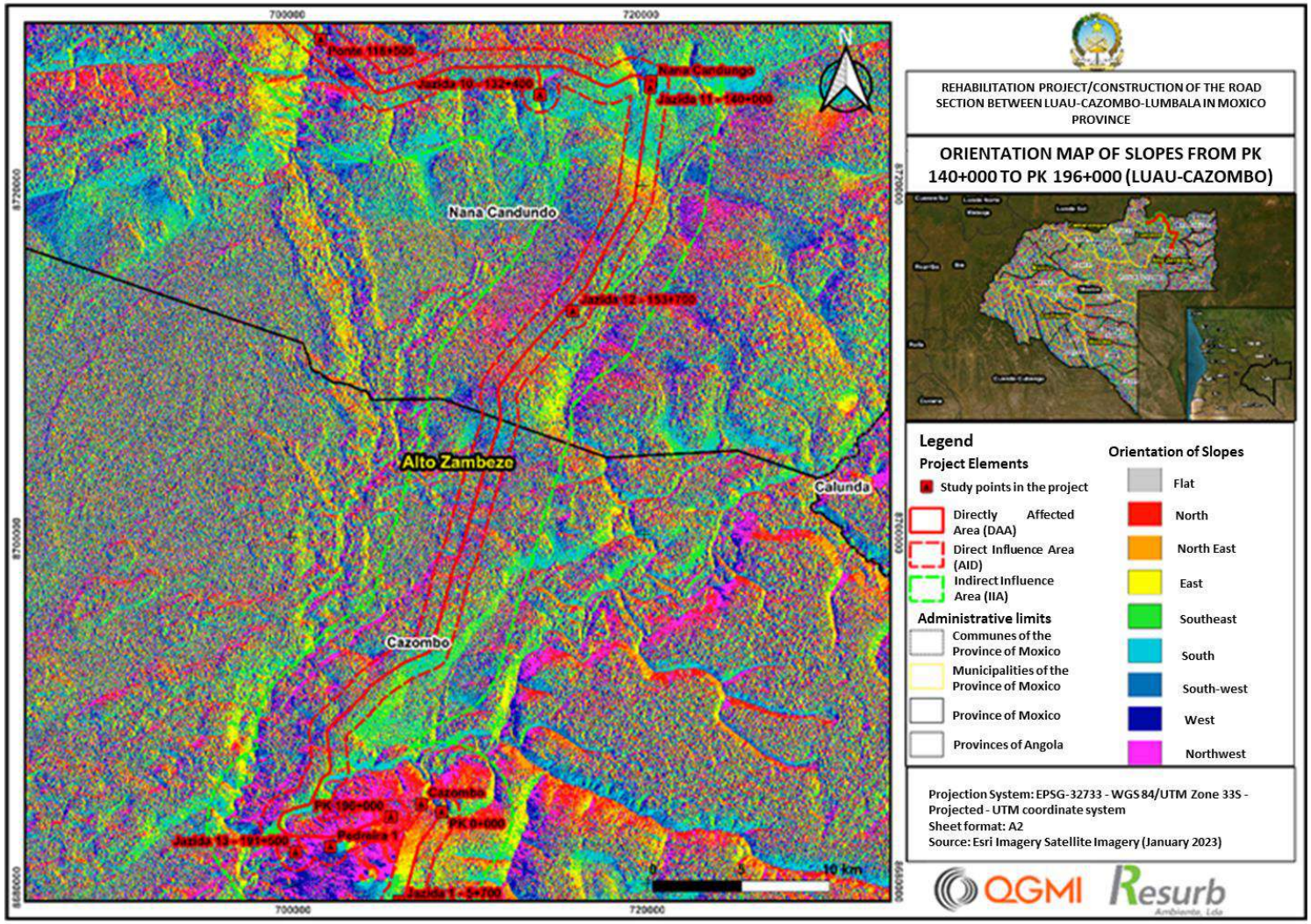


Figure 74 - Slope orientation map of the area PK 140+000 to PK 196+000 (Nana Candundo - Cazombo).

- The area of influence of the road section between PK 0+000 to PK 70+000 (Cazombo – Lumbala Caquengue), has an altitude that varies from 1.068 m to 1.185 m in the NE – SW direction (*see* **Figures 75** and **76**), with a slope ranging from gently undulating (3 – 8%) to flat (0 – 3%) to an average grade of 3.3 to -4.1% (*see* **Figure 77**). The steepest slope in this area is recorded at points PK 27+450, PK 38+715, PK 50+590, and PK 52+700, where crossing is only possible via the existing bridge or via boats (eg., canoes) (*see* **Figure 78**). It should be noted that in some points of the DIA and IIA, it presents undulating to mountainous terrain. The slopes of the relief under study have a preferential orientation towards Northwest (NW) (*see* **Figure 79**).

Figure 75 - Topographic profile of the area PK 0+000 to PK 70+000 (Cazombo – Lumbala Caquengue), in the NE-SW direction.

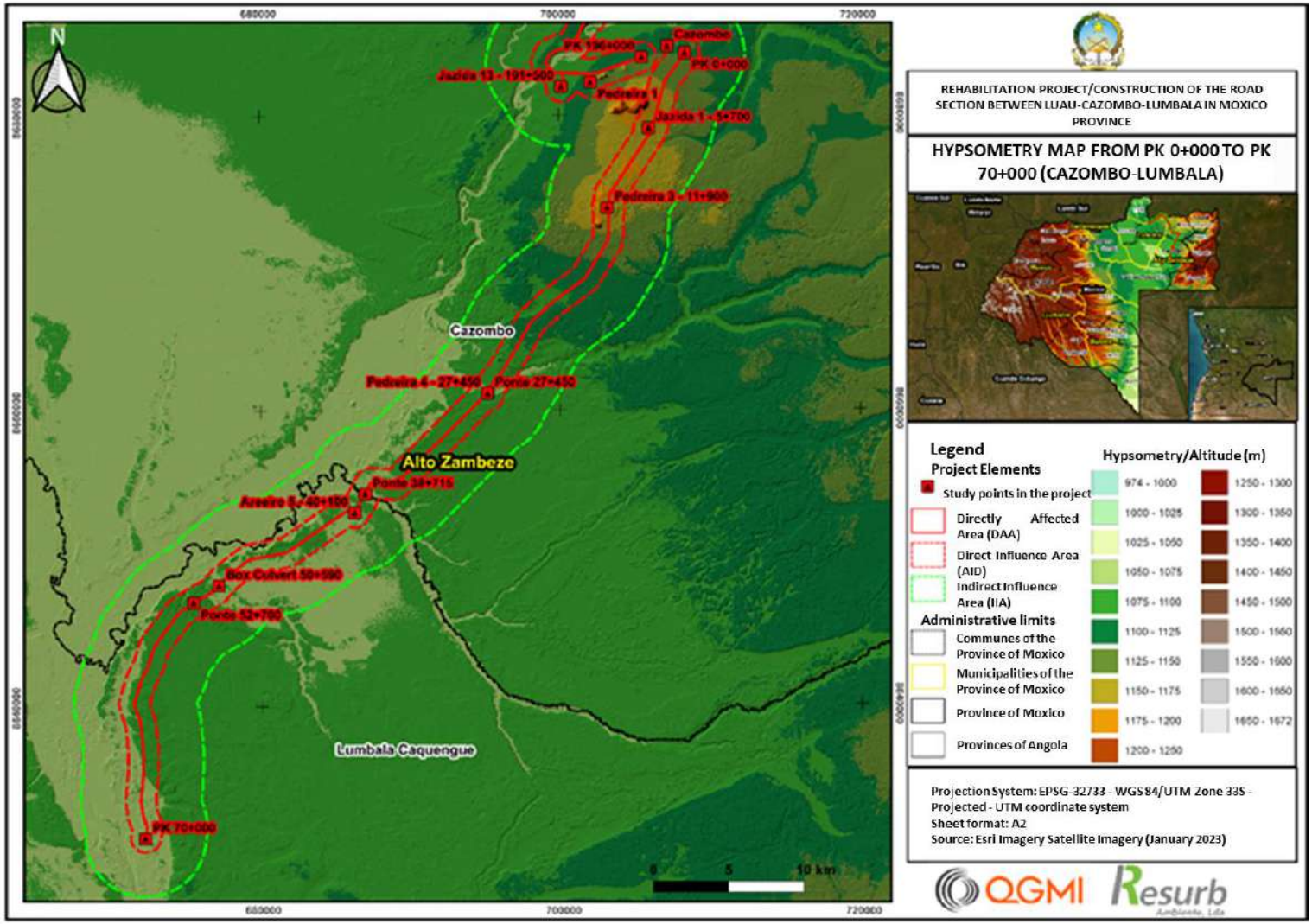


Figure 76 - Hypsometry map of the area PK 0+000 to PK 70+000 (Cazombo – Lumbala Caquengue).

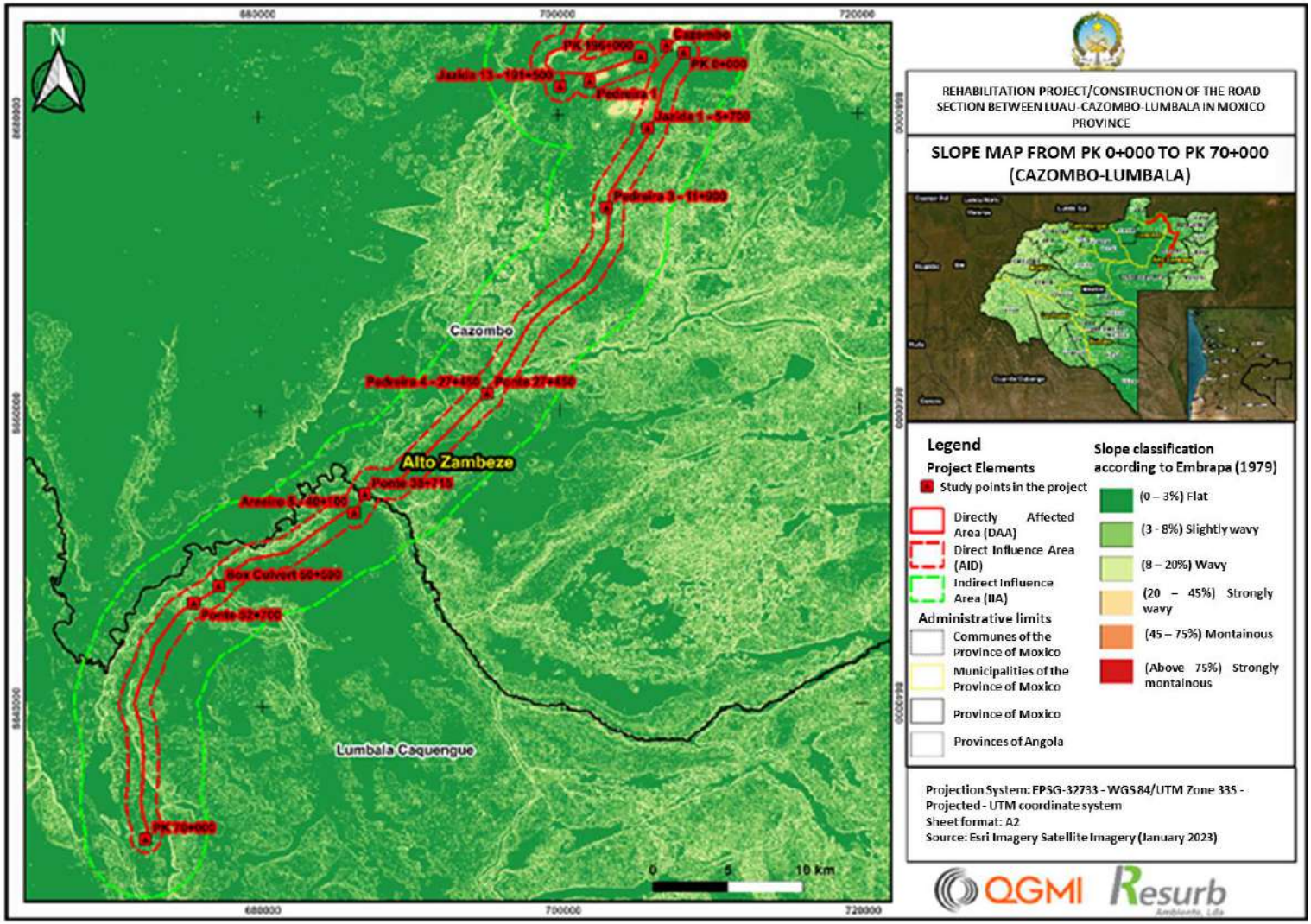


Figure 77 - Area slope map PK 0+000 to PK 70+000 (Cazombo – Lumbala Caquengue).

Figure 78 - Crossing of people and goods in the PK 50+590 (Cazombo – Lumbala Caquengue).

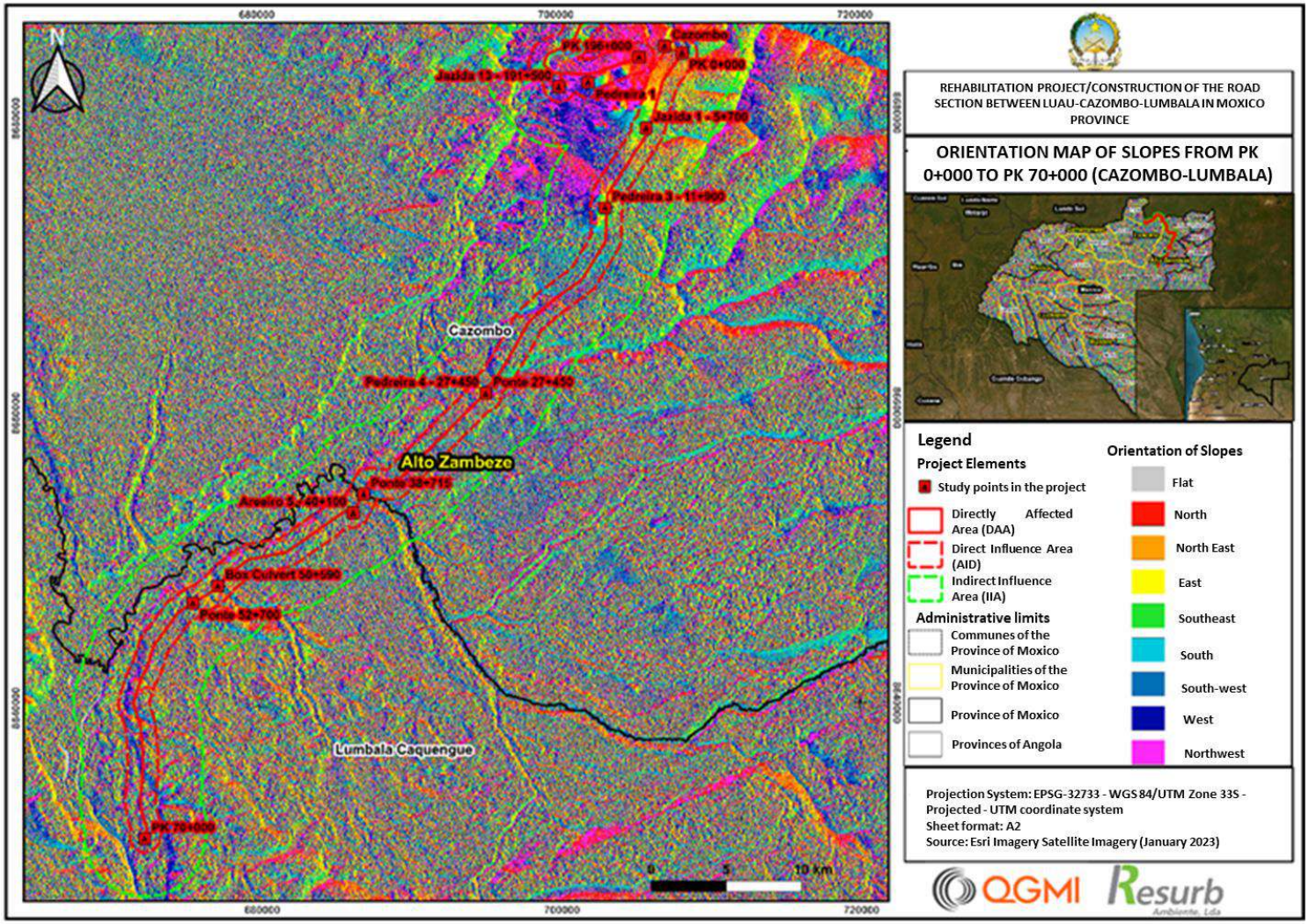


Figure 79 - Slope orientation map of area PK 0+000 to PK 70+000 (Cazombo – Lumbala Caquengue).

6.2.2. Geological Characterization

The Angolan territory presents a wide variety of geological formations evidenced by the presence of rocks that occur or were subject to events from the Archaic to the present. In this context, the geology of Angola is represented by three large groups that encompass eleven regional units, as can be seen in the Geological Map of Angola presented in **Figure 80**, namely, the Base Complex (also called the Old Massif) and the Mesocenozoic Basins that includes the Meso-Cenozoic Coastal Basin.

As far as Moxico Province is concerned, sediments deposited by wind and water dominate the geology. Much of this sediment remains as soil, but rock formations make up most of the area to the east of the Province. Most of these rock formations date back 600 million years. In other places in the Province, only small outcrops are exposed, resulting from volcanic activities and sediments that have solidified (Source: Atlas e perfil do Moxico, Angola, 2015).

Thus, the following figure shows the Geological Map of the Province of Moxico (*see* **Figure 80**).

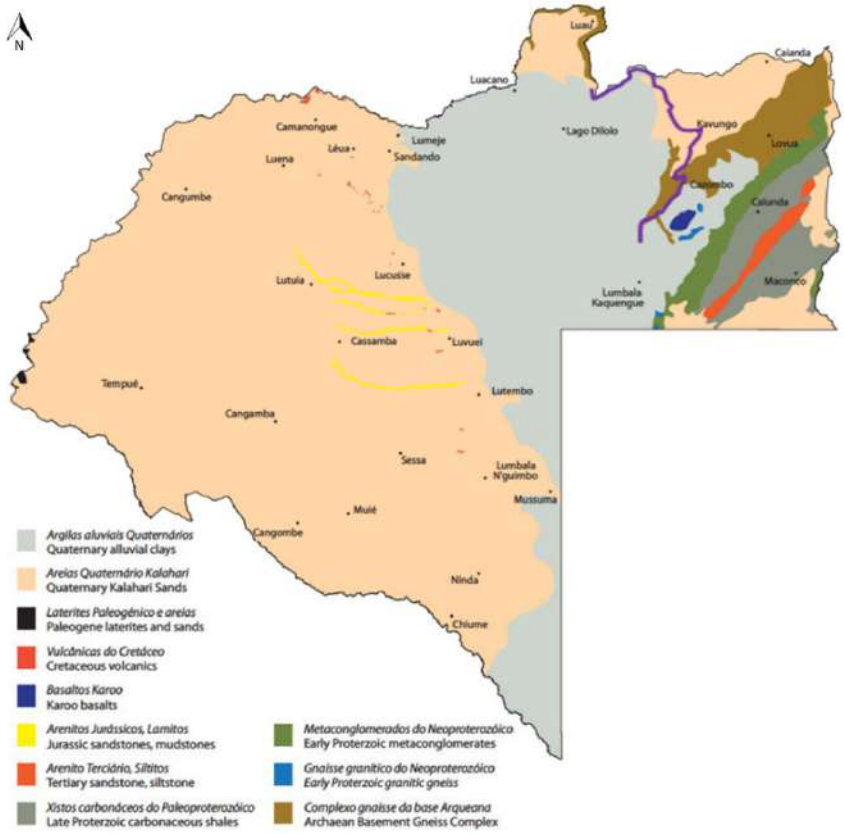


Figure 80 – Geological Map of the Province of Moxico highlighting the location of the project, marked in purple (Source: adapted from Atlas e perfil do Moxico, Angola, 2015).

Analyzing the Geological Map of the Province of Moxico (*see* **Figure 80**) it can be seen that the area under study falls within the geological units *Effusive and Metamorphic Sedimentary Rocks*

and *Undifferentiated Archaic* consisting mainly of quaternary alluvial sands, quaternary sands of the Kalahari and gneiss of the gneiss complex Archean based.

6.2.2.1. Local Geological Framework

From the point of view of local geology, according to the Chart of Mineral Resources of Angola, at a scale of 1:1000 000 (Sheet 4), the area of influence of the project, presents formations dating from the Archaic (Lower Archaic) to the Quaternary (Quaternary Undifferentiated) (ARAUJO, *et al*., 1998) as can be seen by analyzing the following table and figure (*see* **Table 21** and **Figure 81**).

Table 21 - Main geological units in the area of influence of the project for the rehabilitation of the road section between Luau-Cazombo-Lumbala Caquengue (ARAUJO, *et al*., 1998)

Age	Geological province	Geological domain	Formation symbols	Geological formation	Description of the lithology
Quaternary (Undifferentiated)	Continental Depressions	Congo and Okavango plate	apQ	Undifferentiated Quaternary (alluvial-proluvial deposits)	Sands, clays, eluvial-deluvial gravels
Quaternary (Holocene)			$\mathrm{aQ_{IV}}$	Holocene (alluvial deposits)	Sands, alluvial gravels
Neogene (Middle Miocene)			$\mathrm{N_1 - N_2^1 kl_2}$	Kalahari Group – Ocher Sands Formation	Sands and clays
Paleogene (Eocene)			$\mathrm{P_2 - N_1 kl_1}$	Kalahari Group – Polymorphous Stoneware Formation	Stoneware, silicified rocks, conglomerates
Inferior Archaic	Bangwuela shield	Inferior Archaic	$\mathrm{AR_1^2}$	Upper group of Lower Archaic	Gneisses and shales*, amphibolites, leptites and quartzites

* Gneisses and schists of different composition of granulitic, amphibolitic, epidote-amphibolitic facies. In zones of ultrametamorphism: enderbites, charnoquites, plagiogranites, migmatites.

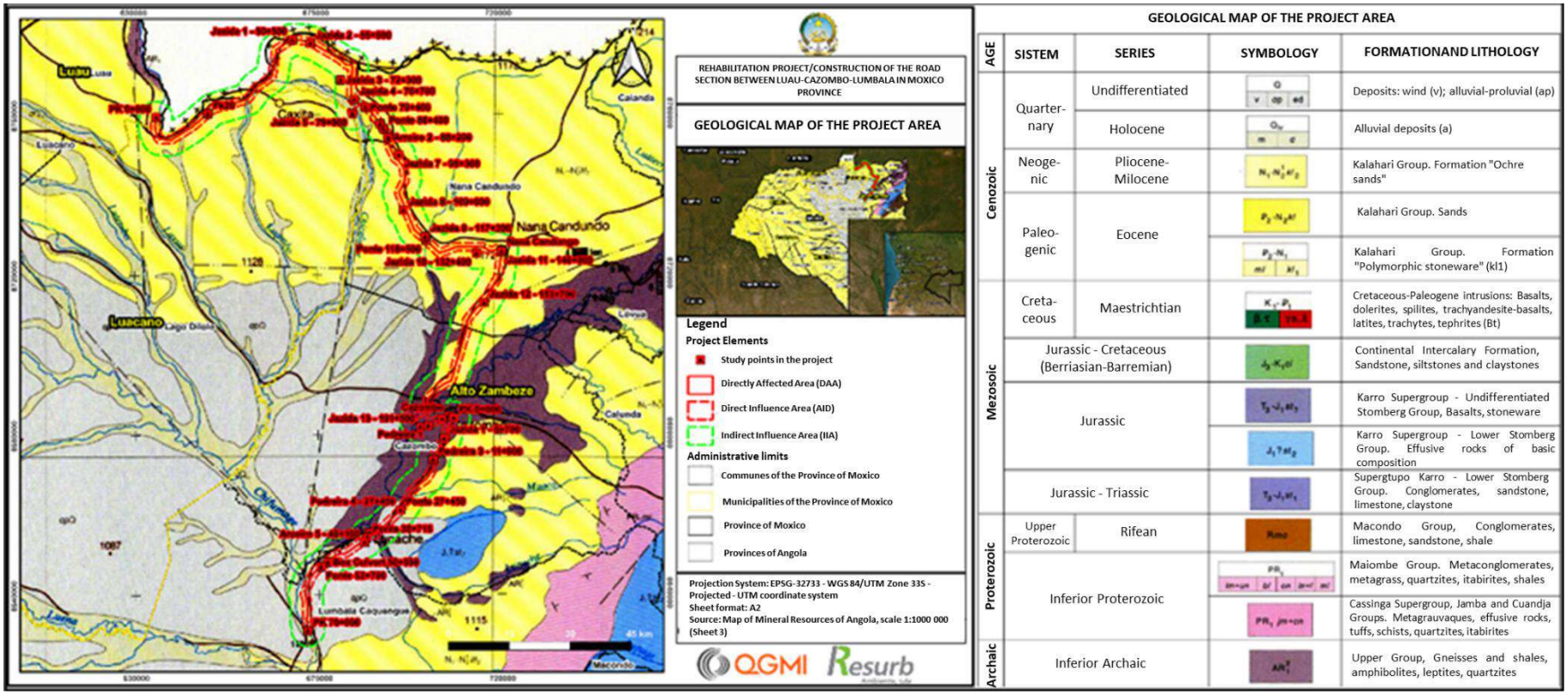


Figure 81 - Geological map of the project area (Source: Map of Mineral Resources of Angola, to scale 1:1000 000 (Folha 4)).

The main geological units in the project's area of influence are distributed differently throughout the project area, namely:

- The Upper Lower Archaic Group is distributed at the top of the area of influence of the PK 165+000 road section, from PK 183+000 to PK196+000 (on the Luau-Cazombo section, within the Cazombo Commune) and PK 0+000 to PK 27+450 (on the Cazombo-Lumbala Caquengue section, in the Commune of Cazombo) (*see* **Figure 82**). Geologically, this group is constituted by gneiss and schists of different composition of granulitic, amphibolitic, epidote-amphibolitic facies (in zones of ultrametamorphism: enderbites, charnoquites, plagiogranites, migmatites) from the Lower Archaic age, formed in the Bangwuela Shield (ARAUJO, *et al*., 1998).

  The gneiss are generally horneblendelic with biotite, sometimes losing their clearly evident schist texture, gradually changing to quartz diorites and diorites (*see* **Figure 83**).

Figure 82 – Photographic record of hornblende gneisses (delimited in red color) with biotite (delimited in blue color): A) general perspective, B) and C) detailed perspective.

- The Polymorphous Stoneware Formation of the Kalahari Group is found distributed at the top of the area of influence of the road section between PK 67+000 and PK 70+000 (on the Cazombo-Lumbala section, in the Lumbala Caquengue Commune) (*see* **Figure 81**). Geologically, this group consists of white and yellow sandstone and lithified sands from the Paleogene (Eocene) age, formed in the continental depressions within the Okavango Plate (ARAUJO, *et al*., 1998).

  Stratigraphically, it is possible to observe that the polymorphous sandstone formation at the base of the formation has breccias with chalcedony and lateritic fragments, sometimes basal conglomerates and gravels with thicknesses up to 2 m. In the upper part, there are feldspathic-quartzic sandstone, followed by essentially quartz stoneware of variable granulometry (from fine to coarse), with graded or crossed stratification. In the upper part are clayey sandstones, weakly lithified, friable.

  The formation presents, mainly in the lower part, silicified layers with sandstones involved in a chalcedony or opal cement and intercalations of chalcedonic and chalcedonite (*see* **Figure 83**) (ARAUJO, *et al*., 1992). In several places this formation was covered by a thin brownish sandy deposit (Diniz, 1973).

Figure 83 – Photographic record of the Polymorphous Stoneware Formation of the Kalahari Group (A); Detail of the cementation of the sediments (B); Grain size detail (C).

- The "Ocher sands" Formation of the Kalahari group is distributed at the top of the area of influence of the road section between PK 0+000 to PK 76+700, from PK 79+400 to PK 165+00, and from PK 167 +000 to PK 183+000 (on the Luau-Cazombo section, in the Luau, Lago Dilolo, Nana Candungo and Cazombo Communes) and, in the area of influence of PK 0+000 to PK 27+450 (on the Cazombo-Lumbala Caquengue section, in the Commune of Cazombo) (*see* **Figure 81**). Geologically, this group consists of fine quartz sands (0.1-0.5 mm) with appreciable levels of clays and iron hydroxides from the Neogene age (Middle Miocene), formed in continental depressions within the Okavango Plate (ARAUJO, *et al*., 1998).

  The Kalahari Group, formation "Ocher sands" or "ocher sandy clays" has a wide extension in the area. In addition to quartz, there are grains of zircon, rutile, tourmaline, staurolite, cyanite. The sequence in question is characterized by the absence of stratification. The passage of the "polymorphic sandstones" underlying the "Ochre sands" is very clear, succeeding the lithified rocks, friable rocks (*see* **Figure 84**). At the base of the "Ochre sands", there are ferruginous films and quartz grains with iron oxides. Sometimes, the "Ochre sands" settle directly on the basement rocks or Mesozoic deposits of the Congo and Okavango depressions (ARAUJO, *et al*., 1992).

Figure 84 – Formation Polymorphic sandstone of the Kalahari group and ocher sands (A); Detail of polymorphic stoneware (B); Detail of the ocher sand (C).

- The alluvial deposits of the Holocene are distributed at the top of the areas of influence of the road section between PK 76+700 and PK 79+400, and in the area of influence of PK 8+820, PK 30+000 and, PK 72 +300 to PK 86+400 (on the Luau-Cazombo section, in the Lago Dilolo and Nana Candundo Communes) and, in the road section interval between PK 50+590 and PK 67+000 (on the Cazombo-Lumbala section, in the do Lumbala Caquengue) (*see* **Figure 81**). Geologically, this group consists of fine and coarse sands, mostly with little clay, sometimes with pebbles, blocks and clay layers 1.5-3.5 m thick from the Quaternary age (Holocene), formed in the continental depressions within the Okavango Plate (ARAUJO, *et al*., 1998).

  The alluvial deposits constitute low terraces with elevations of up to 3 m, in riverbeds (mainly in the Luvua, Luambo, Chicaluege and Chifumage rivers) and marshes of all more or less important water lines. They consist of fine and coarse sand, mostly with little clay, sometimes with pebbles, blocks and clay layers 1.5-3.5 m thick. In its upper

part there are gravel pits. The thickness of the deposits oscillates between 8-9 and 15-20 m (ARAUJO, *et al*., 1992).

The Quaternary (Undifferentiated) proluvial-alluvial deposits are distributed at the top of the area of influence of the road section between PK 27+450 and PK 38+715 and in the area of influence from PK 40+100 to PK 70+000 (on the Cazombo-Lumbala section, in the Communes of Cazombo and Lumbala Caquengue) (*see* **Figure 81**). Geologically, this group consists of sands and clays from the Quaternary age (Undifferentiated), formed in the continental depressions within the Okavango Plate (ARAUJO, *et al*., 1998).

The proluvial-alluvial deposits are characteristic forms of the relief of the plain ("chanas") and are represented by low elevations. The sands of these deposits are well washed or clayey (ARAUJO, *et al*., 1992).

6.2.3. Geological Risks

This chapter intends to identify the various geological risks that may occur in the project's implantation area. Geological risks or hazards are calculated through the integrated assessment of the probability of occurrence of a hazardous event in a given area at a given time, associated with geological phenomena, that is, geological hazard, hazard in the English nomenclature, and its consequences for both humans and materials. The geological risk is just a variant of the natural risks that can be manifested.

Geological risks, as part of natural risks, are associated with geological phenomena that are part of the functioning of the Earth, that is, internal and external geodynamics.

Earthquakes, tsunamis and volcanic eruptions belong to the category of internal geodynamics, while floods and landslides, while the phenomena of erosion and water sedimentation, erosion and coastal accretion and flooding are included in external geodynamics. This description is not, however, consensual, with some authors stressing that, although flooding processes are related to atmospheric processes (rainfall), their constraints are geological/geomorphological in nature, and are therefore classified as resulting from exogenous geological processes, *in* Dias, A. (2000). The same author also mentions that although the processes are the same, there are differences between these processes as in their typology and the intensity with which they occur, varying according to the characteristics of each region.

The identification of geological risks helps to create forecasting methods, that is, identification of precursor events, which can lead to the establishment of preventive measures that allow to minimize the negative consequences, namely with regard to the loss of human lives.

A clear example is the development of landslide risk maps, using matrices of topographic slopes, associated with geological and geotechnical studies of those slopes considered the most dangerous. The matrix that manages the risk of landslides undergoes changes with the perception that increased precipitation may cause these steep slopes. However, so as not to generate misunderstandings, landslides can occur practically anywhere in the world, and are known both on firm ground and at the bottom of the waters; they may occur in rocky or earthy regions; Cultivated areas, unproductive slopes and natural forests are also subject to landslides. In many cases, smooth, shallow slopes of 1 to 2 degrees of slope can also fail.

In the case under study, the identification of the different geological risks that may occur, serve to characterize the natural environment in which the road will be rehabilitated/built, in addition to the support structures. The main geological risks and the probability of their occurrence are described in the following table (*see* **Table 22**).

Table 22 – Type of geological hazards and identification of possible hazards in the area under study (adapted from: Dias, A. (2000))

Type of Geological Risks	Possibility of occurrence in the study area
Avalanche, landslides or landslides	Existing – Very Low to Non-existent
Water table variations and subsidence	Existing – Low to Very Low
Erosion	Existing - Very Low to Moderate
Floods	Existing - Moderate to High
Ice-thaw	Nonexistent
Volcanism Phenomena	Nonexistent
Earthquakes and active fault ruptures	Existing - Very Low
Tsunamis	Nonexistent

The previous table (*see* **Table 22**) allows to outline the possibility of registering some of the potential geological risks. Although existing, the probability of occurrence of some of these risks is unlikely, given the characteristics of the place under study.

The main risks to be taken into account in the project implantation site are associated with exogenous factors. These factors mainly include the occurrence of floods or inundations in a flat area, with little accentuated variations in the topography and with variable precipitation.

Thus, the following figure (*see* **Figure 85**) shows a map of Angola with an indication of flood risk zones.

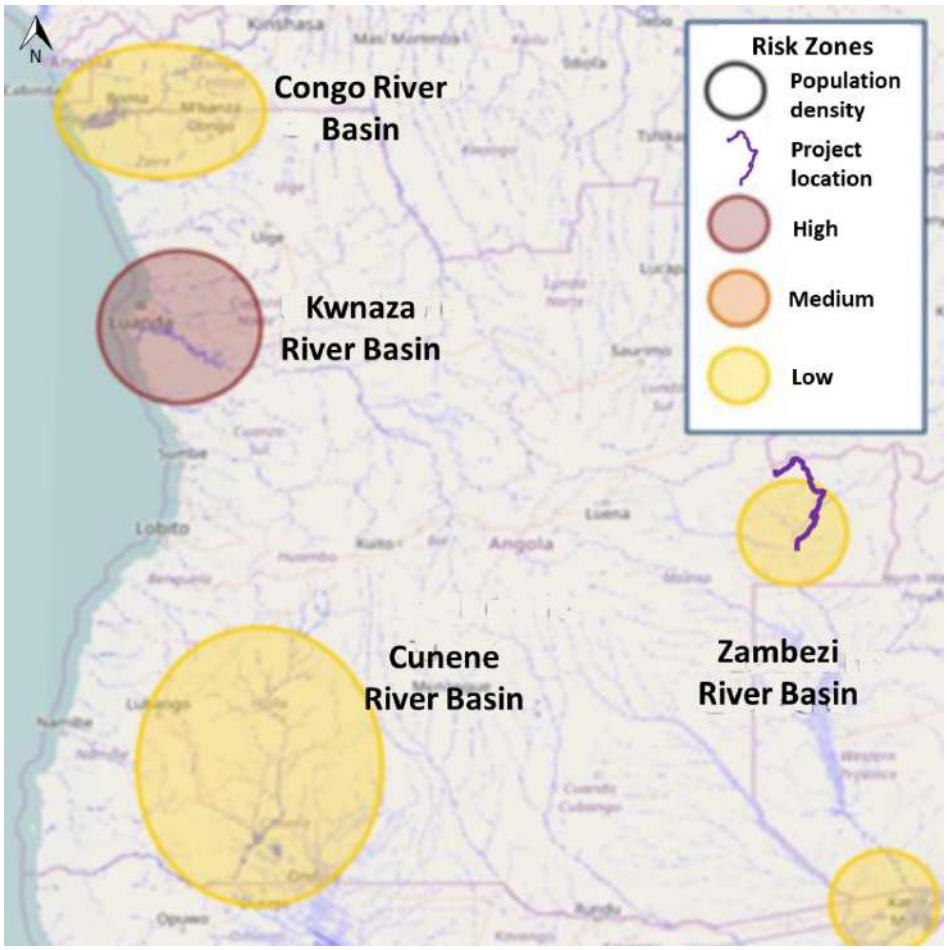


Figure 85 - Flood risk zones in Angola with emphasis on the location of the project (Source: National Strategy for Climate Change 2018-2030).

Analyzing the Map of Flood Risk Zones (*see* **Figure 85**) it can be seen that the project area is located in a low flood risk zone, being framed in the hydrographic basin of the Zambezi River.

In addition to the risk of floods, it is important to point out the occurrence of geological phenomena, to the east of Angola, which are ravines, as over the years they have gained alarming proportions, putting the lives of populations and infrastructures at risk. Due to its geographical situation and being part of a region with a subtropical climate, as referred to in **Chapter 6.1. Climate and Climate Change**, the project implementation area is subject to rainy periods with large amounts of precipitation that, in addition to the risk of flooding, favor the process of soil water erosion (Emmanuel, A., 2018).

The increase in population density in large urban centers due to migration from the interior of the country in search of better living conditions has caused a disorganized growth of cities, giving rise to a series of difficulties in the management of the territory. There are many housing areas that proliferate illegally in ravine areas and that often close the drains of water lines, putting the population at risk. Also, the lack of information and culture of the

populations about the care to be taken with the land as well as its natural resources, have strongly contributed to the degradation of the soil (Ferreira & Diogo, 2015). In this context, it is important to mention that the cities of the Province of Moxico grew very fast during the previous decade. Rapid urban growth was accompanied by major challenges, such as soil erosion, which led to the formation of huge ravines, as can be seen in the following figure (*see* **Figure 86**) which represents a ravine in the city of Luena (Atlas e perfil do Moxico, Angola, 2015).

Figure 86 – Existing ravine in the city of Luena (Source: adapted from *Google Earth*).

In terms of soil erosion risk, this risk is inherent to the degree of vegetation cover it has. The risk of soil erosion in the area under study presents two opposite poles. On the one hand, topographies with gentle slopes create very low erosion conditions, taking into account that the surface run-off does not have a great carrying capacity due to these gentle slopes.

The following figure (*see* **Figure 87**) shows the erosion risk map for the Province of Moxico, where the project is located.

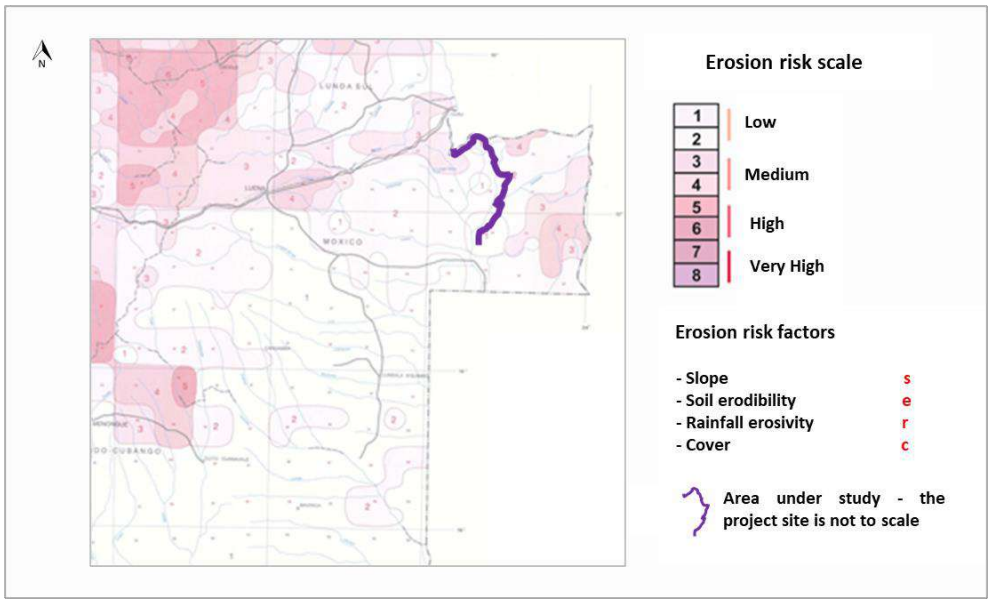


Figure 87 - Soil Erosion Map of the Province of Moxico with the representation of the project layout, in purple (Source: Adapted Erosion Hazard Map of Angola, ISRIC, Holanda, 1:2 000 000).

Analyzing the previous figure, it can be seen that the project is located in grade 1, 2 and 3 areas, that is, areas with low to medium risk of erosion. The degree of risk of erosion may be related, as already mentioned, among others, to the flat topography of the site, but also to the vulnerability of the region to rainfall, whose intense periods of precipitation and concentrated in a short time, can favor soil erodibility, aggravated by the fact that the soils are weakly cemented.

With regard to geological risks of an endogenous nature, namely the occurrence of tsunamis and volcanism, these present zero risk (*see* **Table 22**). It should be noted that, currently, there is no active volcanism in Angolan territory and the site under study is not located in a coastal zone, more vulnerable to the occurrence of tsunamis.

Seismicity in Angola shows characteristics of intraplate seismicity, occurring along alignments that seem to be reactivated from previous orogeny. Most of the instrumental seismicity is recorded along the Lucapa corridor, as can be seen in the following figure (*see* **Figure 88**).

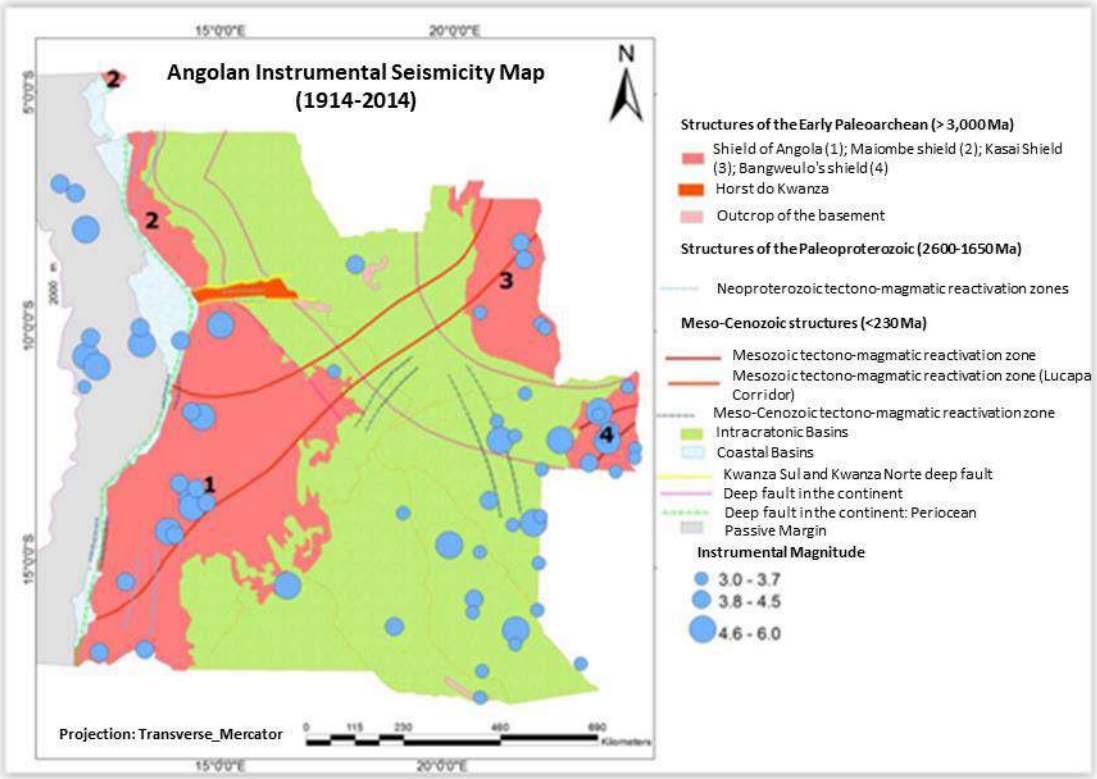


Figure 88 - Map of earthquakes in Angola between 1914-2014 (Fonte: Neto, 2014).

Seismicity in Angola seems to be concentrated along the Lucapa Corridor (*see* **Figure 88**), a Proterozoic structure, reactivated during the Jurassic distensive phases of crustal extension, which created conditions for the installation of alkaline, ultrabasic, carbonatite magmas and which is associated with Mesozoic kimberlite chimneys. It is likely that the southern fault of the corridor will continue to present stresses, as most of the seismicity seems to be concentrated in the southern branch. To the north, oceanic seismicity related to the Cuanza basin, in alignment with Horst do Cuanza. Perioceanic seismicity may also indicate halokinesis processes in the salt deposits of the same basin.

In the eastern part of Angola, some seismicity also occurs which seems to be linked to reactivations of structures in the Bangweulo shield. Much of the seismicity occurs in areas covered by Cenozoic sediments of the Kalahari basin, where sediments carpet the topography and where pre-Cenozoic structures are hidden.

Therefore, Angola has a relatively low and dispersed seismicity in time, but it occurs occasionally, although there are no focal points near the study site.

Regarding the risk of contamination of soils and surface water lines resulting from the activities inherent to the project, this should be small in view of the good practices/good implementation rules implemented in the project, as well as the technical areas and support

areas being implanted on concrete slabs, being properly waterproofed. However, it is always necessary to consider the possibility of an accident. However, if this occurs, it will only be in an emergency situation, for example, flooding or leakage (spill). However, with the implementation of an Environmental Emergency Plan the probability of occurrence is reduced and the risk is controlled.

6.2.4. Forecast in the Absence of the Project

Any geological risks that may occur to the project site will be mitigated in the absence of the project. However, the issue of erosion will always be present in the area of influence of the project since the area in question is characterized by containing poorly consolidated rock formations, namely Quaternary alluvial sands, Quaternary sands from the Kalahari and gneiss from the Archean-based gneiss complex. The risk of erosion shown in **Figure 87** shows the slope and vegetation cover as the main factors, but as previously mentioned, none of them are of considerable concern in the area.

With regard to the directly affected area, in the absence of the implementation of the project, there will be preservation of the existing geology, as a result of which construction activities that could affect the geological patrimony will not take place.

6.3. Water Resources

6.3.1. Surface Water Resources

The Angolan hydrographic network is extensive, with around 70 permanent river (*see* **Figure 89**). From this wide hydrographic network, two large-scale transnational rivers stand out, namely the Congo River and the Zambezi River, whose hydrographic basins originate in non-Angolan territory, but after entering Angola they extend over a considerable part of the territory.

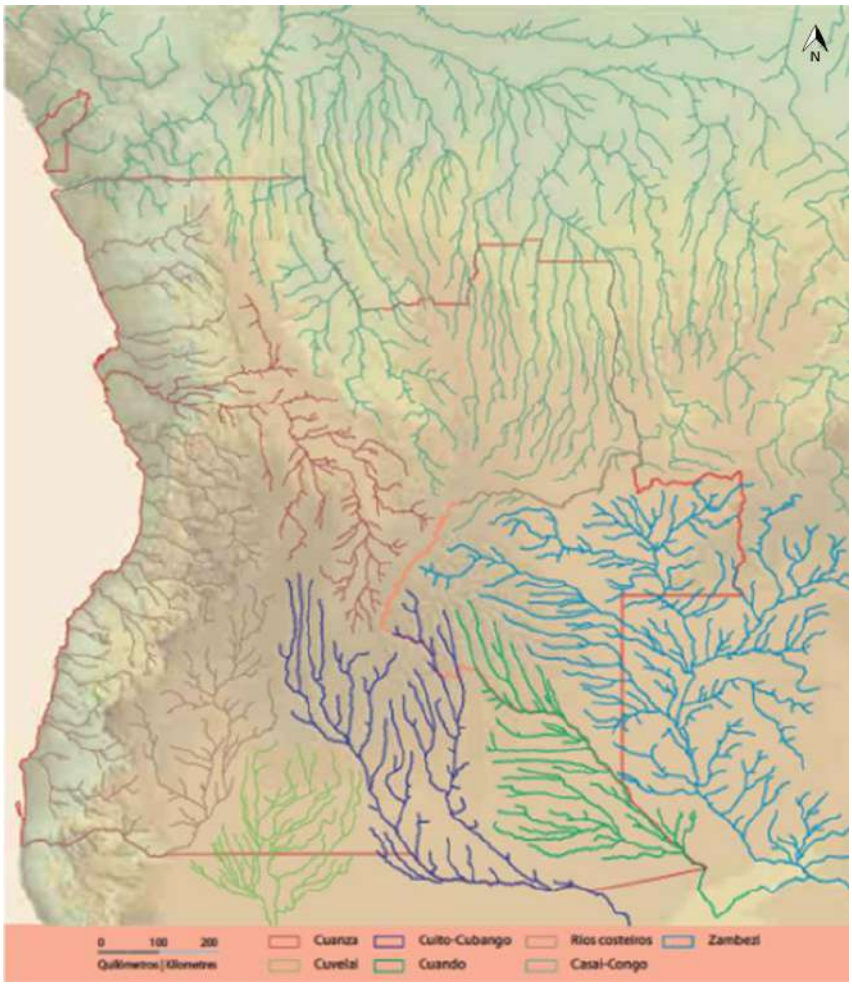


Figure 89 - Hydrographic Network of the Angolan Territory (Source: adapted from hydrosheds.cr.usgs.gov).

It should be noted that the rivers of Angola can be classified into two categories. The first, consisting of coastal rivers, which drain the central and western plateau, quickly flowing westwards into the Atlantic Ocean. The second category of rivers includes those that flow to the North, East and South, in the great Kalahari Basin, where the project is inserted (Source: Atlas e perfil do Moxico, Angola, 2015).

Moxico Province is drained by three river basins, namely, the Zambezi in the east center, the Kubango in the south and the Zaire in the north, as can be seen in the following figure (*see* **Figure 90**).

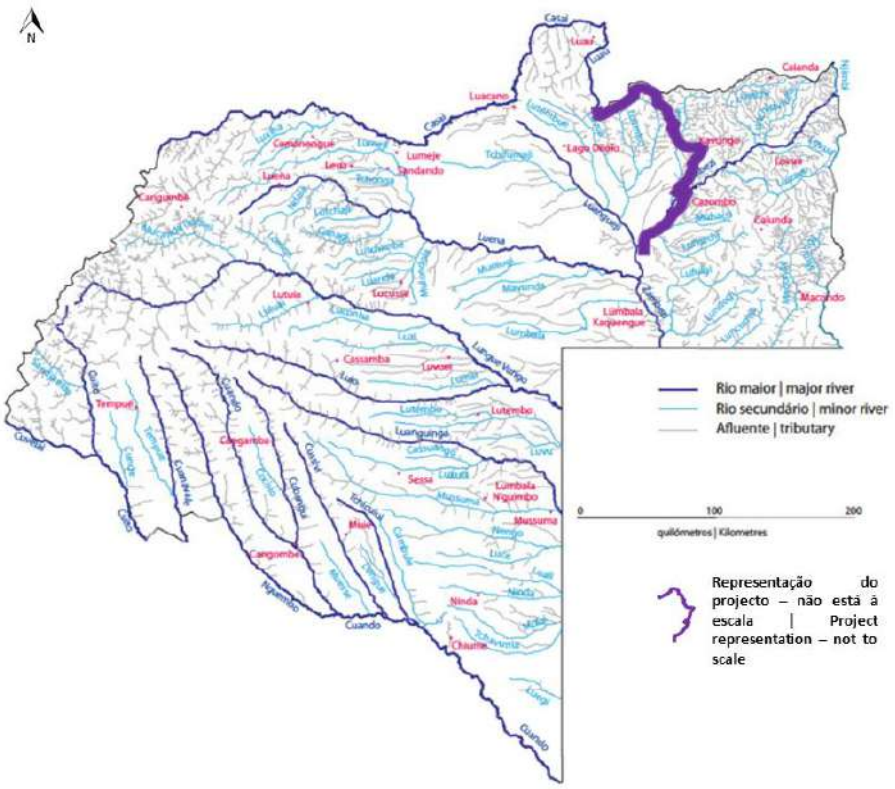


Figure 90 – Hydrographic network of the Province of Moxico, with emphasis on the location of the project (Source: adapted from hydrosheds.cr.usgs.gov).

Through the analysis of the previous figure, it can be seen that important watercourses cross the entire Province, namely Zambezi, Luena, Lungué-Bungo, Cassai, Chicaluege, Loio, Luanguinga and Kuango. There are also *anharas* in the Moxico Province, commonly known as eastern *chanas*, flooded annually in the rainy season (*in* wordpress.com). *Anharas* or *chanas* are the vast plains with herbaceous cover where tree and shrub extracts are rare or practically absent and which are subject to prolonged flooding (PGDURHBH Zambeze, 2022). The following figure shows the photographic record of a wetland identified in the project implementation area (*see* **Figure 91**).

Figure 91 – Photographic record of a wetland in the HPU of Alto Zambeze-Zambeze (left) and Fungi demonstrating the humidity of the area (right).

It is also mentioned that most of the Angolan hydrographic system originates from the highlands of the Central Plateau, with the plateau tops of Huambo, Bié and Moxico functioning as a great reference line or ridge, separating the drainage networks and creating directions runoff preferences, (*in* Diniz (1991)). There is another festus line that corresponds to the plateau top of Camabatela-Negage-Canda, which separates the rivers that flow to the Atlantic Ocean from those that flow to the North, belonging to the Congo River basin. These ridge lines create five major drainage systems that can be seen in **Figure 92** and which correspond to the Atlantic slope, the Congo hydrographic network, the Zambezi hydrographic network and the Okavango/Etosha slopes.

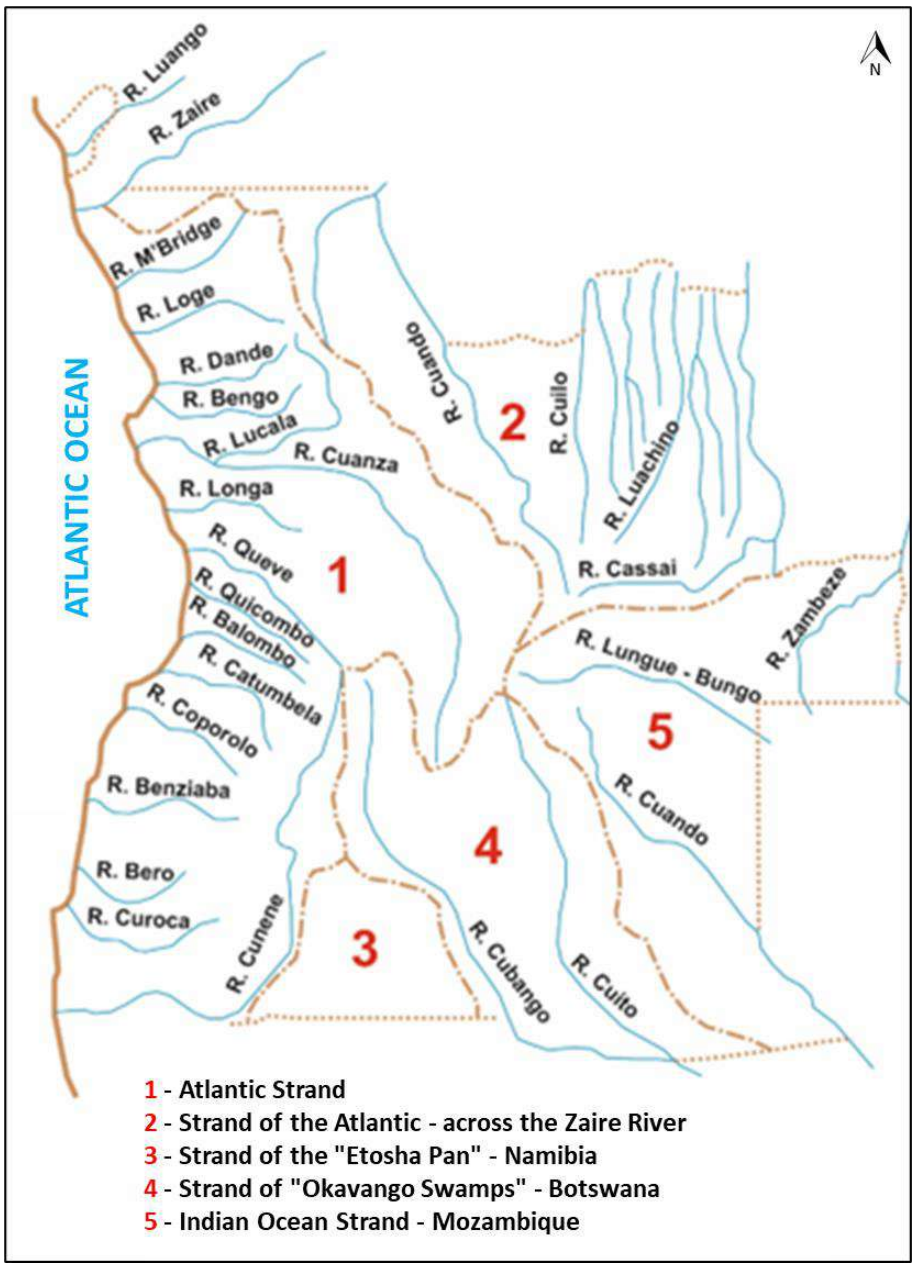


Figure 92 - Main run-off zones in the Angolan territory (Source: adapted from *National Strategy Plan for Rehabilitation of the Hydrometric Network in* Angola, 2004).

By analyzing the previous figure (*see* **Figure 92**) it can be seen that the project fits into runoff zone number 5 (Indian slope - Mozambique), being framed by the Zambezi river which corresponds to a hydrographic basin in eastern Angola, as already mentioned. The Indian Ocean or Zambezi slope (where the project is located) covers an area of approximately 18% of Angola's territory, in the east of the country, with the Luena, Luanguinga and Cuando being the main tributary rivers of the Zambezi.

Carrying out an analysis within the scope of hydrographic units, it appears that the project is located in the main hydrographic planning unit (HPU) of Alto Zambeze – Zambeze (ZZ) and in the secondary hydrographic planning units or Chifumage sub-basin (ZZ2) and the Zambezi (ZZ4), as shown in the following figure (*see* **Figure 93**) (PGDURHBH Zambezi, 2022).

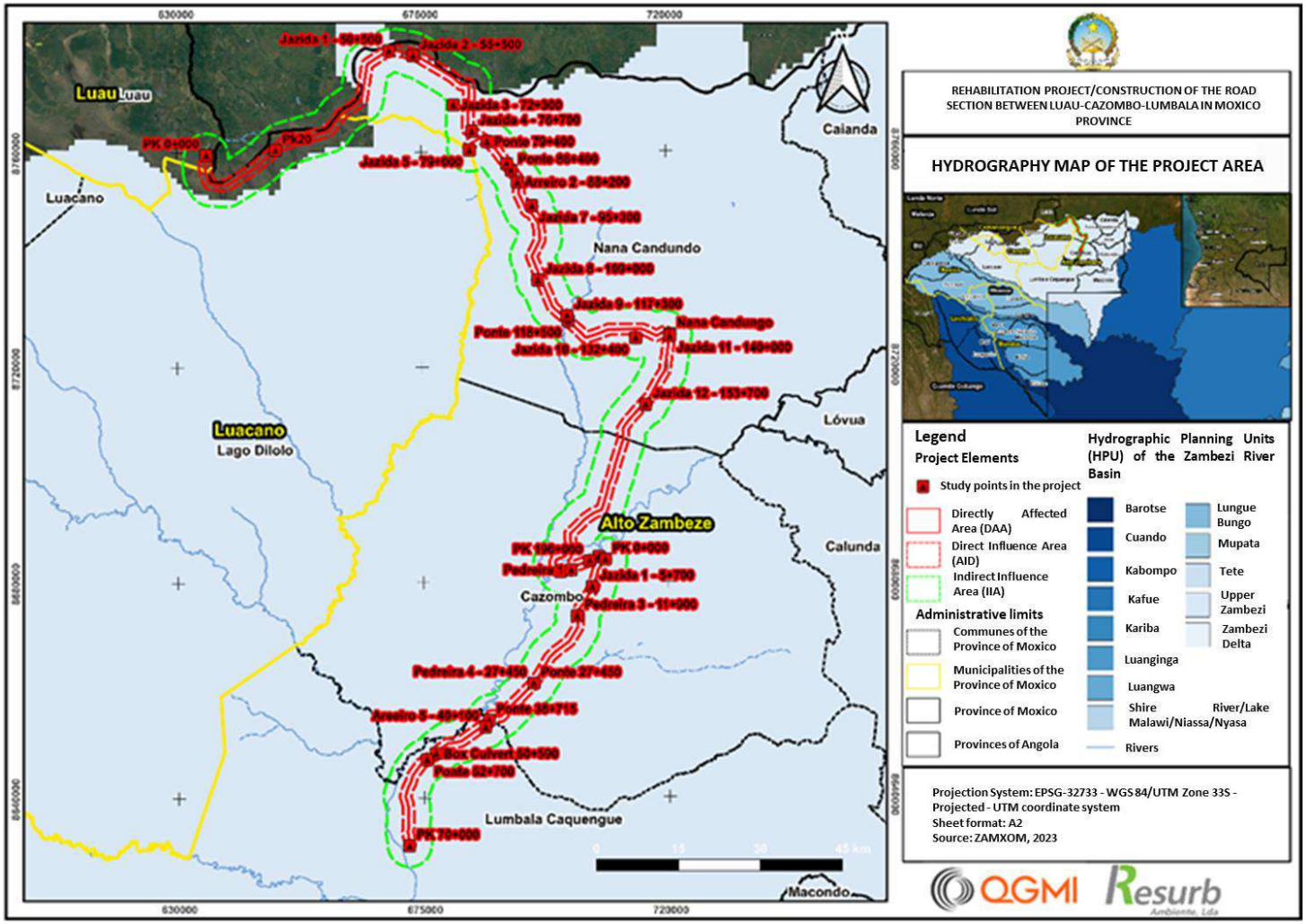


Figure 93 - Map of the Hydrographic Planning Units of the Zambezi River basin with the representation of the project layout (Source: adapted from ZAMXOM, 2023).

The area of the Zambezi River Basin in Angola is about 260.000 km^2 (19% of the total cross-border basin area), covering about 87% of Moxico Province (including Luena, capital of the Province) and 41% of Cuando Cubango, although Menongue, the capital of the Province, is located outside, and quite far, from the basin area. This basin has the Zambezi River as its main river, with a total length of 2.750 km. This river originates in Zambia, in the Kalene Hills, approximately at an altitude of 1.451 m, 30 km from the border with Angola, entering Angolan territory in Cazombo and leaving south of Lumbala-Caquengue, in the Municipality of Alto Zambeze, Province of Moxico (PGDURHBH Zambeze, 2022).

The Chifumage sub-basin has an area of 20.535.29 Km^2, with annual surface flows of about 5.198.70 hm^3/year in wet years, 4.584.50 hm^3/year in medium years and 3.924.10 hm^3/year in dry years (*in* PGDURHBH Zambeze, 2022). The area of influence of the road section between PK 0+000 and PK 190+000 of the Luau – Cazombo section (located in the Communes of Luau, Lago Dilolo, Nana Candundo and Cazombo), is found in this sub-basin which is crossed by seven permanent rivers, namely the Sapo River (*see* **Figure 94**), the Conoegi River (*see* **Figure 95**), the Maquenhe River (*see* **Figure 96**), the Luvua River (*see* **Figure 97**), the Camiava River, the Calunda River and the Cavungo River, and fourteen intermittent rivers, namely Maxivi (*see* **Figure 98**), Luau, Cassa, Cacoloegi, Cassau, Camboa, Camicevo, Cauengue, Capalala, Cassalanga, Lopanda, Catotchi, Cagimina and Tchissassa, according to the Topographic Map of Angola 1:100,000 (Sheets 201, 202, 203, 224 and 225).

Figure 94 – Photographic record of the course of the Sapo River located in the Luau Commune.

Figure 95 – Photographic record of the course of the Conoegi River located in the Commune of Nana Candundo.

Figure 96 – Photographic record of the course of the Maquenhe river located in the Commune of Nana Candundo.

Figure 97 – Photographic record of the course of the river Luvua located in the Commune of Nana Candundo.

Figure 98 – Photographic record of the course of the Maxivi River located in the Nana Candundo Commune.

The Zambezi sub-basin has an area of 25.084.00 Km^2, with available surface annual flows of about 6.922.40 hm^3/year in wet years, 6.225.20 hm^3/year in medium years and 5.491.60 hm^3/year in dry years (PGDURHBH Zambezi, 2022). The area of influence of the road section between PK 190+000 and PK 196+000 of the Luau – Cazombo section (located in the Municipality of Cazombo), and PK 0+000 to PK 70+000 of the Cazombo – Lumbala Caquengue section (located in the Communes of Cazombo and Lumbala Canquengue) is found in this sub-basin and is crossed by eight permanent rivers, namely the Zambezi river (*see* **Figure 99**), Muhaca river (*see* **Figure 100**), Lunatchi river (*see* **Figure 101**), river Luambo (*see* **Figure 102**), Caxivi River, Calama River, Cacongi River and Tchilomba River, as well as several intermittent rivers connected to the Zambezi River, according to Topographic Map of Angola 1:100,000 (Sheets 224 and 246).

Figure 99 – Photographic record of the course of the Zambezi River located in the Commune of Cazombo.

Figure 100 – Photographic record of the course of the Muhaca River located in the Commune of Cazombo.

Figure 101 – Photographic record of the course of the Lunatchi river located in the Commune of Cazombo.

Figure 102 – Photographic record of the course of the river Luambo located in the Commune of Lumbala Caquengue.

Following the characterization carried out for the descriptor Climate and Climate Change and Geology and Geomorphology, it appears that the Province of Moxico is affected, annually, in the rainy season by flood phenomena, sometimes resulting in human, agricultural and infrastructures. The areas most vulnerable to these factors are the Municipalities of Kamanongue, Bundas, Luena and Alto Zambeze (*in* PGDURHBH Zambeze, 2022), although, when carrying out the field work to characterize the socio-environmental reference situation, the occurrence of floods, during periods of rain, in *chanas* and in general in the region of Cazombo, so it is also considered that the place where the project will be implemented is vulnerable to climate change.

6.3.2. Underground Water Resources (Hydrogeology)

Angola's main groundwater resources are:

- In coastal aquifers, at an average depth between 5 to 30 meters;
- In the aquifers of the central plateau region, whose average depth varies between 10 to 30 meters;
- In aquifers in semi-arid areas (Cunene) with depths of the order of 200 meters or more (MINUA, 2006).

The use of groundwater varies across the country, with some Provinces occupying more than 90% of the groundwater supply, however most use between 40 and 80% of the water supply from groundwater. In terms of groundwater, 73% of known water systems in Angola use groundwater sources, while 27% use surface water in Cowater, 2014.

Estimates of renewable groundwater resources in Angola point to around 58 km^3/year. Although wells exist throughout the country, groundwater reserves are generally not significantly developed due to the easy availability of surface water. The most important aquifers are found in sedimentary deposits. The groundwater depth varies between 10 and 30 m in the Central Plateau around Huambo, between 5 and 30 m in the coastal zone and 200 m in the semi-arid zones of the south of the Cunene River basin where well production is very low (FAO 2005).

Despite the depth of groundwater, an inventory of water points carried out in 1975 showed that most of the wells (more than 2.000) were in the Southwest of the country, in or around the Cunene River basin. There is low rainfall here and apart from the river there are few other sources of water. About 40% of the wells in the country are located in Cunene Province, 30% in Huíla Province and 15% in Namibe Province. Thus, wells are mainly intended to satisfy domestic and pastoral needs and the productivity of wells is generally good or very good, equivalent to a value between 1 and 10 liters per second.

The aquifers of the basins in the project's area of influence are located in the NE Quadrant (which corresponds to the Provinces of Lundas and Moxico). The circulation of the aquifers is predominantly intergranular, with very high permeability, constituting extensive aquifers with a flow of around 5 l/s. The water quality is good, but sometimes it has a high iron content, which can deteriorate with depth (PNEA 2013-2017).

In terms of groundwater availability, the Alto Zambeze-Zambeze UHP has an area of 85.039 km^2, with renewable resources of 36.320.20 hm^3 in wet years, 26.430.10 hm^3 in medium years and 19.164.40 hm^3/year and, with a specific flow of 13.5 l/s/km^2 in wet years, 9.8 l/s/km^2 in medium years and 7.1 l/s/km^2 in dry years (PGDURHBH Zambeze, 2022).

As mentioned in **Chapter 6.2.2** referring to the Geological Characterization, the project implantation area falls within Effusive and Metamorphic Sedimentary Rocks and Undifferentiated Archaic (sands) characteristic of sedimentary aquifers and rocky substrate aquifers, as can be seen in the following figure (*see* **Figure 103**).

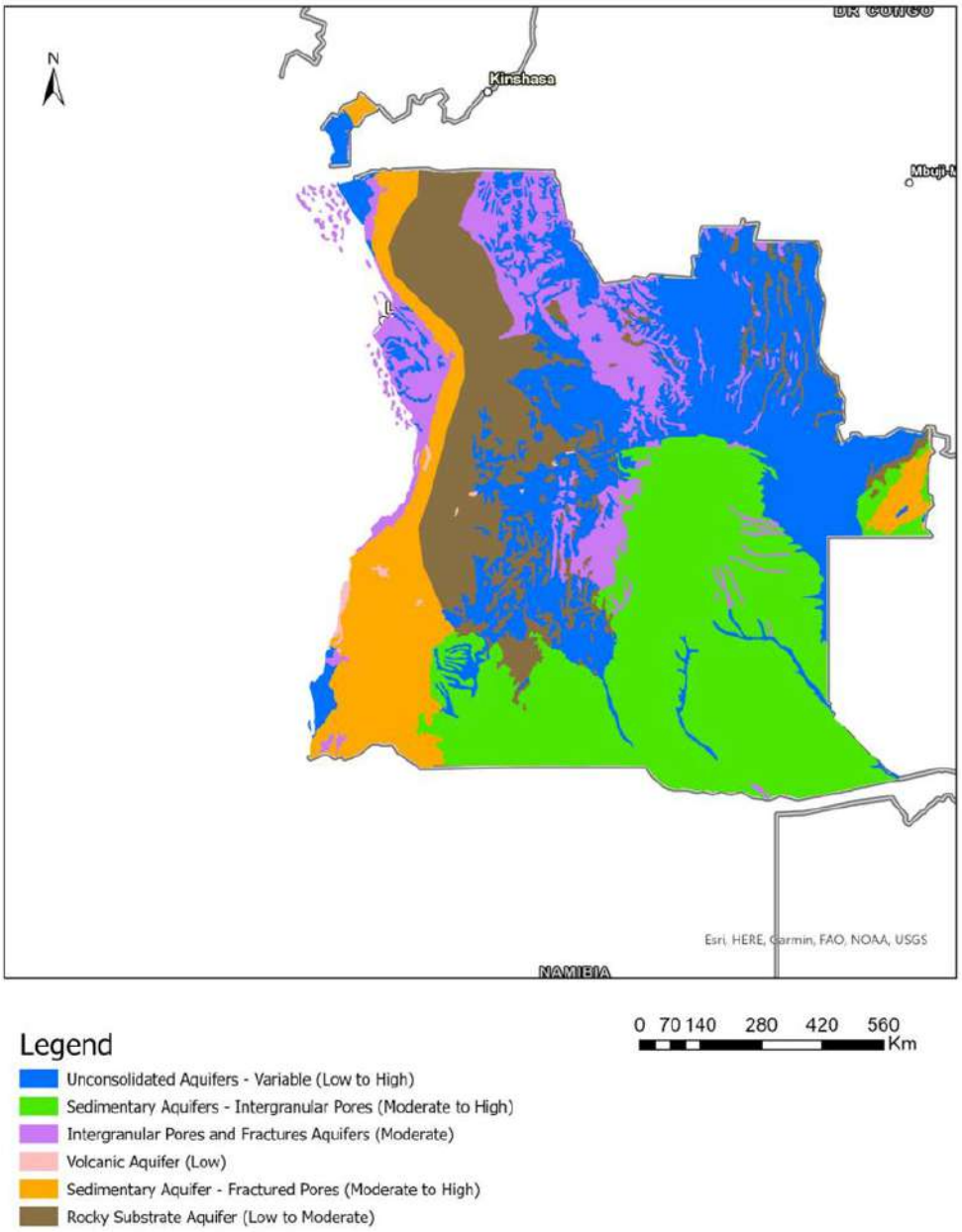


Figure 103 – Type of Aquifers existing in Angola and their Productivity with emphasis on the location of the project (marked in purple) (Source: adapted from *SADC Groundwater Information Portal*).

Analyzing the previous figure (*see* **Figure 103**) it can be seen that the project implantation site is located over an area of Unconsolidated Aquifers with variable productivity (low to high), Sedimentary Aquifers with intergranular pores of moderate to high productivity and Aquifers of Base Rocky Substrate of low to moderate productivity.

As for the vulnerability of the aquifer systems, the area covered by the Zambezi Hydrographic Basin (HB) (where the project under study is located) comprises two units classified as having a high degree of vulnerability, corresponding to the Aquifer Systems and the Cameia-Lumbala

Hydrogeological Unit. The Diangoma and Cazombo - Macondo Hydrogeological Units have low and low/variable pollution vulnerability (PGDURHBH Zambeze, 2022).

6.3.3. Field Work

In view of the lack of analytical reference results for the project site, this ESIA included *in situ* monitoring of water quality using a multi-parameter probe at eight water points in the project area.

The following table (*see* **Table 23**) presents the sampling points and respective location where the monitoring was carried out.

Table 23 - Location and description of water resources monitoring points

Monitoring Point	Origin	Description	Coordinates
P1	Superficial	River Sapo located next to the bridge at km 79+400 on the road section between River Sapo and Cazombo	-11.195270° 22.713942°
P2		River Maquenhe located next to the bridge at km 86+400 on the road section between River Sapo and Cazombo	-11.243617° 22.754775°
P3		Water line located next to the bridge at km 118+500 on the road section between River Sapo and Cazombo	-11.495995° 22.850787°
P4		Water line located next to the bridge at km 27+450 on the road section between Cazombo and Lumbala Caquengue	-12.105154° 22.793214°
P5		Muhaco River located next to the bridge at km 39+175 on the road section between Cazombo and Lumbala Caquengue	-12.170360° 22.716672°
P6		Water line located next to the bridge at km 38+175 on the road section between Cazombo and Lumbala Caquengue	-12.167186° 22.718134°
P7		Water line located at km 50+590 of the road section between Cazombo and Lumbala where the Box Culverts will be installed	-12.223395° 22.628655°
P8		Water line located next to the bridge at km 52+700 of the road section between Cazombo and Lumbala Caquengue	-12.233864° 22.613224°

Next, the photographic record of the places where the monitoring took place is presented. It should be noted that no monitoring points of underground origin were identified to carry out the characterization of the water quality reference situation for this descriptor.

Figure 104 – Photographic record of the P1 sample collection site.

Figure 105 – Photographic record of the P2 sample collection site.

Figure 106 – Photographic record of the P3 sample collection site.

Figure 107 – Photographic record of the P4 sample collection site.

Figure 108 – Photographic record of the P5 sample collection site.

Figure 109 – Photographic record of the P6 sample collection site.

Figure 110 – Photographic record of the P7 sample collection site.

Figure 111 – Photographic record of the P8 sample collection site.

6.3.4. Water Quality

The regulation on water quality (which contains the national water quality standards) was published in Diário da República, in the form of Presidential Decree n. º261/11, of 6 October 2011. This diploma establishes standards and criteria for water quality, in order to protect the aquatic environment and improve the quality of water, depending on its main uses. The provisions of the diploma apply to inland, surface and underground waters, waters for aquaculture, livestock, agricultural irrigation and spas. The rules for controlling the discharge of wastewater into national aquatic bodies and soil are also regulated in this law, in order to preserve the quality of the aquatic environment and protect public health.

Angola is crossed by important rivers that descend from the interior into deep valleys, then widening in the vicinity of the ocean, forming natural bays and harbours.

The quality of water in the water environment is a little-known issue in the country, and there is no national water quality network, as even the existing hydrometric network is very small.

For the quality parameters established in that diploma, the following were defined: maximum admissible values (MVA), which indicate the quality norm values that must not be exceeded; maximum recommended values (VMR), which indicate the quality standard values that must be met or not exceeded; and emission limit values (ELVs) which indicate the concentration value of certain substances that cannot be exceeded by discharge into the aquatic environment and onto the soil.

The quality standards of water for human consumption are regulated in Annex I and the minimum quality standards for surface water are found in Annex IX of Presidential Decree n. 261/11, of October 6, 2011.

Given the lack of publicly available analytical results for the region under study, during the fieldwork carried out by RESURB, samples were taken in order to obtain a characterization of the quality of the water resources surrounding the project for the project's reference situation.

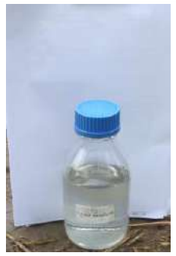
The water samples were analyzed *in situ* using a multi-parameter probe, model HI9829-00042, as shown in the following figure (*see* **Figure 112**).

Figure 112 – Photographic record of water quality monitoring, on the left, and of the multi-parameter probe, on the right.

Thus, the following table (*see* **Table 24**) presents the results obtained *in situ* for the surface water resources that will serve, to characterize the water quality and "measure" the impact of the construction activities on the quality of the water resources surrounding the project implementation area, since there will be reference values to consider when monitoring the water quality during the course of the project, as defined in the Environmental and Social Management Plan.

Annex V presents the Environmental Monitoring Sheets referring to Water Resources.

Table 24 - Results obtained using the multi-parameter probe – Surface water collection points

Parameters Analyzed	Results								Reference Value - World Health Organization (*)
	P1 surface point	P2 surface point	P3 surface point	P4 surface point	P5 surface point	P6 surface point	P7 surface point	P8 surface point	
Date	05/01/2023	05/01/2023	05/01/2023	06/01/2023	06/01/2023	06/01/2023	06/01/2023	06/01/2023	--
Hour	14h00	15h00	10h30	08h00	09h30	10h00	11h15	12h00	--
Temperature (ºC)	26,0	26,0	26,0	27,0	27,0	27,0	27,5	27,5	--
Weather Conditions	No occurrence of rain	No occurrence of rain	No occurrence of rain	No occurrence of rain	No occurrence of rain	No occurrence of rain	No occurrence of rain	No occurrence of rain	--
Photographic register									--
Color	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	--
Turbidity	Clear	Clear	Clear	Slightly turbid	Clear	Clear	Clear	Clear	--
Smell	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	--
pH (Sorensen Scale)	7,35	8,09	7,40	7,50	7,18	7,24	7,33	7,37	5,0 – 9,0
Temperature (ºC)	20,67	21,02	20,43	21,39	21,80	21,04	20,30	20,45	30
Conductivity (µS/cm)	244,00	235,00	188,00	191,00	225,00	230,01	263,40	274,00	--
Dissolved oxygen (%)	113,90	106,12	125,10	131,80	115,00	120,00	138,10	127,60	--

*The indicated reference values are in accordance with the WHO (World Health Organization).

The following figure (*see* **Figure 113**) presents a spatial graphic representation of the results obtained, *in situ*, for the parameters analyzed at the various monitored points.

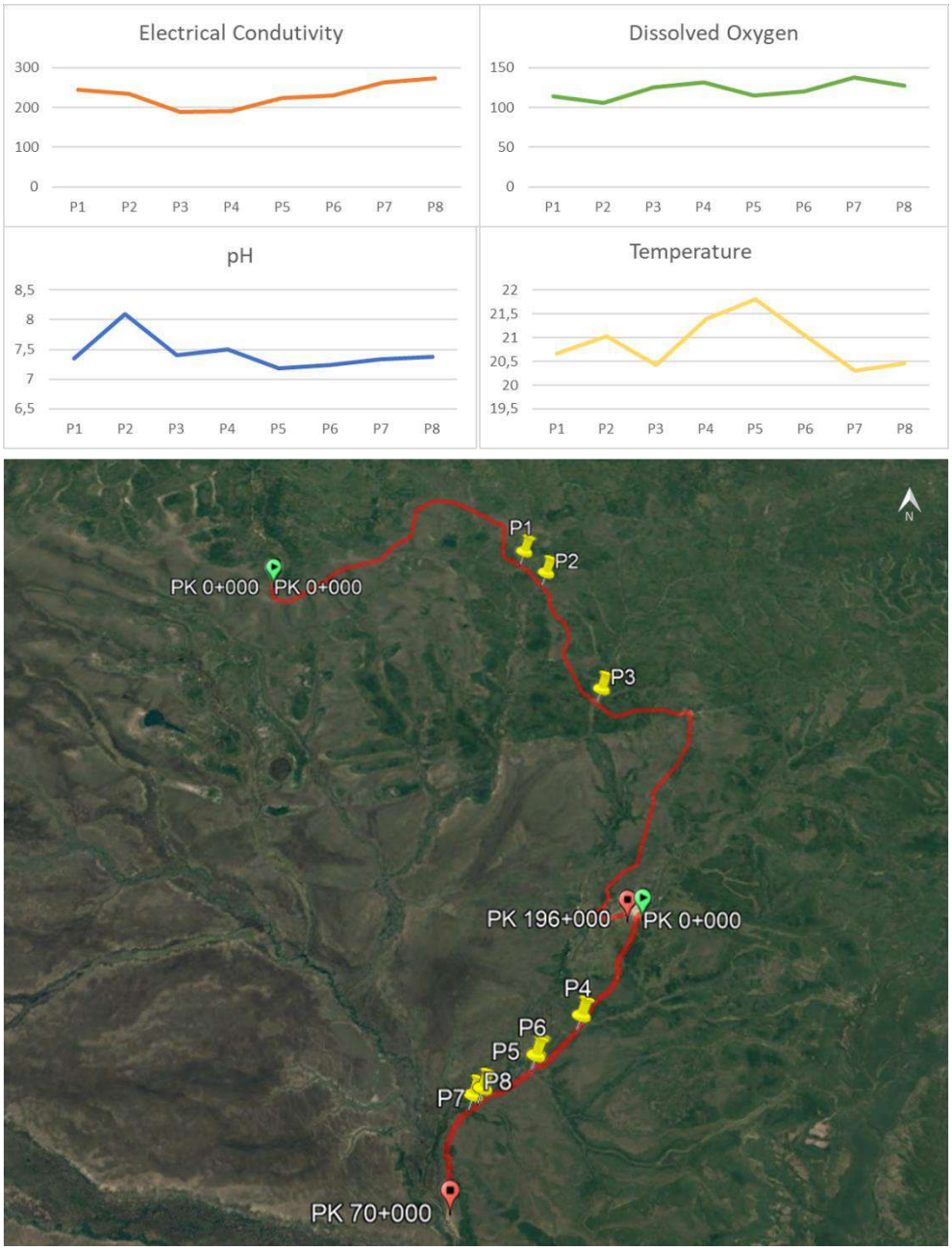


Figure 113 – Spatial graphic representation of the *in situ* results obtained for the parameters monitored in the project's area of influence.

Analyzing the results obtained during the *in situ* monitoring of water quality at the surface points shown above, it is verified that all the parameters analyzed with the multi-parametric probe comply with the reference values considered as an indication.

With regard to the organoleptic analysis carried out, it can be seen that all the samples were colorless, clear and odorless, with the exception of the superficial point P4, whose collected sample was slightly turbid.

As for the analyzed parameters, *in situ*, there is no correlation or trend from upstream to downstream of the various analyzed parameters.

Dissolved oxygen is a parameter that indicates the degree of aeration of the water and is therefore an excellent indicator of water quality since its presence is of vital importance for aerobic aquatic beings. With regard to monitored surface water resources, the maximum dissolved oxygen value was recorded at point P7 (Water line located at km 50+590 of the road section between Cazombo and Lumbala Caquengue where the Box Culverts will be installed) and the minimum value at point P2 (Maquenhe River located next to the bridge at km 86+400 on the road section between Sapo River and Cazombo). This situation may be associated, among others, with the fact that when monitoring point P2, the practice of washing clothes by the local population was identified and a situation of spillage of chemical products, directly on the ground, by the local community, in the proximity to the monitoring point, whose identified situations reveal the existence of anthropogenic sources of pollution that could also have contributed to a lower dissolved oxygen value at point P2.

The pH parameter has a mostly decreasing trend from upstream to downstream, which may be influenced by the origin and nature of the land crossed, as will be detailed in **Chapter 6.7.1.**

The electrical conductivity is a parameter that allows to assess, in a quick and global way, the degree of mineralization. High mineralization of the water can lead to unpleasant tastes. The electrical conductivity value depends on hydrogeological and environmental conditions. With regard to this parameter, there is an upward trend from point P3 to point P8. This situation may possibly be related to the hydrogeological and environmental conditions of these sites, of transition from Quaternary Kalahari complexes to Archean base gneiss complexes, as described in **Chapter 6.2.2**.

In short, the water quality of surface water resources monitored in the area of direct influence of the project, although some sources of pollution of anthropogenic origin have been identified in the areas of influence of the project, does not reveal to be contaminated. On the other hand, the current state of degradation of the road section also does not allow for the dynamization and establishment of economic activities in the region with potential negative impacts on the water quality of surface water resources.

Currently, the surroundings of the surface water resources monitoring points are predominantly natural, as shown in **Figures 85** to **92**.

6.3.5. Polluting Sources

When carrying out the field work for the elaboration of the characterization of the reference situation of the project, it was verified the existence of some waste disposal passives by the local community, next to the residential areas, as a result of the non-operationalization of the

national strategy for waste management which means that the community has to bury, burn and/or deposit waste in the soil and surrounding water lines, in order to "solve" the problem of waste management in the Province.

The following figure (*see* **Figure 114**) illustrates some sources of pollution registered during the field work in the area of direct influence of the project.

Figure 114 - Photographic record of improper disposal of waste by the local community, identified during fieldwork.

Regarding the type of housing, these are predominantly of a precarious nature (*see* **Figure 115**), lacking a basic sanitation network, which is why the domestic effluents produced are directly channeled/drained to the ground and/or to the water lines closer, potentially contaminating soil, underground and surface water resources.

Figure 115 – Photographic record of existing standard houses in the project's area of influence, without access to the public sanitation network.

On the other hand, it should also be noted that the fact that most of the existing accesses are not paved, contributes to the emission of particles and dust that may, in situations of precipitation, also lead to the production of contaminated runoff water.

6.3.6. Forecast in the Absence of the Project

The non-implementation of the project may, or may not, contribute to the maintenance of water quality, since it is understood that the non-implementation of the project will not prevent the worsening of the presence of total suspended solids (TSS) in the water, based on the surroundings, predominantly, natural and of unpaved accesses. At the same time, whether or not the project is implemented, and in view of the existing sources of pollution identified when characterizing the reference situation, it is considered that they may, by themselves, be conducive to promoting the risk of contamination of surface water resources and underground.

6.4. Environmental Noise

Noise is a factor of environmental degradation and can cause negative impacts on the physical and behavioral health of affected populations. Annoyance due to noise results essentially from its intensity, translated by the criterion of maximum exposure, and its emergence in relation to the existing environmental noise, regulated by the criterion of annoyance. These aspects should be taken care of from a prevention perspective, taking into account the economic costs that their correction may entail.

6.4.1. Baseline Measurements

The control of ambient noise has as main objectives to protect the population from intruding noises that disturb their daily activities and to prevent the increasing increase in ambient noise that could result in a decrease in the quality of life.

In this way, it is intended to carry out the characterization of the surroundings of the project area.

In the absence of specific Angolan legislation on noise, the legal framework of this descriptor was carried out using the observation of the recommendations of the World Health Organization (WHO), as it is considered adjusted and capable of responding to the main problems that are observed and characterize the reference acoustic situation.

According to the WHO, ambient noise contributes to the degradation of human health by enhancing the following effects: hearing loss, interference with oral communication, sleep disturbances, cardiovascular and physiological problems, psychological problems, reduced work performance and general discomfort.

The following table (*see* **Table 25**) indicates the values recommended by the WHO applicable to sensitive receptors, namely outdoor spaces (residentials and schools) and indoors (residential), in order to avoid the indicated negative effects on health.

Table 25 - Recommended value, LAeq (dB(A)), by OMS in the publication "*Guidelines for Community Noise*" (WHO, 1999)

Type of receivers	Period	Recommended value, LAeq dB (A)	Negative effect if be surpassed the recommended value
Housing (Outside)	Daytime and evening	55	Serious annoyance
Housing, bedroom (Interior)	Nocturne	30	Sleep disorder
School (Outside)	Daytime and evening	55	Annoyance

With regard to the environmental noise, the characterization of the environment affected by the project was carried out through site visits, in order to identify potentially exposed sensitive receptors and potential polluting sources. This characterization will serve as an indicator of the quality of the urban environment.

It should be noted that the main source of noise pollution to which the population surrounding the project is subject is related to socio-economic activities. Thus, in order to obtain a perception of the significance of road traffic in the evolution of environmental noise in the project's area of influence, road traffic was counted at the points identified in the following table (*see* **Table 26**).

Table 26 - Location and description of the traffic monitoring point

Monitoring Point	Description	Coordinates
T1	Nacional Road 250 at the beginning of the road section between Sapo River and Cazombo (Pk 0+000)	-11.218513° 22.240665°
T2	National Road 250 at the end of the road section between Sapo River and Cazombo (Pk 196+000)	-11.899122° 22.887215°
T3	National Road 190 at the beginning of the road section between Cazombo and Lumbala Caquengue (Pk 0+000)	-11.896476° 22.913628°
T4	National Road 190 at the end of the road section between Cazombo and Lumbala Caquengue (Pk 196+000)	-12.378353° 22.583695°

Next, in **Table 27**, the average of the registered traffic values is presented, in a period of the day with greater traffic, during the daytime period, in the points monitored *in situ*, namely the points T1, T2, T3 and T4. The measurement lasted 30 min.

Annex VI presents the Environmental Monitoring Sheets referring to the traffic count.

Table 27 – Average values representing the traffic registered at points T1, T2, T3 and T4

Vehicle typology	Monitoring Points			
	T1	**T2**	**T3**	**T4**
Light	5	2	3	5
Heavy	--	--	1	1

Vehicle typology	Monitoring Points			
	T1	T2	T3	T4
Motorcycles	9	8	8	10
Others	--	--	--	--
Total	**14**	**10**	**12**	**16**

Analyzing the recorded values, there is a trend of traffic density near the more urbanized areas, with the maximum value being recorded at Point T4, at the end of the road section, in the Commune of Lumbala Caquengue and the minimum value in a rural area, in the Point T2, in the Commune of Nana Candungo with low housing density. In this sense, it is to be expected that noise, in the Construction Phase, will be one of the relevant environmental aspects in assessing the impacts of this project.

At the same time, environmental noise monitoring was carried out in order to characterize the environmental noise in its current state (reference situation, before the project materialised), in the project surroundings, in the absence of construction activities, for the daytime period, in four defined locations taking into account the sensitive receptors identified in the project surroundings.

The following table (*see* **Table 28**) presents the location and description of the environmental noise monitoring points.

Table 28 - Location and description of noise monitoring points

Monitoring Point	Description	Coordinates
Ramb1	Houses near the beginning of the road section between River Sapo and Cazombo (Pk 0+000)	11°12'41.24"S 22°14'30.30"E
Ramb2	Houses near the end of the road section between River Sapo and Cazombo (Pk 196+000)	11°53'47.26"S 22°54'49.64"E
Ramb3	Houses near the beginning of the road section between Cazombo and Lumbala Caquengue (Pk 0+000)	11°53'56.91"S 22°53'12.17"E
Ramb4	Houses near the end of the road section between Cazombo and Lumbala Caquengue (Pk 196+000)	12°22'59.72"S 22°34'56.01"E

Next, a photographic record of the places where the monitoring took place is presented.

Figure 116 – Photographic record of monitored locations – Ramb1, Ramb2, Ramb3, Ramb4 and Ramb5.

The following table (*see* **Table 29**) presents the Reference Limit Values defined in the EHS Guidelines (for the daytime), considered as an indication, and the values obtained, in Points Ramb1, Ramb2, Ramb3 and Ramb4.

Table 29 – Presentation of the results regarding the measurement of the environmental noise at points Ramb1, Ramb2, Ramb3 and Ramb4

Point	Measurement Period	Reference Value (dB) defined in the EHS Guidelines*	Results(dB)
Ramb1	Daytime (07:00-20:00) - 30 min of measurement	55	54,0
Ramb2			52,6
Ramb3			52,9
Ramb4			51,3

(*) Reference Limit Values defined in the EHS Guidelines (Table 1.7.1: Noise Level Guidelines).

Next, the result of the monitoring of environmental noise carried out at the four sensitive receivers in the area of influence of the project is presented in graphic format (*see* **Figure 117**), and the respective reference limit considered as an indication.

Annex VII presents the Environmental Monitoring Sheets referring to the monitoring of environmental noise and **Annex VIII** presents the Environmental Monitoring Results for the characterization of the environmental noise.

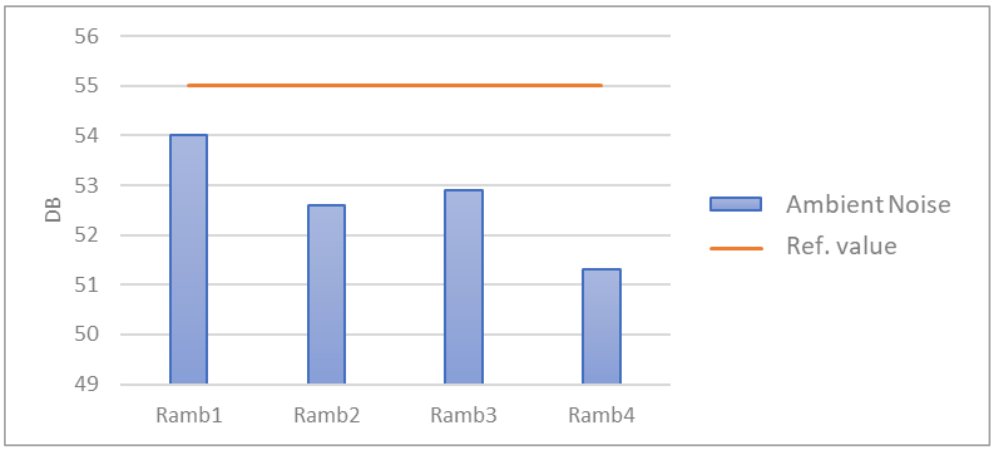


Figure 117 - Environmental noise monitoring values (LAT) recorded at the four monitoring points.

The following figure (*see* **Figure 118**) presents a spatial graphic representation of the results obtained for the characterization of the environmental noise of the reference situation, which were carried out near sensitive receivers, of greater expression, identified along the road section.

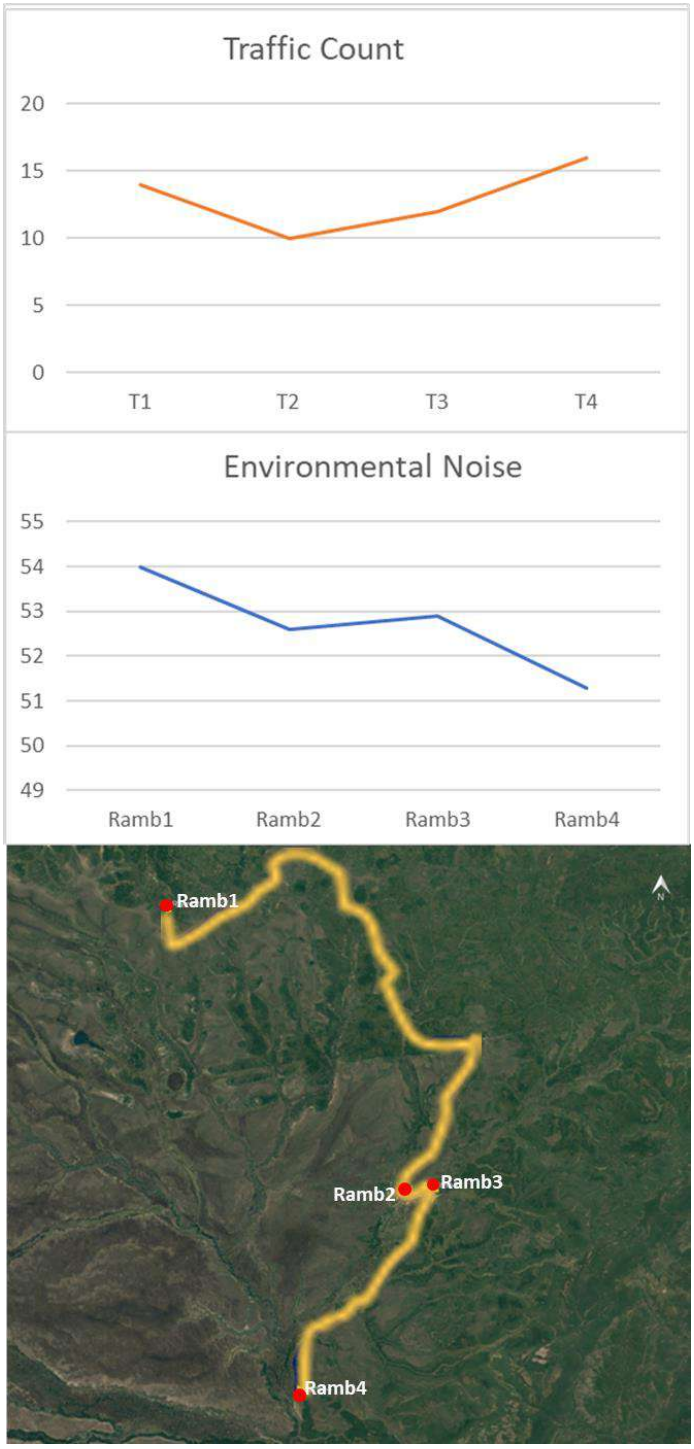


Figure 118 – Spatial graphic representation of the results obtained for the characterization of the environmental noise.

Analyzing the results of the monitoring carried out to characterize the environmental noise of the reference situation of the project implementation area, it is verified that all monitoring points presented values lower than the reference values defined in the Environmental, Health and Safety Guidelines (EHS Guidelines) considered as an indication given the lack of national legislation for this purpose. Carrying out a comparative analysis of the results obtained with

the traffic count values recorded at the site, it is not possible to identify a direct correlation between the values obtained in the measurements of the environmental noise, carried out near the sensitive receivers, with the registered traffic levels. This situation may be related, among others, to the days and times of the monitoring carried out, weather conditions and disturbances carried out during the monitoring, as well as the proximity of the road to the sensitive receiver.

6.4.2. Forecast in the Absence of the Project

From an acoustic point of view, the evolution of the current situation assuming the absence of the project, represents a situation of lower sound levels compared to the execution of the same, representing smaller impacts. However, it cannot be considered that the future situation in this hypothetical condition represents a maintenance of the current acoustic values, not least because, given the expected evolution for the region, it is expected that there will be an increase in the levels of sound emission due to the expansion of associated human activities.

6.5. Effluents and Waste

The development of cities and the increase in populations contribute on a large scale to the increase in waste production. The production of waste is inherent to all anthropogenic activities, whatever their size, magnitude or type. Associated with the production of waste, there are also emissions to the atmosphere, water and soil, as well as noise and other annoyances which, taken together, contribute to an increase in environmental problems and the economic costs associated with their resolution.

Since the total elimination of waste is by no means possible, organizations have the obligation to optimize the management of the waste they produce, in order to favor its recovery at the expense of other operations that are less positive for the environment, such as disposal in landfills or dumps.

In various parts of the world, environmental and public health problems have arisen in some way associated with waste, such as the detection of chemical and toxic products in drinking water supply systems and in groundwater, which is why greater attention has been paid to the risks of exposure of the population to inadequate waste disposal. In recent years, several solutions have emerged that allow the recovery of a large percentage of the waste produced.

In Angola, pollution problems have arisen a lot as a result of the accelerated growth that the country's economy has experienced in recent years. If, on the one hand, this growth is beneficial and contributes to the population's well-being, on the other hand, it imposes new

challenges, such as the management of waste generated by various economic/constructive activities.

6.5.1. Characterization of Waste Management in the Project Area

Economic growth and the consequent increase in the quality of life of populations have a direct influence on the increase in waste production. This increase has been very significant, with negative impacts on the population and the environment, which is why it is already considered a problem at national level. In this way, with the continuous population increase and the expected increase in the quality of life of the inhabitants of the Province of Huambo, the amount of waste generated will also tend to increase, making this a problem that will worsen. Urban waste is extremely important, not so much for its danger, but mainly, and for the quantity and diversity of materials that constitute it, being essential to know its qualitative and quantitative characteristics.

In a national scale analysis, the main problems related to solid waste in the country arise in urban areas and are currently the result of the government's lack of capacity to respond to garbage collection needs.

According to the Ministry of Environment, the daily production of urban solid waste in Angola is currently estimated at around 0,65 kg of waste/inhabitant (in www.jornaldeangola.sapo.ao). Considering this estimated production, and that the project will affect, in the operation phase, around 500 employees, it is estimated that the production of associated daily urban waste will be around 324 kg.

In addition to the above, another problem with urban waste concerns its composition, since many of the waste deposited in landfills could be sent to reuse and/or recycling processes, such as wood, paper/cardboard, plastic, glass, metals, as they are waste that have been selectively collected, they are likely to be recovered.

Regarding the methods of treatment of urban waste used in the country, incineration is the main one, as well as for hospital waste and some industrial waste. The burning of accumulated waste on the streets and near squares is one of the unconventional solutions used in Angola to reduce the accumulated volumes, and widely used by the population.

In an analysis of the project area, it appears that the collection of urban waste, similar to what happened throughout Angola, is scarce, verifying, however, some deposition points of the same in the villages located in the vicinity of the area of project, thus assuming collection services. These services were even carried out by private companies, but with the worsening of the country's economic situation and the lack of foreign exchange, the municipal services

began to assume this collection. However, as will be easy to understand, this procedure is weak and inefficient, and its ineffectiveness is visible throughout the project's intervention area.

However, most of the time, the collected waste ends up being deposited in open-air dumps and/or in hydraulic channels, since there is no sanitary landfill in the Province of Moxico. Often, in order to reduce the volume, the inhabitants of local communities burn waste in the open and without any environmental control mechanism.

The following figure (*see* **Figure 119**) shows some situations recorded in the characterization of the reference situation.

Figure 119 – Photographic record of improper disposal of waste on the ground and burning in the area of direct influence of the project.

The previously illustrated situations corroborate the information obtained when carrying out surveys to the population in the areas of influence of the project to characterize the reference situation. The analysis and treatment of the results showed that about 29% of the sample interviewed stated that they deposited waste on the ground and, given the non-existence and/or poor functioning of the system for collecting and managing waste in the Province of Moxico, 42% stated that they burned for the control and treatment of waste produced and the remaining 36% stated that they sometimes bury waste. With regard to waste management, all respondents stated that there was no municipal collection of waste in their Municipality/Commune.

Regarding the final destination of the waste produced, the majority of respondents (95%) stated that there are no controlled dumps or landfills in their Municipality and the remaining 5% did not answer this question.

With regard to wastewater management, the situation of the basic sanitation network in the Province of Moxico is weak, with an inefficient drainage and wastewater treatment system, which can lead to public health problems and contribute to the environmental degradation of

the environment. In some places, wastewater is often sent to septic tanks, situations in which sewage runs in the open air, on public roads and close to houses, as can be seen when carrying out fieldwork, are not excluded.

Figure 120 shows some situations of discharge of domestic wastewater into the ground without any kind of previous treatment, which portray one of the sources of anthropogenic pollution.

Figure 120 - Photographic record of domestic wastewater (sewage) flowing in the open.

In summary, all the shortages and deficiencies of the Waste Management System previously listed for the national scale were also identified in the area of direct intervention of the project and in its immediate surroundings, namely:

- Deposition of urban waste in the open under and on the ground and/or in water lines;
- Deposition of waste on the sides of roads;
- Shortcomings in the system of adequate disposal, collection and transport of urban waste in areas with difficult access;
- Lack of awareness among the population for the disposal of urban waste in an appropriate place (containers).
- Shortages in the collection and final destination for industrial waste from industrial and commercial activity and construction and demolition waste.

This improper disposal of waste, both industrial and domestic, constitutes an environmental attack, from the point of view of soil degradation and contamination of the sub-soil and underground water resources, as well as a public health problem.

6.5.2. Forecast in the Project Absence

With the continuous increase in population, economic growth, improvement of socio-economic conditions and consequent change in the population's way of life, not accompanied by the necessary civic education and environmental awareness, it is expected that the production of waste will continue to increase.

Since it is believed that investing in waste management will contribute not only to increasing the population's environmental awareness, but also to the frequency of waste collection, it is expected that, in the absence of the project, the reference situation described remains or worsens.

6.6. Air Quality

Human beings are extremely vulnerable and sensitive to the air quality of their surroundings. This descriptor is one of the main vehicles for conditioning public health, given that air pollution, caused by the emission of pollutants, is a type of global and diffuse pollution, not confined to the place where a certain pollutant is emitted. Notwithstanding there are phenomena of atmospheric pollution that are felt initially and mainly in the range of action where it is produced.

Deficient air quality, or with significant concentrations of pollutants, causes pathological effects, leaving biological markers on human health. The following effects stand out:

- Increased cardio-respiratory mortality;
- Increased use of health services and related costs;
- Increased incidence of respiratory symptoms and diseases;
- Increased frequency of asthma exacerbations;
- Decrease in respiratory function parameters;
- Lung inflammation and deterioration of defense mechanisms.

Suspended particles, originating from emissions from automobiles, machines and industrial chimneys generate two types of particles:

- pm < 10 µm – attach to the bronchial wall;

- pm < 2,5 µm – they attach to the pulmonary alveoli.

These particles have a harmful effect and cause or aggravate respiratory and cardiovascular diseases, being scientifically proven to be responsible for the cause of lung cancer.

As for damage to ecosystems, the oxidation of vegetation structures can be mentioned, which, among many other consequences, can lead to the premature fall of leaves in some species or the premature rotting of some fruits. Finally, when it comes to damage in terms of built patrimony, the case of acidifying pollutants that chemically attack built structures can be given as an example, causing the degradation of materials and consequently reducing the useful life of these structures.

The health effects of air pollutants vary as a function of time and their concentrations. This fact usually makes people talk about chronic and acute effects of air pollution.

The acute effects reflect the high concentrations of a given pollutant that, when reached, can soon have repercussions on the receptors. Chronic effects are related to longer exposure over time and lower concentration levels. Although this level is lower, the exposure takes place for a prolonged period, which causes the appearance of effects that derive from the accumulated exposure to these pollutant levels.

In Angola there is currently no specific legislation on air quality. Thus, an analysis was made of the international conventions and protocols ratified by Angola in this area and the use of guide values recommended by the WHO and Portuguese legislation, for the protection of human health.

The United Nations Framework Convention on Climate Change (UNFCCC - United Nations Framework Convention on Climate Change) is an international treaty that was the result of the United Nations Conference on Environment and Development, informally known as the Earth Summit, held in Rio de Janeiro in 1992. This treaty was signed by almost every country in the world and aims to stabilize the concentration of greenhouse gases (GHG) in the atmosphere, at levels such as to avoid dangerous interference with the climate system.

The Montreal Protocol is a protocol on substances that deplete the ozone layer. This was agreed at the Vienna Convention on March 22, 1985 and signed on September 16, 1987. Its stakeholders are aware of their obligations under the Convention to take appropriate measures to protect human health and against harmful effects that result or may result from human activities that modify or may modify the ozone layer. They also recognize that worldwide emissions of certain substances can significantly deplete the ozone layer, increasing the risk of harmful effects on human health and the environment.

Angola ratified the Vienna Convention and the Montreal Protocol on June 18, 1998 and became a Signatory Party to the Montreal Protocol since May 17, 2000.

The Kyoto Protocol, held in the Japanese city with the same name and elaborated by the United Nations Framework Convention on Climate Change, is an international agreement aimed at reducing at least 5% of GHG emissions, responsible for global warming, in the period between 2008 and 2012. This agreement entered into force in 2005 and was ratified by Angola in 2007.

The first edition of the WHO recommendations in the field of air quality (Air Quality Guidelines for Europe) was published in 1987, the second edition being the most recent and referring to the year 2000.

The recommended reference values (thresholds) for the various air pollutants were intended to provide guidelines to protect human health from their harmful effects and to support national and local authorities in the management of air quality.

The reference values considered, as an indication in this study, are presented in the following Table (*see* **Table 30**).

Table 30 – Reference values for air pollutants

Pollutant	Reference Period	World Health Organization (WHO)	European Legislation (2008/50/CE Directive)	European Directive 2019/130
		Annual Reference Values (µg/m³)	Annual Reference Values (µg/m³)	Professional Exposure Values (mg/m³)
Carbon Monoxide (CO)	Eight-hourly Average	10.000		--
Azote Dioxide (NO_2)	Annual Average	40		--
	Hourly Average	200		--
Ozone(O_3)	Hourly Average	70 (3)	--	--
Sulfur Dioxide (SO_2)	Hourly Average	350		--
	Daily Average	125 (2)		--
PM_{10} Particles (Less than 10 µm particles)	Daily Average	150 (1)	50	
	Annual Average	70 (1)	40	--
$PM_{2,5}$ Particles (Less than 2,5 µm particles	Daily Average	75(1)	--	--
Formaldehydes	Daily Average	3,25*	--	--
TVOC	Daily Average	<120-140	--	--
Benzene	Eight-hourly Average	--	--	3,25

(1) Intermediate target value 1 for human health protection;
(2) For the application of the reference value established by the WHO, this value corresponds to the intermediate target value 1 for human health protection;

(3) Fund value indicated by WHO (World Health Organization), Air Quality Guidelines for Europe, 2nd edition, 2020;
(*) Parameter expressed in mg/m3.

6.6.1. Current Situation

We are currently witnessing high industrial growth in Angola, which in turn gives rise to a high influx of population to urban centers. This reality requires urban planning and a more controlled development of various industrial sectors, with the aim of avoiding an increase in air pollution levels.

The main sources of emissions to the atmosphere identified are related to the combustion of fossil fuels, originating from:

- Vehicles in circulation;
- Motorbikes circulating on the roads adjacent to the project;
- Generators used to supply energy without any environmental protection measures;
- Agricultural fires;
- Open burning of waste;
- Unpaved traffic lanes (high dust dispersion);
- Organic decomposition of waste without any control;
- Existence of domestic animals (goats, chickens, dogs, etc.) abandoned on traffic routes;
- Circulation of vehicles that are sometimes in poor condition.

Vehicles are responsible for most emissions of carbon monoxide (CO), non-methane volatile organic compounds (NOVOC) and lead (Pb). Methane (CH4) emissions come almost entirely from the final disposal of solid urban waste and burns for agricultural purposes and waste containment.

However, it is important to highlight that the main source of air pollution in Angola and for neighboring countries is biomass burning, carried out mainly during the dry season – between May and August. Fires occur for at least three reasons, being summarized as follows:

- Home heating source;
- Hunting;
- Agricultural and livestock purposes.

The result of the combustion of this biomass is the emission of carbon monoxide (CO), nitrogen oxides (NO_x), nitrous oxide (N_2O), methane (CH_4), non-methane hydrocarbons, particles, in addition to carbon dioxide (CO_2).

An important source of dust in the air results from the natural drag of fine soil materials by the wind, during the dry season, which end up depositing on vegetation, dwellings and watercourses. When the soil becomes dry, the wind is responsible for resuspension of large amounts of particles that form clouds of dust. This phenomenon also has great expression in the region under study.

In the project's intervention area, the main sources of emission of air pollutants identified in the field survey of the reference situation were:

- Automobile circulation;
- The burning of waste in the open;
- The operation of generators for public and private purposes.

When carrying out the fieldwork, it was found that the main sources of pollution outside the project correspond mainly to existing economic activities, road transport, as well as anthropogenic sources. At the same time, unpaved roads also contribute to a constant level of suspended particles.

As has been mentioned throughout the document, resulting from the lack of a properly functioning waste treatment system in the Province of Moxico and efficient waste management, the waste resulting from human activities ends up being dumped in waste streams, without any control and/or treatment. Thus, the decomposition of waste promotes the release of gases and methane in particular, which may even cause explosions and even cause respiratory diseases, if in contact with them.

6.6.2. Field Work – Baseline Measurements

Given the lack of air quality monitoring stations in Angola that provide up-to-date data on this descriptor in the territory, the characterization of the reference situation in the project area was carried out using bibliographic data, field reconnaissance and monitoring carried out *in situ*. In this fieldwork, the main sources of air pollutant emissions and the main receptors were identified in the project's direct intervention area and in its immediate surroundings. During the monitoring, meteorological data were also collected, namely measurements of temperature and relative humidity of the air, direction and intensity of wind and precipitation, which influence the conditions of dispersion of pollutants in the atmosphere.

The following table (*see* **Table 31**) presents the location and description of the air quality monitoring points.

Table 31 - Location and description of air quality monitoring points

Monitoring Point	Description	Coordinates
Qar1	Houses near the beginning of the road section between River Sapo and Cazombo (Pk 0+000)	11°12'41.24"S 22°14'30.30"E
Qar2	Houses near the end of the road section between River Sapo and Cazombo (Pk 196+000)	11°53'47.26"S 22°54'49.64"E
Qar3	Houses near the beginning of the road section between Cazombo and Lumbala Caquengue (Pk 0+000)	11°53'56.91"S 22°53'12.17"E
Qar4	Houses near the end of the road section between Cazombo and Lumbala Caquengue (Pk 196+000)	12°22'59.72"S 22°34'56.01"E

Next, we present the photographic record (*see* **Figure 121**) of the places where the monitoring was carried out at points Qar1, Qar2, Qar3 and Qar4.

Figure 121 – Photographic record of monitoring points Qar1, Qar2, Qar3 and Qar4.

The following table (*see* **Table 32**) presents the results obtained at the monitored points (Points Qar1, Qar2, Qar 3 and Qar4) as well as the Reference Limit Values defined in the WHO Guidelines which will be considered, for purely indicative purposes, in view of the absence of Angolan legislation for this purpose. **Annex IX** contains the Air Quality Environmental Monitoring Sheets.

Table 32 – Presentation of results referring to points Qar1, Qar2, Qar3 and Qar4

Parameter	Qar1	Qar2	Qar3	Qar4	Reference Value (EHS Guidelines* and European Directive 2019/130 - Carcinogenic and Mutagenic Substances**)
T (°C)	26,0	26,0	27,0	27,5	-
Humidity (%)	44,3	44,6	36,8	39,2	-
Air velocity (m/s)	0,93	1,26	0,41	0,36	-
PM_{10} (µg/m³)	57	71	60	52	150 µg/m³*
PM 2.5 (µg/m³)	32	53	37	41	75 µg/m³*
PM1.0 (µg/m³)	32	53	37	41	-
Formaldehydes (HCHO) (mg/m³)	0,0	0,0	0,0	0,0	3,25 mg/m³*
VOCT (µg/m³)	0,0	0,0	0,0	0,0	<120-140 µg/m³*
Benzene (mg/m³)	0,0	0,0	0,0	0,0	3,25mg/m³**

(*) Reference Limit Values defined in the EHS Guidelines (Table 1.1.1: WHO Ambiente Air Guidelines).
(**) Occupational Exposure Limit Values – Directive 2019/130 amending Directive 2004/37/EC on the protection of workers against risks related to exposure to carcinogens or mutagens during work.

Next, the result of the quality monitoring carried out at four points in the project's area of influence is presented in graphic format (*see* **Figures 122** and **123**), and the respective reference limit considered as an indication.

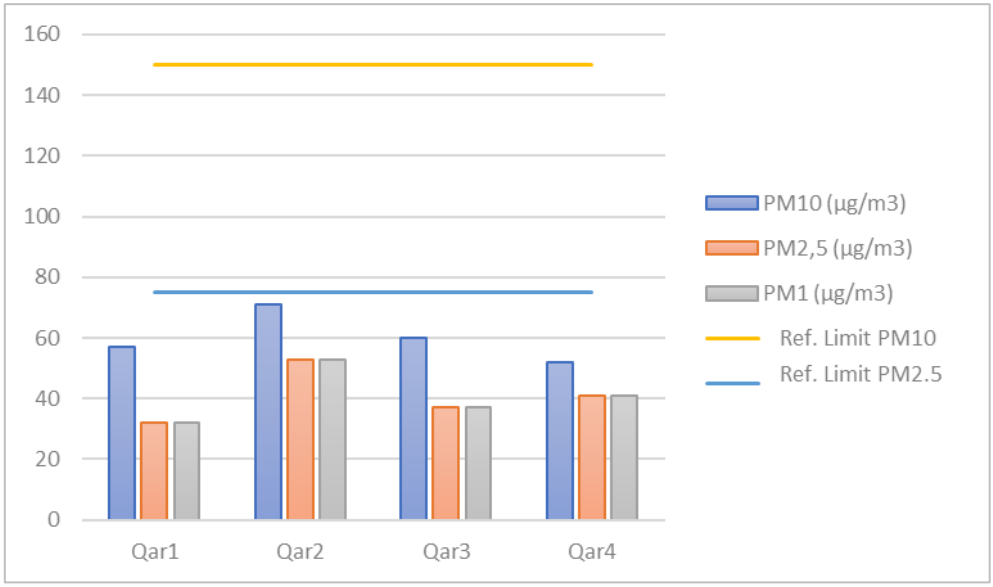


Figure 122 - Air quality monitoring values (suspended particles) obtained at the four monitoring points.

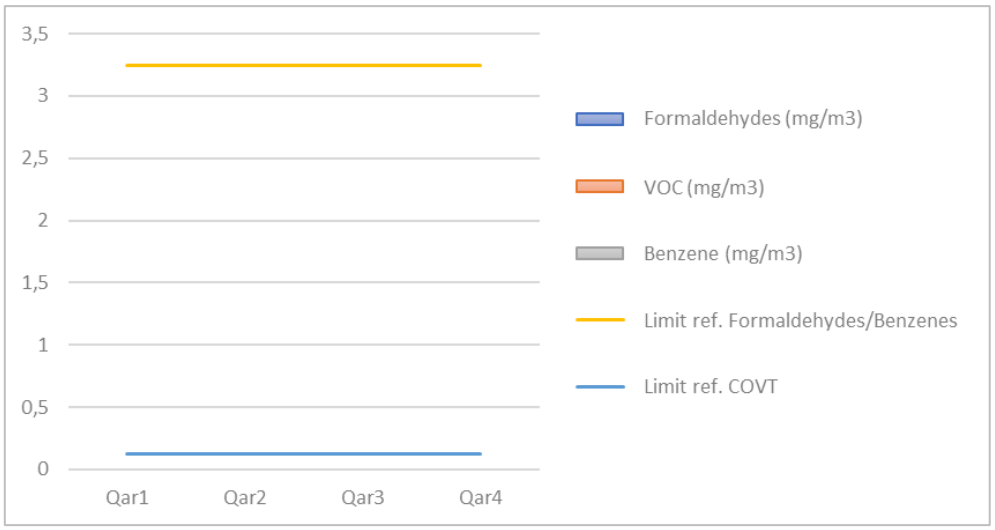


Figure 123 - Air quality monitoring values (dispersion of pollutants) obtained at the four monitoring points.

Analyzing the results of the monitoring carried out to characterize the Air Quality of the project implementation site, during the Reference Situation, given the lack of detailed reference data for the project's area of influence. It appears that all monitored points recorded particle values lower than the reference values considered as an indication.

Through the analysis of the previous figures, it can be seen that it is at Point Qar2 that the highest values of parameters PM_{10} and $PM_{2.5}$ are found. This situation may be related, among others, to the fact that the circulation of vehicles and people on the roads close to the monitored location that are not asphalted was recorded, which contributed to the emission of dust and particles in suspension at the time of monitoring. It is noted that $PM_{2.5}$ particles are not inhalable particles, however, it is suggested during the construction phase, whenever possible and sustainable, the irrigation of the circulation paths in the surroundings of the project in order to reduce the emission of dust/suspended particles, especially on more critical days, as well as the use by workers, during the work phase, of adequate personal protective equipment (eg, mask).

With regard to formaldehyde, benzene and COVT parameters, all monitored points registered zero values. This situation may be related to the predominantly residential use of the monitoring sites, with no economic activities being recorded in the surroundings conducive to the emission of volatile organic compounds (industrial processes that use combustion and transport).

6.6.3. Forecast in the Project Absence

If the project does not come to fruition, it is expected that the situation now analyzed will remain or worsen. In the long term, the socio-economic dynamism of the Province of Moxico is foreseen, since this Province integrates the national priorities with regard to the development and improvement of infrastructures, which, eventually, will be reflected in the deterioration of air quality.

6.7. Soils

Knowledge of pedological characteristics is essential for the perception, among other aspects, of the suitability of each type of soil identified for its current occupation and future uses, also allowing the detection of the presence of areas with greater or lesser propensity to erosive phenomena.

A soil results from the alteration of rocks and therefore reflects the original chemical composition of those rocks. There are two other factors that affect the type of soil that will form: climate and topography. The climate encompasses a series of parameters that will influence the formation of the soil, including temperature, humidity and rainfall. Finally, topography conditions the development or not of a soil. The existence of slopes are not favorable as they tend to be eroded and transported to flatter areas, *in* Diniz (1991).

The knowledge of the pedological characteristics is fundamental for the perception, among other aspects, of the suitability of each type of soil identified for its current occupation and for future uses, also allowing to detect the presence of areas with greater or lesser propensity to erosive phenomena. The methodology followed for the characterization and analysis of the soils present in the study area was based on bibliographical and cartographic research of all the elements considered relevant for the description of the soils present in the project area.

The soil characterization carried out has as main objective the identification and knowledge of the pedological units existing in the project area, the evaluation of their representativeness and respective distribution in space, as well as the dominant uses and occupation patterns.

Many regions of the territory still have very poorly developed soils or a complete absence of soils, whenever the climate and especially the slope do not allow for pedogenesis, but favor erosion and transport of disaggregated rock particles.

More than half of the Angolan territory to the East is constituted by Psammitic soils or Arenossols, making up an area of 57.5% of Angola, as can be seen in the analysis of **Figure 124**. These occupy most of the eastern part of the territory, being observed in the Provinces of

Moxico, Luanda and part of Kuando Kubango. These soils are of limited agricultural interest (Diniz, 1991).

In the plateaus of the Center and in the sub-plateaus of the Center North, the great spot of Ferralitic soils stands out, which occupy about 21.6% of the territory, with its agricultural constraints dictated by the low chemical fertility that results from its weak mineral reserve.

These two large patches of soil, covering more than two thirds of the Angolan territory, around 80%, support a low-intensity livestock and agricultural activity, where the use of irrigation may only have a complementary and restricted character in some less extensive areas, in the valleys of the rivers, in Serralheiro *et al*. (2007).

Three types of soils cover a large part of Moxico Province, namely sandy soils or the windblown Kalahari sands that dominate the areas to the west; the gleysol clays found in the large central area of Várzea do Bulozi; ferrasolos are predominant in the hills and in the immediate vicinity of the east of the province (Source: Atlas e perfil do Moxico, Angola, 2015).

The following figure (*see* **Figure 124**) shows the spatial distribution of the different types of soil in Angola.

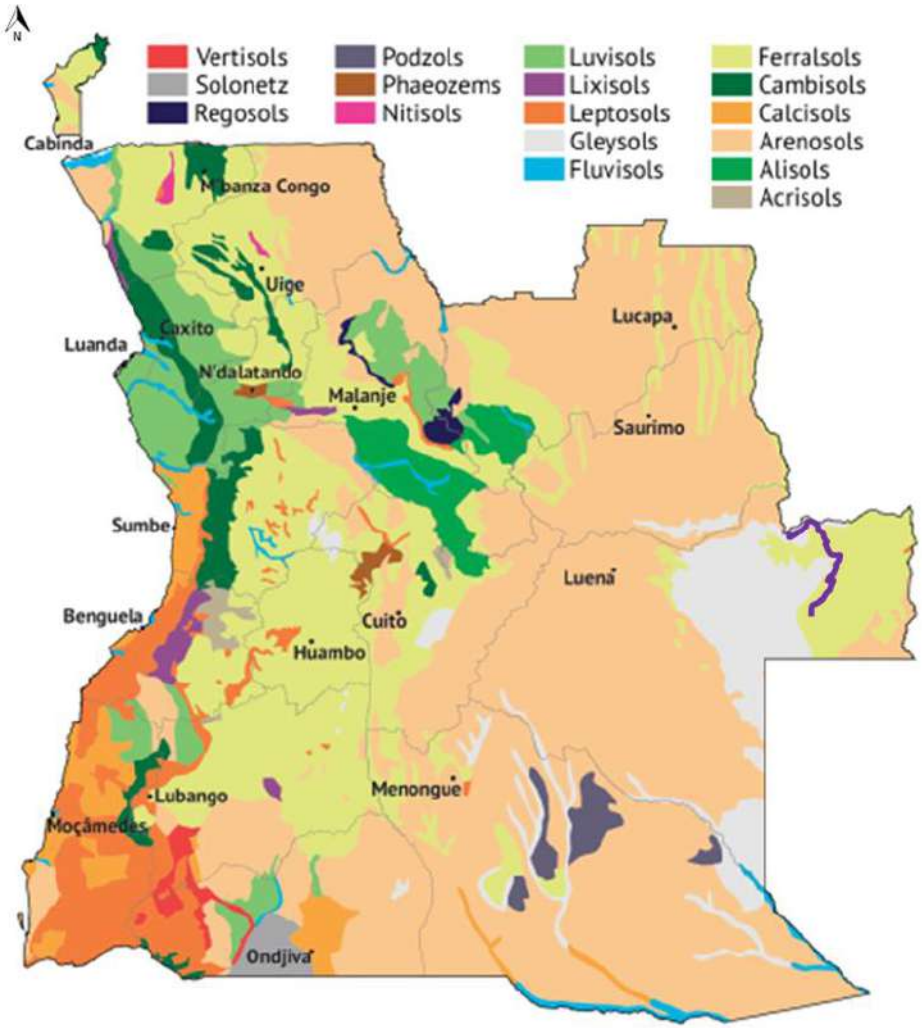


Figure 124 - Map of Soils in Angola highlighting the location of the project, represented in purple (Source: adapted from Marques, 1997).

According to this map (*see* **Figure 124**), it is possible to observe that the project implantation area is mainly constituted by Ferrasols (represented in yellow color) and in some areas subject to temporary flooding, Psamohydromorphics (gleysols) may also occur, more rich in organic matter (Marques, 1977).

6.7.1. Local Pedological Framework

The following figure shows the Soil Map of the project (*see* **Figure 125**) where it is possible to verify that in the area of influence of the project soils of the type Haplic Haplic Sandy Gleicosols (GLhaar) or gleysols, Hypoluvic Arenosols (ARwl) and Xantic Ferrasols dominate (FRxa) (ESDAC, 2013).

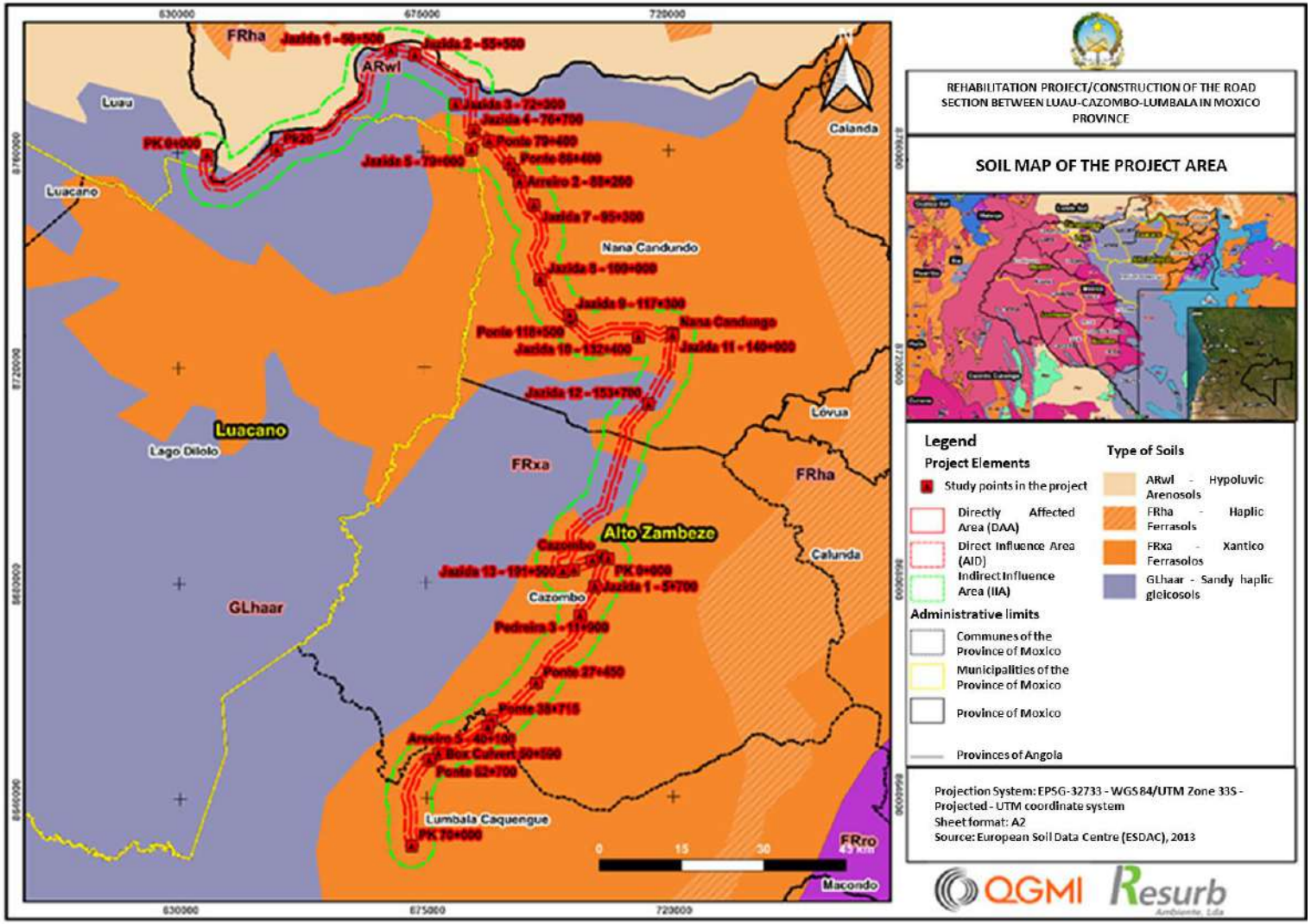


Figure 125 – Project soil map (Source: adapted from ESDAC, 2013).

Sandy haplic gleysols occur in low lying areas or depressions where groundwater comes close to the surface and the soil is saturated with water for long periods of time. Gleysols show a characteristic reddish, brownish or yellowish color in the upper soil where oxygen is present, in combination with deeper grey/blue colors in the soil where oxygen is absent or reduced (*see* **Figure 126**) (Jones, *et al*., 2013).

This type of soil is located in the area of influence of the road section between PK 0+830 and PK 72+300, from PK 148+230 to PK 156+420 and from PK 165+000 to PK 180+000 (in the section Luau – Cazombo, in the Commune of Luau, Lago Dilolo, Nana Candundo and Cazombo).

Figure 126 also shows the type of soil characteristic of the Sachilombo Neigborhood area (Commune of Nana Candungo) which is located next to Deposit 12 located at km 153+700 of the road section between the river Sapo and Cazombo. This soil is mainly made up of light colors, they are little evolved and with a variable or even non-existent thickness. The soils present in this location have a moderate thickness with different grain sizes (sand and fine clay).

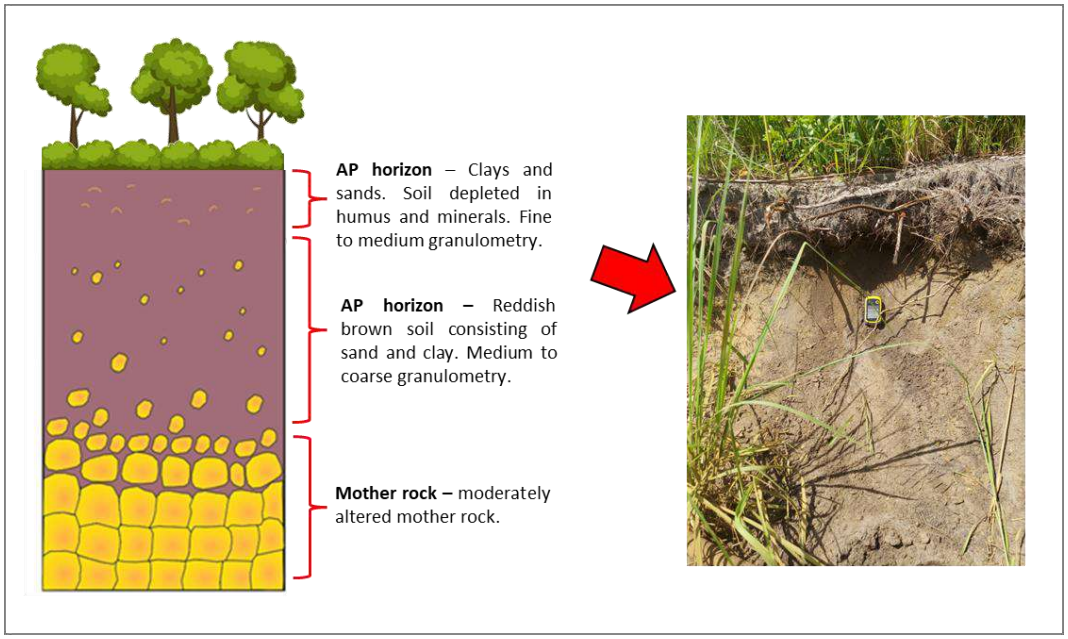


Figure 126 – Soil profile: sandy haplic gleissoilss in KP 153+700 (Commune of Nana Candundo).

Through the analysis of the previous figure (*see* **Figure 126**) it is verified that this soil exhibits the presence of some vegetation. Most of the time the AP horizon is extensive with a mixture of almost unaltered rock and some signs of alteration with the presence of silts, sands and clays.

Xantic Ferrasols (FRxa) are strongly leached yellowish soils with low nutrient retention capacity and which have lost almost all of their unstable minerals over time. As a result, they are

dominated by stable products such as aluminum oxides, iron oxides and kaolinite, which give ferrasols their strong red and yellow colors (*see* **Figure 127**). Calcium and magnesium levels are very low. The binding of particles by iron oxides gives an apparent sandy or muddy feeling (pseudo-sand) (Jones, *et al*., 2013). This type of soil is located in the area of influence of the road section between PK 72+300 and PK 148+230, from PK 156+420 to PK 165+000 and from PK 180+000 to PK 196+000 (in the section Luau – Cazombo, in the Commune of Luau, Lago Dilolo, Nana Candundo and Cazombo), as well as on the road section between PK 0+000 and PK 70+000 (in the section Cazombo – Lumbala Caquengue, in the Commune of Cazombo and Lumbala Caquengue) .

Thus, the following figure (*see* **Figure 127**) shows the profile of soils identified in the area next to KP 193+400 of the road section between Cazombo and Lumbala Caquengue.

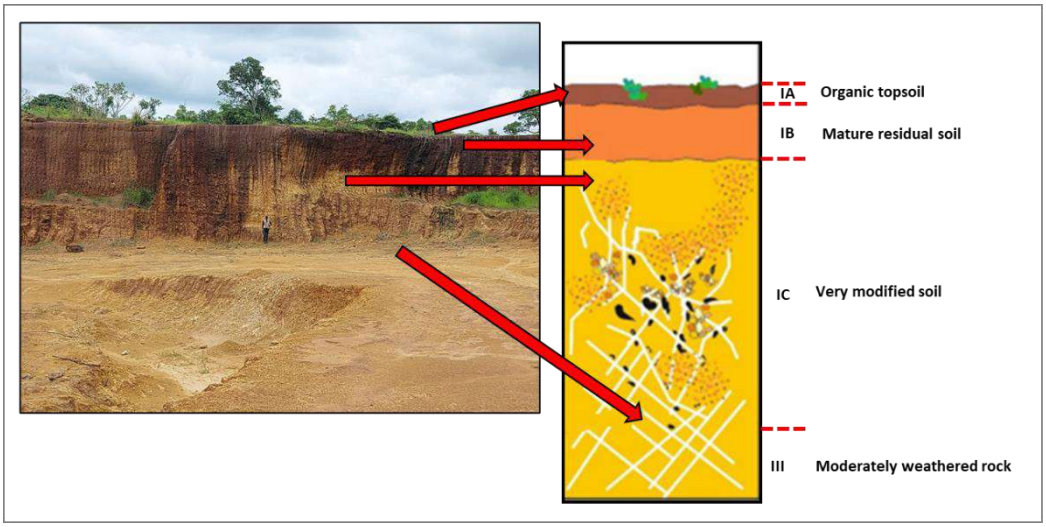


Figure 127 – Soil profile: Sandy Xantic Ferrasols at KP 193+400 (Commune of Cazombo).

The soils observed at this location are of the reddish ferrasols type, as shown in **Figure 127**, resulting from the alteration of the rocks. This soil has a brownish-red upper layer (IA) with traces of organic matter. The following layers correspond to the profile of this type of soil, with layers of clay and reddish sand, with fine characteristics, with the massif, without any internal structure (IB). This layer is formed by the physical-chemical process of laterization and by the concentration of iron hydroxides and oxides.

The bottom layer corresponds to the highly weathered rock level (IC) and has an orange-yellow color, a chemical change resulting from the climatic conditions of the region.

Finally, Hypoluvial Arenosols (ARwl) are sandy soils with distinct clay accumulation, easily erodible with low water and nutrient retention capacity. Arenosols develop as a result of *in situ* weathering of quartz-rich parent material or newly deposited sands. Soil formation is

often limited by a low rate of weathering, but it is prone to wind erosion if not covered with vegetation (Jones, *et al*., 2013).

This type of soil is located in the area of influence of the road section between PK 0+000 and PK 0+830, as well as in the area of influence of the road section between PK 0+000 and PK 72+300 of the Luau – Cazombo.

Figure 128 shows the soil profile of the implantation area of Deposit 10 located at km 132+400 of the road section between the Sapo river and Cazombo.

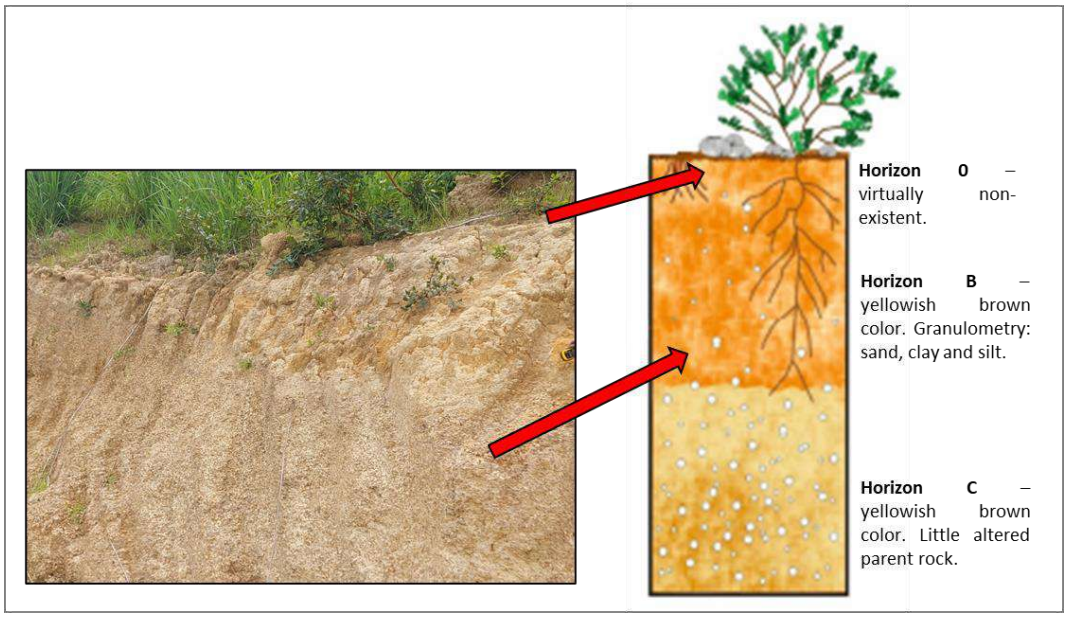


Figure 128 – Soil profile: Hypoluvial Arenosols in the PK 132+400.

It is possible to verify in the previous figure (*see* **Figure 128**) the presence of sands and sandstones as a rocky substrate, which makes it difficult to understand whether the sands observed at the surface are leached and loose sands due to profound alteration of the parent rock or whether correspond to the sandstone parent rock, which is originally uncemented and loose from there.

This type of soil is characterized by its water deficit. The presence of vegetation and humic acid-producing microorganisms are therefore scarce, which makes the soils marked by poor organic matter. This type of soil is poor in vegetation since the lack of soil and organic matter does not allow the development of a dense flora.

The soils identified in **Figure 128** correspond to poorly developed soils with an upper zone with an "O" horizon that is practically non-existent due to scarce vegetation and organic matter. The horizon subsequent to this is characterized by the presence of sand, silt and yellowish-brown clay granulometry clasts, not very cohesive, without moisture content and easily

disaggregated, which may be associated with the "B" horizon. Larger clasts may be the result of *in situ* rock alteration. The bottom of this profile already reveals a little altered rock that will constitute the "C" horizon.

As far as sand content is concerned, the soils in most areas of Moxico Province are unsuitable for growing crops, as can be seen from the analysis of the following figure (*see* **Figure 129**).

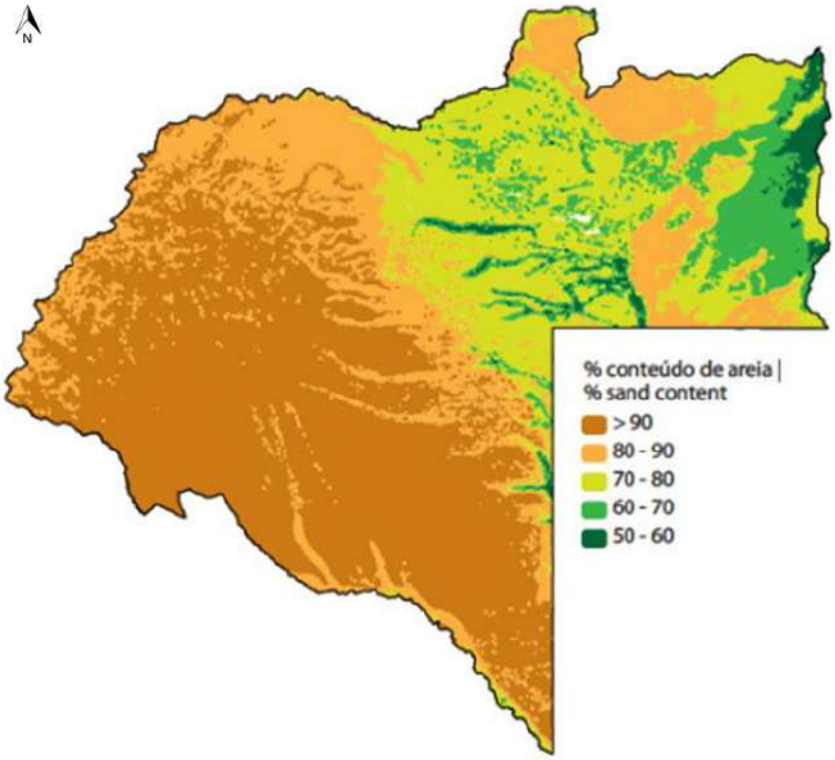


Figure 129 – Soil map of Moxico Province with % sand (Source: adapted from *Soil Atlas of Africa*).

Through the analysis of the previous figure (*see* **Figure 129**) it is also verified that in the Municipalities of Moxico, Luchazes and Lumbala-Nguimbo the present soils present the highest sand content (above 90%). The high sand content in the soil means that the soil is dominated by quartz crystals which do not provide nutrients to the plants. The sands were also devoid of nutrients due to high rainfall, not being able to retain water for a long time (Source: Atlas e perfil do Moxico, Angola, 2015).

6.7.2. Field Work

In the project area and immediate surroundings, the present soils have a moderate thickness with different granulometries. In this sense, during the field work, four samples collected in the area of direct influence of the project were visually evaluated in the field in order to assess the structure and composition of sediments and soil in order to complement the reference information on the type of dominant soils.

In the following table (*see* **Table 33**) is the description of the soil collection sites.

Table 33 – Soil sampling points

Location	Description	Coordinates
S1	Soils next to Houses located near the beginning of the road section between Rio Sapo and Cazombo (Pk 0+000)	11°12'41.24"S 22°14'30.30"E
S2	Soils next to Houses located near the end of the road section between Rio Sapo and Cazombo (Pk 196+000)	11°53'47.26"S 22°54'49.64"E
S3	Soils next to Houses located near the beginning of the road section between Cazombo and Lumbala Caquengue (Pk 0+000)	11°53'56.91"S 22°53'12.17"E
S4	Soils next to Houses located near the end of the road section between Cazombo and Lumbala Caquengue (Pk 196+000)	12°22'59.72"S 22°34'56.01"E

Annex X presents the Environmental Monitoring Sheets of the collected soil samples.

In the following figure (*see* **Figure 130**) it is possible to observe the soil collection sites at points S1, S2, S3 and S4 mentioned above.

Figure 130 - Detail of the soil collected at the Points S1, S2, S3 and S4.

The previous figure (*see* **Figure 130**) referring to soil samples taken in the project implementation area shows, at point S1, the presence of gleysols, which are soils formed in an environment of prolonged waterlogging, leading to the reduction and removal of iron and,

consequently, give the soil a usually grayish-brown color. As far as points S2, S3 and S4 are concerned, the presence of ferrasolos can be seen, which have a brownish-orange color, influenced by the climatic characteristics of the region and by the lithological characteristics as previously described in the characterization of the reference situation of the project in **Chapters 6.1.** and **6.2.**

It should be noted that the presence of traces of contamination with chemical products was not visually identified near the soil sampling sites, referred to in **Table 33**.

6.7.3. Forecast in the Project Abcense

In the absence of the project, the soils would continue their natural evolutionary process, a slow process and, given the region in question, the soil typology and the vegetation cover, it is expected that this evolution will take place in a natural and continuous way.

6.8. Land Use and Spatial Planning

With this descriptor we intend to describe and analyze the Project implementation area and the closest surroundings, in terms of its current land occupation and land use and fruition, since, according to the Land Law of Angola, land occupation must comply with environmental protection standards, in particular those concerning the protection of landscapes and species of flora and fauna, the preservation of ecological balance and the right of citizens to a healthy and unpolluted environment, in order not to compromise the regeneration capacity of arable land and the maintenance of its productive capacity.

At the same time, spatial planning must be considered as a fundamental policy, in which various measures of a global and sectoral nature are integrated, in order to contribute to the promotion of local development and to the improvement of the living conditions of the population residing in the area under study. In this context, an attempt was made to identify which planning and management instruments exist or are currently being prepared that cover the area under study.

6.8.1. Land Use

The classification of land occupation appears as an essential tool for the correct organization of the territory, since it indicates which are the urban, agricultural and natural spaces soils. It will thus allow for territorial expansion in harmony with the other uses, as long as it is articulated with the other existing plans. Considering that the Municipal Master Plan (MMP) for the Municipalities of Luau, Lucano and Alto Zambeze (Municipalities where the project is implemented) is not yet available, the foreseen use and existing constraints for the area are

not perceptible of project implementation. Thus, the characterization of the descriptor "Soil Use and Territorial Planning" took into account the bibliographical research of all the elements considered relevant for the characterization of this descriptor, as well as visits to the areas of influence of the project.

The consultation of documented strategic information for the national development of the Republic of Angola, allowed the integration of the present project for the Rehabilitation of the EC 192/EN 250/EN 254/EC 385 between Luau and Cazombo, under analysis in the present ESIA, in Policy 22: Planning of the Territory the importance of implementing programs of "Construction and Rehabilitation of Road Infrastructures" (Program 5.2.2) and "Development of the Urban Network" (Program 5.2.5), of the National Development Plan 2018-2022, therefore provides that the conceptual model of the project, given that it is a rehabilitation of an existing road section, complies with the constraints defined within the scope of territorial planning and the national road plan.

The following table (*see* **Table 34**) presents the classification of land use in the national territory.

Table 34 – Classification of land use in the Angolan national territory (Source: World Bank, 2015)

Way of use	Area (ha, %)
Arable land, pastures (continuous use as pasture for more than 5 years), cocoa and coffee growing areas, rubber tree forests	59.190.000 (47.47)
Forests	57.856.000 (46.41)
Others (pastures (less than 5 years old/urban areas))	7.624.000 (6.12)
Total	124.670.000 (100.00)

Analyzing the previous table, it appears that Angola is occupied by 47.47% of arable land, 46.41% of forest and the remaining 6.12% by "other" (pastures (less than 5 years old/urban areas)).

As far as the Province of Moxico is concerned, the soils are generally not very fertile, with little or no aptitude from an agricultural point of view, as referred to in **Chapter 6.7.** The clusters located in the *chana* areas (deposits in an elongated shape) show a marked halomorphism and hydromorphism, which makes them unsuitable for the establishment of agriculture. Most of the soils in this region have little or no suitability for agricultural activities. The only soils in the Province that have acceptable levels of cation exchange capacity are located in the eastern zones, along the rivers and in the Várzea do Bulozi. However, high rainfall has stripped most of the nutrients from the ferrasoils to the east, and the gleysols along the rivers are often too acidic or too waterlogged to grow crops (Source: Atlas e perfil do Moxico, Angola, 2015).

As for land use and occupation, the project's area of influence, in general, the region under study is mainly occupied by areas of natural vegetation: arboreal, shrubby and herbaceous (ESA/WorldCover, 2021) being distributed as follows:

- The area of influence of the road section between PK 0+000 and PK 86+400 (Luau-Nana Candundo), is mostly occupied by herbaceous vegetation (45,16%) in the area of influence of the section between PK 0+000 and PK 72+000; and by natural vegetation (trees and shrubs) (31.36% and 20.45%, respectively) in the area of influence of the section between PK 72+000 and PK 86+400, as well as in the area of influence of the section between PK 0+000 and PK 86+400, which is crossed by some wetlands with herbaceous plants (2,98%) (*see* **Figure 131**).

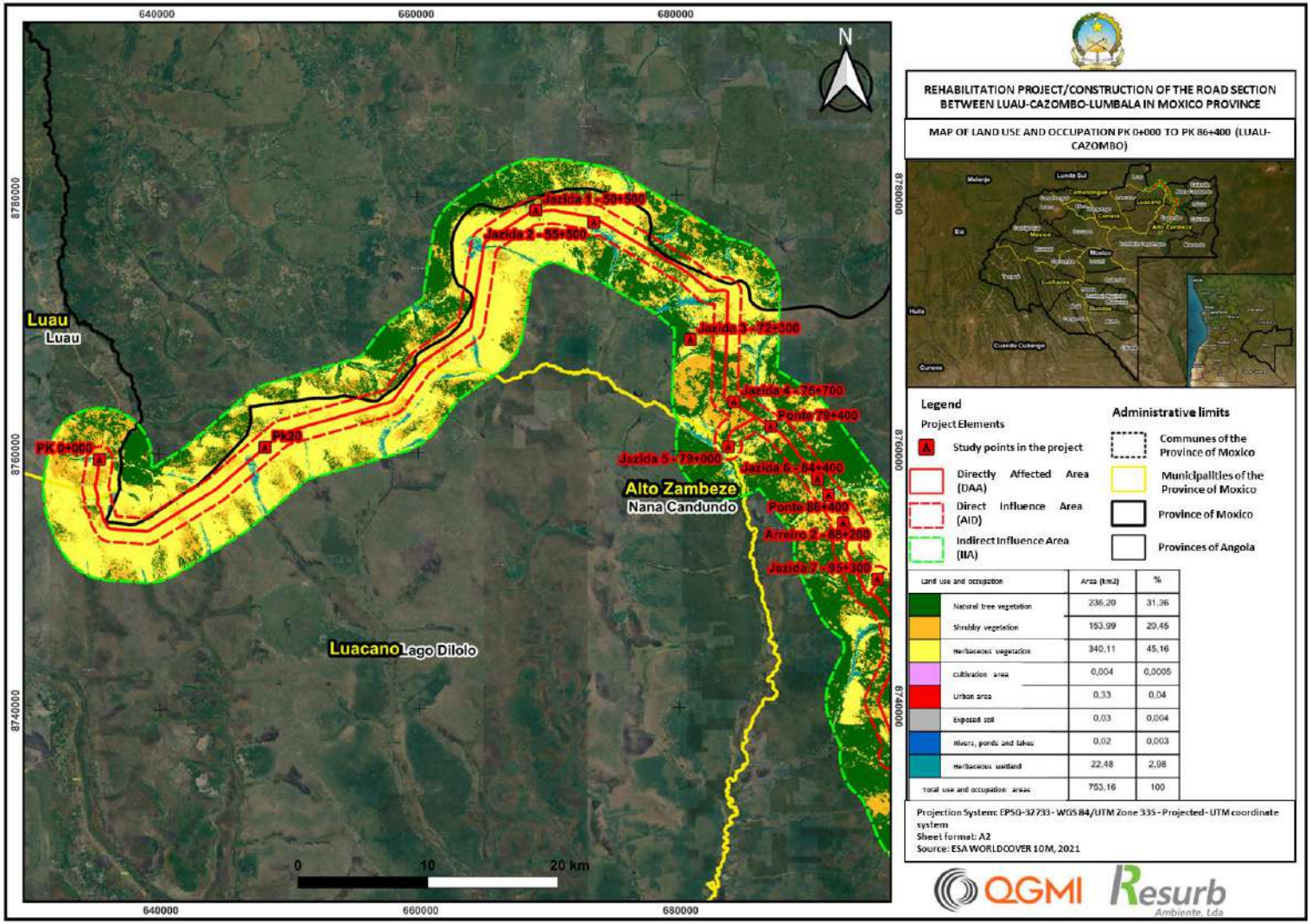


Figure 131 - Land use and occupation map of the area of influence of the road section PK 0+000 to PK 86+400 (Luau-Nana Candundo).

- The area of influence of the road section between KP 86+400 and KP 140+000 (Nana Candundo) is mostly occupied by natural vegetation (trees and shrubs) (63,45% and 17,87%, respectively), being crossed by some herbaceous vegetation (17,72%) and wetlands with herbs (18,19%). This area still has an extension of cultivated area (0,17%) and urban area (0,05%) in the village of Cavungo (*see* **Figure 132**).

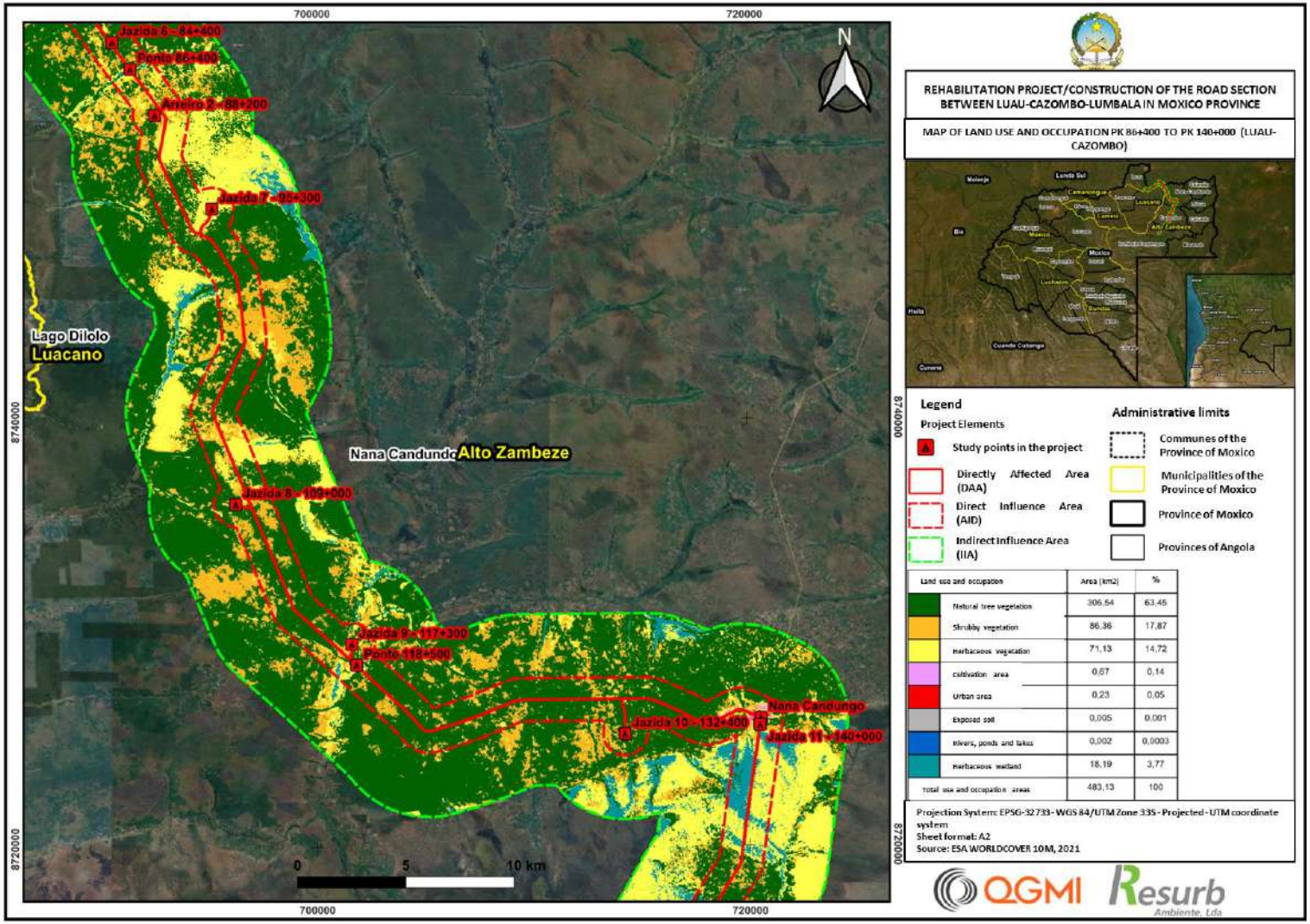


Figure 132 - Land use and occupation map of the project's area of influence between KP 86+400 and KP 140+000 (Nana Candundo).

- The area of influence of the road section between PK 140+000 and PK 196+000 (Nana Candundo - Cazombo) is mostly occupied by wetlands with herbaceous (4,62%) and herbaceous vegetation (40,44%) in the zone of the PK 140+000 to PK 146+200; and by natural vegetation – trees and shrubs (32,54% and 20,72%, respectively) in the area of influence of the road section between PK 146+200 and PK 196+000. This area still has an extension of cultivated area (0,17%) and urban area (1,19%) in the village of Cazombo (*see* **Figure 133**).

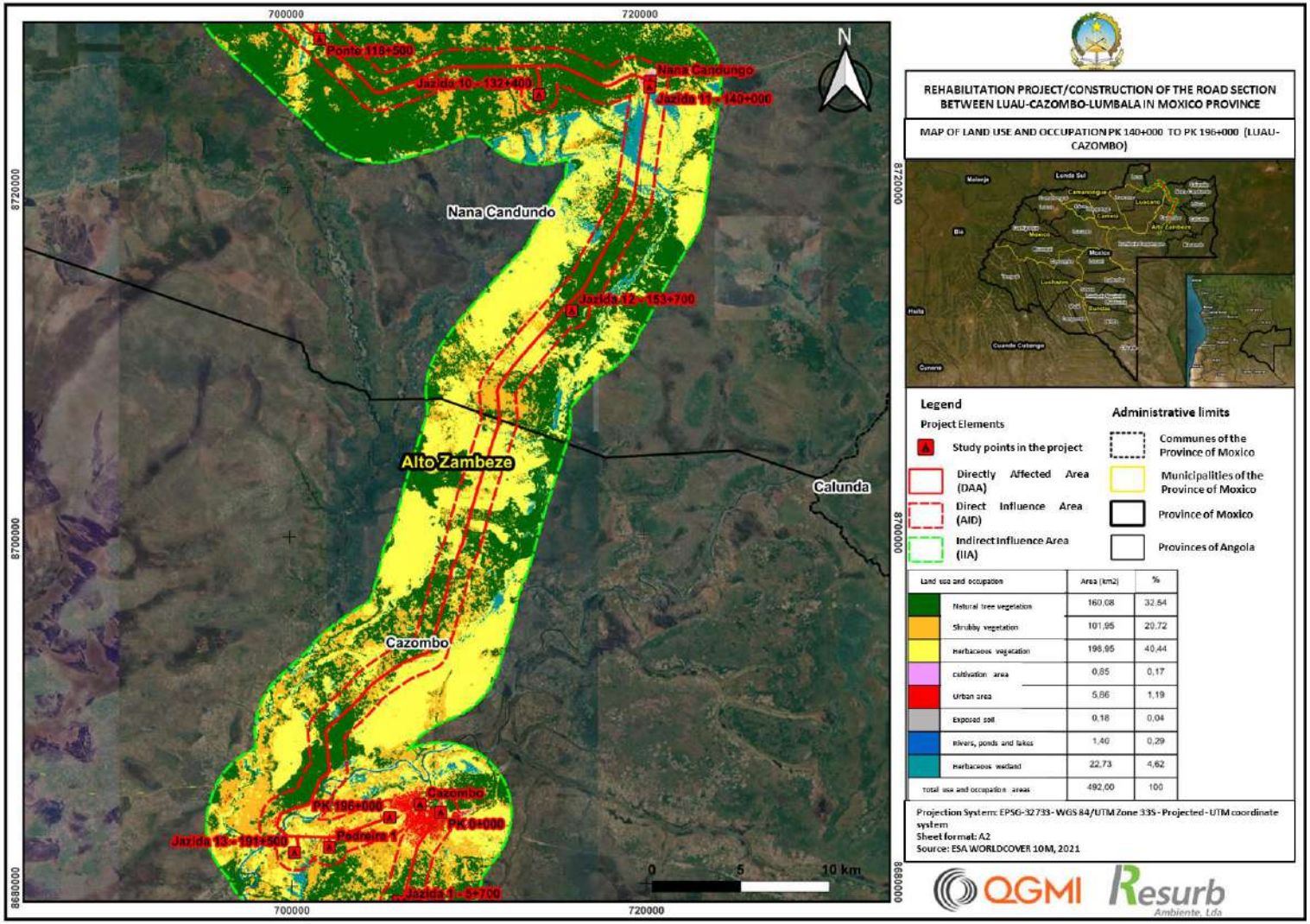


Figure 133 - Land use and occupation map of the area of influence of the road section between PK 140+000 and PK 196+000 (Nana Candundo-Cazombo).

- The area of influence of the road section between PK 0+000 and PK 70+000 (Cazombo – Lumbala Caquengue) is mostly occupied by natural vegetation (trees and herbaceous vegetation) (41,84% and 35,41%, respectively), being crossed by some shrubby vegetation (13,5%) and wetlands with herbaceous plants (7,25%). This area still has an extension of cultivated area (0,09%) and urban area (0,86) in the village of Cazombo (*see* **Figure 134**).

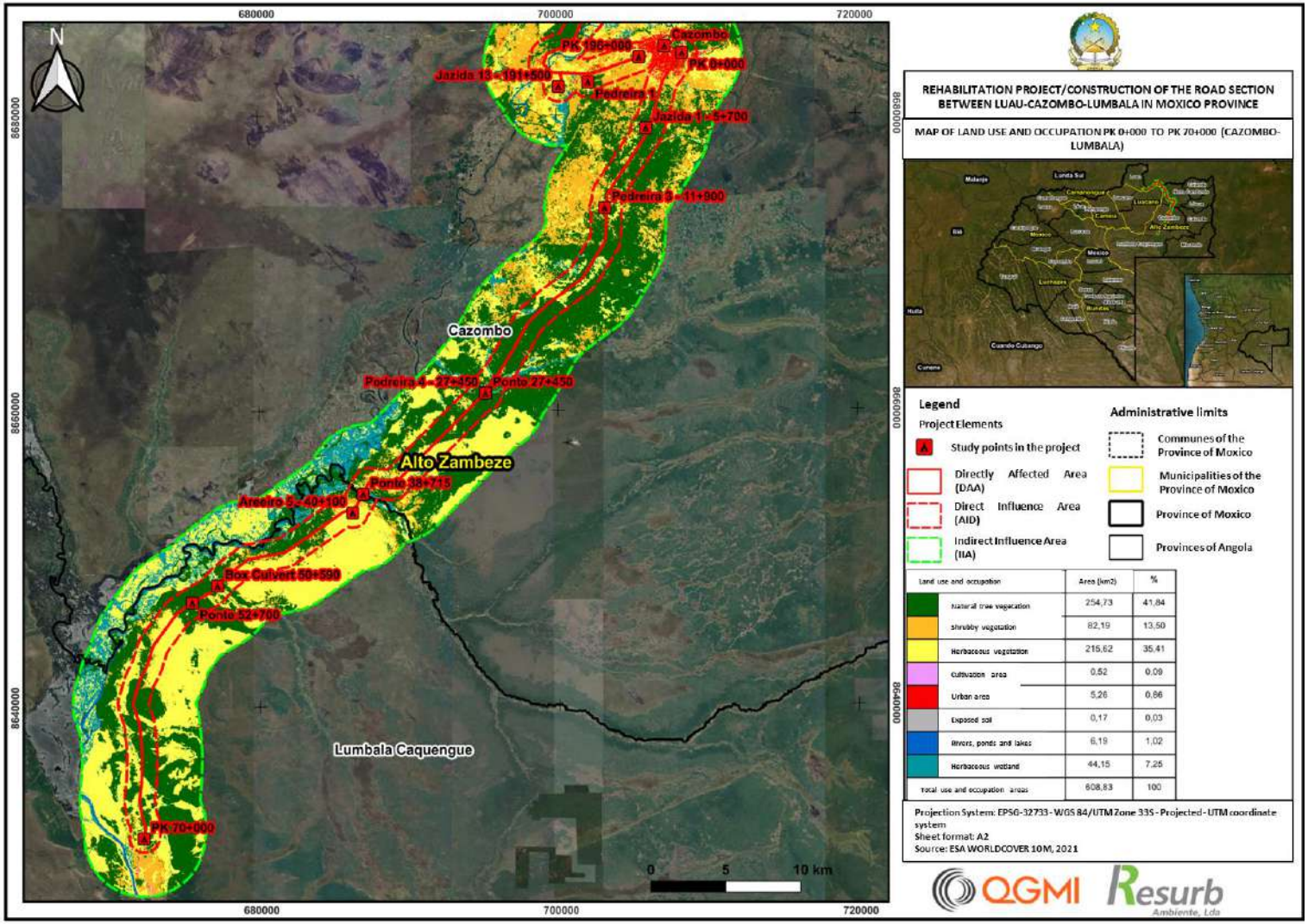


Figure 134 - Land use and occupation map of the area of influence of the road section between PK 0+000 and PK 70+000 (Cazombo – Lumbala Caquengue).

Analyzing the land use and occupation maps presented above (*see* **Figures 131** to **134**) from the surroundings to the road layout that will be rehabilitated within the scope of the project, it was concluded that the area of indirect influence that corresponds to a radius of 3 km around the area of direct influence, defined as a radius of 1.000 m around the directly affected area ("footprint") is mainly occupied by areas of natural vegetation: arboreal (40.97%), herbaceous (35.333%) and shrubby (18.16%). Thus, as this is a project to rehabilitate an existing road section located in the road easement area, it is not envisaged that the local community's means of subsistence will be affected (cultivation areas, forests and/or housing, among others) by the project since the directly affected area ("footprint") will be limited to the national road easement area.

At the same time, it was noted during the field work to characterize the project's reference situation that the Municipalities covered by the project depended heavily on the primary sector (*see* **Chapter 6.11.3.8. Production Framework and Employment**).

6.8.2. Spatial Planning

The Land Law of Angola (Law 9/04 of 9 November) and the Law on Spatial Planning and Urban Planning (Law 3/04 of 25 June), approved in 2004, are the only legal instruments to support the regulation and elaboration of a development project complemented by the environmental law. Territorial planning normally aims to create favorable conditions that guarantee the objectives of economic and social development, social well-being, environmental protection and citizens' quality of life.

The project takes place in the Province of Moxico, the largest of Angola's 18 Provinces. It has an extension of 201.873 square kilometers, 16,1% of the Angolan territory (Census, 2014). The Province of Lunda Sul is located to the North of the Province of Moxico, the Province of Bié to the West and the Province of Cuando Cubango to the South. To the east, Moxico Province borders Zambia and the Democratic Republic of Congo. At its widest points, Moxico Province covers an extension of about 650 km from east to west and about 620 km from north to south (Source: Atlas e perfil do Moxico, Angola, 2015).

Luena is the administrative capital and trade center of Moxico. According to the Political-Administrative Division Law - Law n.º 18/16, of October 17, the Province of Moxico has 9 Municipalities, namely, Moxico, Luchazes, Bundas, Alto Zambeze, Luacano, Cameia, Camanongue, Léua and Luau. It also has 27 Communes.

The following figure (*see* **Figure 135**) presents a political-administrative map of the Province of Moxico and the following table (*see* **Table 35**), the respective Municipalities and Communes of the Province of Moxico.

Figure 135 - Administrative political map of the Province of Moxico (Source: Atlas e perfil do Moxico, Angola, 2015).

Table 35 – Municipalities and Communes of the Province of Moxico

Municipalities	Communes
Moxico	Lucusse; Cachipoque; Luena; Muangai
Luchazes	Cangombe; Cassamba; Tempué; Cangamba; Muié
Alto Zambeze	Nana Candundo; Lumbala Caquengue; Cazombo; Macondo; Caianda; Calunda; Lóvua
Bundas	Lutembo; Chiume; Lumbala Nguimbo; Luvuei; Ninda; Mussuma; Sessa
Luacano	Luacano; Lago Dilolo
Léua	Léua; Liangongo
Camanongue	--
Luau	--
Cameia	--

It is important to note that the first colonial settlement known as “Moxico Velho” was established about 18 km south of the city of Luena. The first schools and hospitals in Moxico were established by Protestant missions in Muié, Boma, Kavungo and Cazombo, and by Catholic missions in Cazombo, Luau, Lumeje, Léua, Camonongue, Lumbala, Nguimbo, Cangamba, Cassamba, Cangumbe, Moxico Velho and Luena.

With regard to the existing villages next to the road route, which will be rehabilitated within the scope of the project, the RESURB Team identified, during the course of the field work, in order to characterize the reference situation, the presence of 39 neighborhoods and/or small settlements, as can be seen in the following figure (*see* **Figure 136**).

At the same time, and in accordance with what was communicated by the entity executing the project, no physical and/or economic impact on the community in the neighborhoods surrounding the project is foreseen, since the road rehabilitation activities will be restricted to the road easement area.

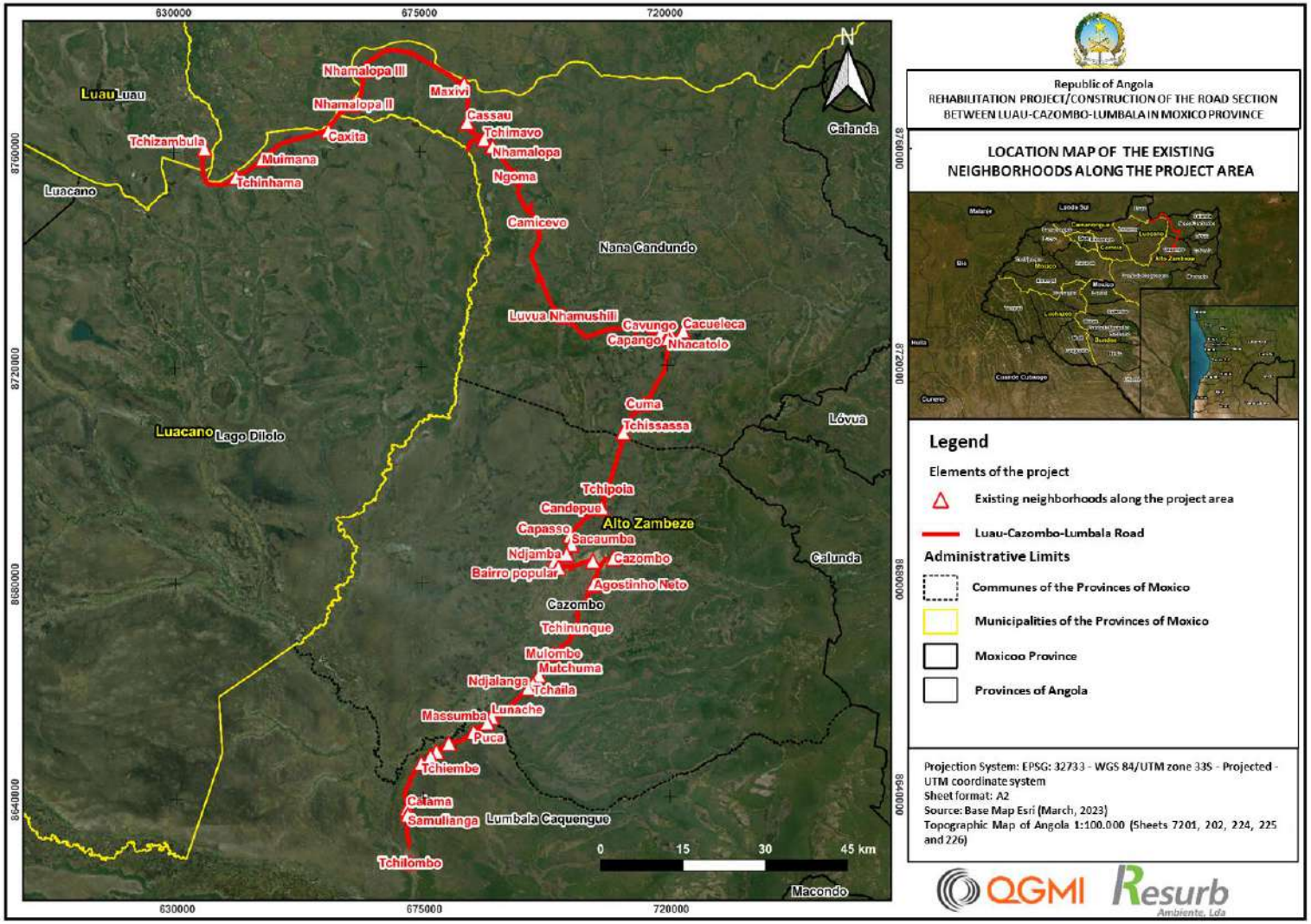


Figure 136 – Location of neighborhoods and/or small settlements existing throughout the road rehabilitation project.

6.8.3. Forecast in the Absence of the Project

In the absence of the project, it is expected that most of the land in the region will continue with the transition from an occupation based mainly on miombo forests to an occupation based on housing and/or commercial infrastructures.

6.9. Biodiversity and Ecological Factors

6.9.1. Methodology

For the present characterization, the study area is defined as the one corresponding to the direct overlapping of the project's implantation, as well as its immediate surroundings, where eventual disturbances on the ecological systems may manifest themselves.

It is considered that with the definition of this study area, the current state of the project's implantation area will be duly assessed. However, an attempt was also made to infer about potential interactions between the project area and ecologically sensitive areas located in the surrounding region, where possible impacts could also be felt. For this purpose, the Key Biodiversity Areas (KBAs) defined by the IUCN, and the areas with National Conservation Statute of Angola were considered.

The methodology used for the reference characterization of the study area focused on bibliographical compilation (primary sources), resorting mainly to the IUCN database with the spatial distribution of potential species present in the study area and respective status classification of the species referenced by the IUCN red list and in the Red List of Angola, visits to the project site and analysis of different geographic information systems and aerial photography, that is, it consists of integrating primary and secondary sources.

The collection of primary information was based on plots and transects of vegetation to guide data collection in the field and sampling points that allow the identification and distribution of families in the analyzed environments (*see* **Figure 137**).

Taking into account the extension of the project and for better control of the survey, a rectangular grid (5x7 km) was defined for the field survey and data collection that allows a characterization of the natural capital of the project implementation area (*see* **Figure 138**).

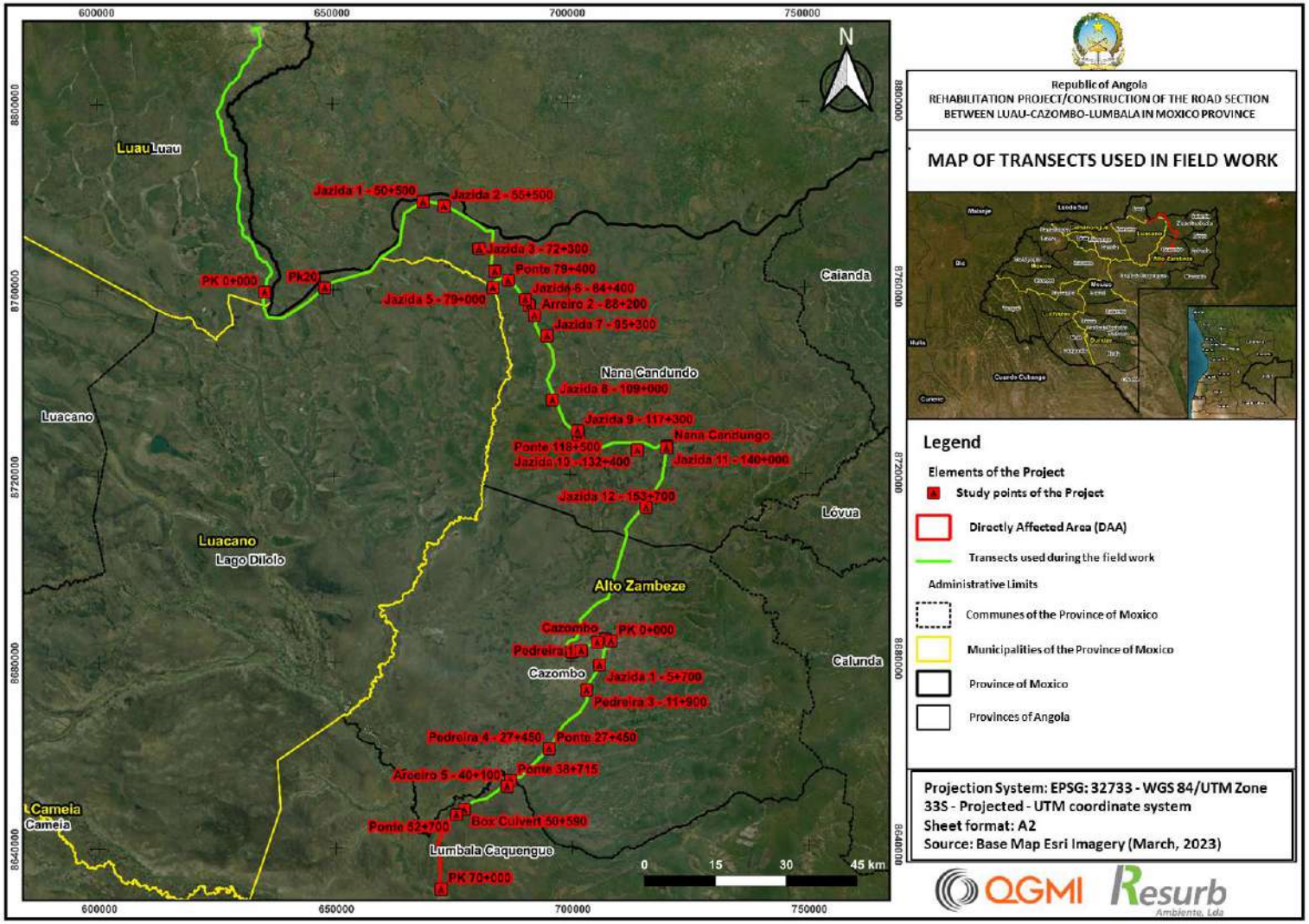


Figure 137 - Flora and Fauna sampling sites (Transects).

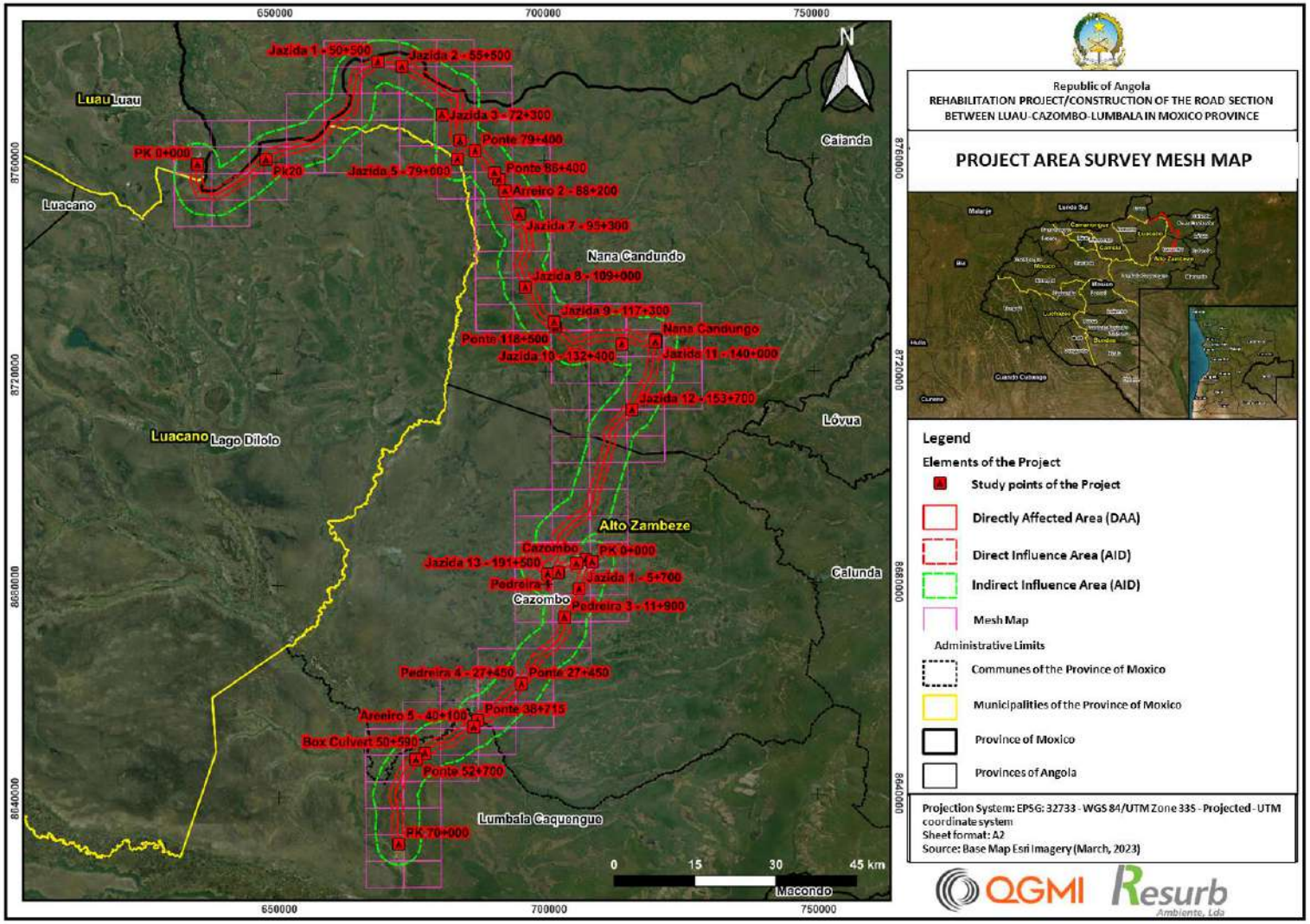


Figure 138 - Field Survey Mesh.

In addition to the biotic information collected at the sampling sites, all additional relevant information obtained was also recorded, namely, between trips made to and from the study area and between sampling sites.

The materials used during the field survey were: geological maps, topographic maps, soil maps, Google Earth image with superimposed unsupervised classification, cameras, tablets, phones, GPS´s, satellite radios, sound level meter, boots, Kits collection point, species classification guide, field book, vehicle, canoe and fishing net.

In the present study, more than a quantitative determination, it is intended to qualitatively assess the local floristic and faunal community, with special focus on species of conservation and/or scientific interest.

The collection, analysis and cross-referencing of information, through subsequent discussion, will determine the value and relevance of the study area for nature conservation.

6.9.2. Ecoregions

The ecoregions represent the first hierarchical level of regionalization of the Biomes presented in the previous subchapter. The geological, geomorphological and climatic factors are the criteria for stratification of ecoregions, which condition the biogeographic distribution.

Ecoregions can be used to develop biological conservation policies, natural resource management and/or sampling point selection criteria to represent the environmental variability of the biome.

Within the biomes mentioned in the previous subchapter, Burgess *et al*. (2004) defined a total of 119 terrestrial ecoregions for Africa and its islands.

Ecoregions are defined as “large units of land or water that contain a distinct set of species, habitats and processes, and whose boundaries attempt to portray the original extent of natural communities before major land use changes” (Dinerstein *et al*., 1995).

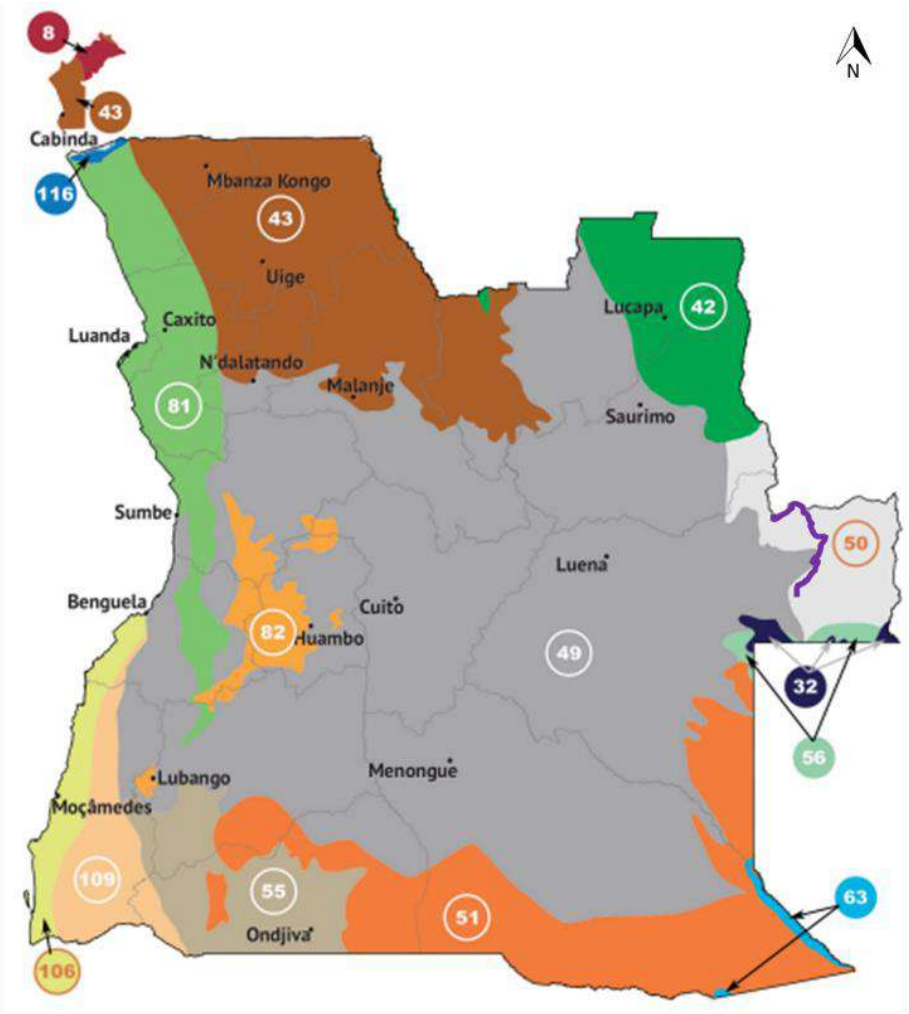
According to Burgess et al. (2004), Angola has not only the greatest diversity of biomes, but also the second largest representation of ecoregional diversity in Africa, as can be seen from the analysis of the following table (*see* **Table 36**). **Table 36** also presents the relationship between biomes and ecoregions (according to Burgess *et al*., 2004) and the vegetation units of the Phytogeographic Chart of Angola by Barbosa (1970).

Table 36 – African Biomes and Ecoregions (as defined by Burgess *et al*., 2004) and Angolan vegetation types (Barbosa 1970) with indicative genres

No. of the Ecoregion	Biome	Ecoregion	No. of Barbosa, name and key genres
8	Tropical and subtropical forest	Equatorial Forest Atlantic coast	1, 2. Closed forest *Gilbertiodendron, Librevillea,Tetraberlinia*
32	Deciduous tropical and subtropical dry forest	*Cryptosepalum* Dry Forest Zambezian	4. Closed forest *Cryptosepalum, Brachystegia Erythrophleum*
42	Meadows, savannas, shrub savannas and tropical and subtropical forests	Southern Congolese Savannah Forest Mosaic	8. Forest-Savanna Mosaic *Marquesia, Berlinia, Daniella, Hymenocardia*
43	Meadows, savannas, shrub savannas and tropical and subtropical forests	West Congolese Savannah Forest Mosaic	3. Closed forest *Celtis, Albizia, Celtis* 13. Thicket-Forest Mosaic *Annona, Piliostigma, Andropogon, Hyparrhenia*
49	Meadows, savannas, shrub savannas and tropical and subtropical forests	Angolan Miombo Forest	16, 17, 18. Woods *Brachystegia, Julbernardia, Guibourtia, Burkea, Pterocarpus*
50	Meadows, savannas, shrub savannas and tropical and subtropical forests	Central Zambezian Miombo Forest	17, 19. Woods *Brachystegia, Julbernardia, Cryptosepalum*
51	Meadows, savannas, shrub savannas and tropical and subtropical forests	*Baikiaea* Forest Zambezian	25. Arboreal and Shrubby Savannah *Baikiaea, Guibourtia, Pterocarpus, Combretum*
55	Meadows, savannas, shrub savannas and tropical and subtropical forests	Mopane Forest of Angola	20. Woods *Colophospermum, Croton, Combretum, Sclerocarya, Acacia*
56	Meadows, savannas, shrub savannas and tropical and subtropical forests	Zambezian Meadow western	31. Meadows *Loudetia, Monocymbium, Tristachya,* Parinari, Syzygium
63	Flooded meadows and savannas	Flooded meadows Zambezians	31. Meadows *Loudetia, Echinochloa, Oryza*
81	Mountain meadows and shrub savannas	Forest-Mountain Meadow Mosaic of Angola	6, 32. Relic Forest, meadows *Podocarpus, Apodytes, Pittosporum, Protea, Erica*
106	Deserts and xeric bushes	Kaokoveld Desert	28, 29. Desert, steppes *Welwitschia, Zygophyllum,Stipagrostis, Odyssea*
109	Deserts and xeric bushes	Namibian Escarpment Forest	27. Steppes *Acacia, Commiphora, Colophospermum, Sesamothamnus, Rhigozum*
116	Mangrove	Central African mangroves	14 A. Mangrove

No. of the Ecoregion	Biome	Ecoregion	No. of Barbosa, name and key genres
			Rhizophora, Avicennia, Raphia, Elaeis

Figure 139 shows the map of Angola with the representation of the ecoregions, with emphasis on the project implementation area.



8. Atlantic Equatorial Coastal Forest
32. Zambezian Cryptosepalum Dry Forest
42. Southern Congolese Forest-Savannah Mosaic
43. West Congolese Forest-Savannah Mosaic
49. Angolan Miombo Forest
50. Central Zambezian Miombo Forest
51. Forest of Baikiaea Zambeziana
55. Angola's Mopane Forest
56. Western Zambezian Meadow
63. Zambezian Flooded Meadows
81. Savanna and Forest of the Escarpment of Angola
82. Angola's Forest-Mountain Meadow Mosaic
106. Kaokoveld Desert
109. Escarpment Woods of Namibia
116. Mangroves of Central Africa

Figure 139 – Ecoregions of Angola highlighting the location of the project (marked in purple) (Source: adapted from Burgess *et al.*,2004).

As can be seen from the analysis of the previous table and figure (*see* **Table 39** and **Figure 120**), the largest section of the project is predominantly located in ecoregion number 50, corresponding to the *Central Zambezian Miombo Forest* and a smaller section of this road section is located in ecoregion number 49, namely in the *Angolan Miombo Forest*.

6.9.3. Flora and Habitats

Angola is botanically rich and floristically diverse, but its exploitation remains very irregular, with few harvests in the eastern half of the country. Angola has approximately 6.850 species of native plants and the level of endemism is around 14.8%. However, it is important to mention that the Angolan territory underwent profound changes, not so much due to human occupation at the time of population growth in the 60s of the 20th century, but due to the civil war that only ended in 2002.

According to the IUCN (International Union for Conservation of Nature), Angola is considered the second country in Africa with the most endemic plants, approximately 1.260 species.

Spatial information on the composition of plant species and the distribution of vegetation types is essential for the management of natural resources. In Angola, the first national vegetation map was prepared by Gossweiler in 1939. Barbosa later published a revised map with much more detail in 1970 and his work has remained until today the main reference regarding Angolan vegetation (*see* **Figure 140**).

Due to its climate, hydrography and topography, the Province of Moxico stands out for its wide variety of tree species with great commercial value. In the Province there is dense and dry forest and open forest with savannah and *chanas* (Emmanuel, A., 2018).

Miombo forests characterize a large part of the Province of Moxico and also dominate a large area that extends across Southeast Africa, from Angola to Tanzania and Mozambique. In the interior of Moxico Province, the forests have trees that vary in height and density. The species composition of dominant trees also varies. Many of these variations are due to the type of soil and its depth.

In the following subchapters (**Chapters 6.9.2.1.** to **6.9.2.5.**), the floristic biodiversity and biological/biotic factors of the project implementation area are described, also influenced by the ecological factors (physical/abiotic) previously described in the environmental descriptors presented above.

6.9.3.1. Vegetation Units

It should be noted that in addition to the distribution of biodiversity across the 6 biomes of Angola described above, 32 vegetation units can also be distinguished. According to the Phytogeographic Chart of Angola (Barbosa, 1970), which describes the vegetation units, the study area falls within areas classified as "*Fog Forest*" and "*Open Miombo (10-20 m) with Brachystegia spiciformis var latifoliolata, Julbernardia paniculata and B. longifolia with Hyparrhenia stratum graminale*" as can be seen in the following figure (*see* **Figure 140**).

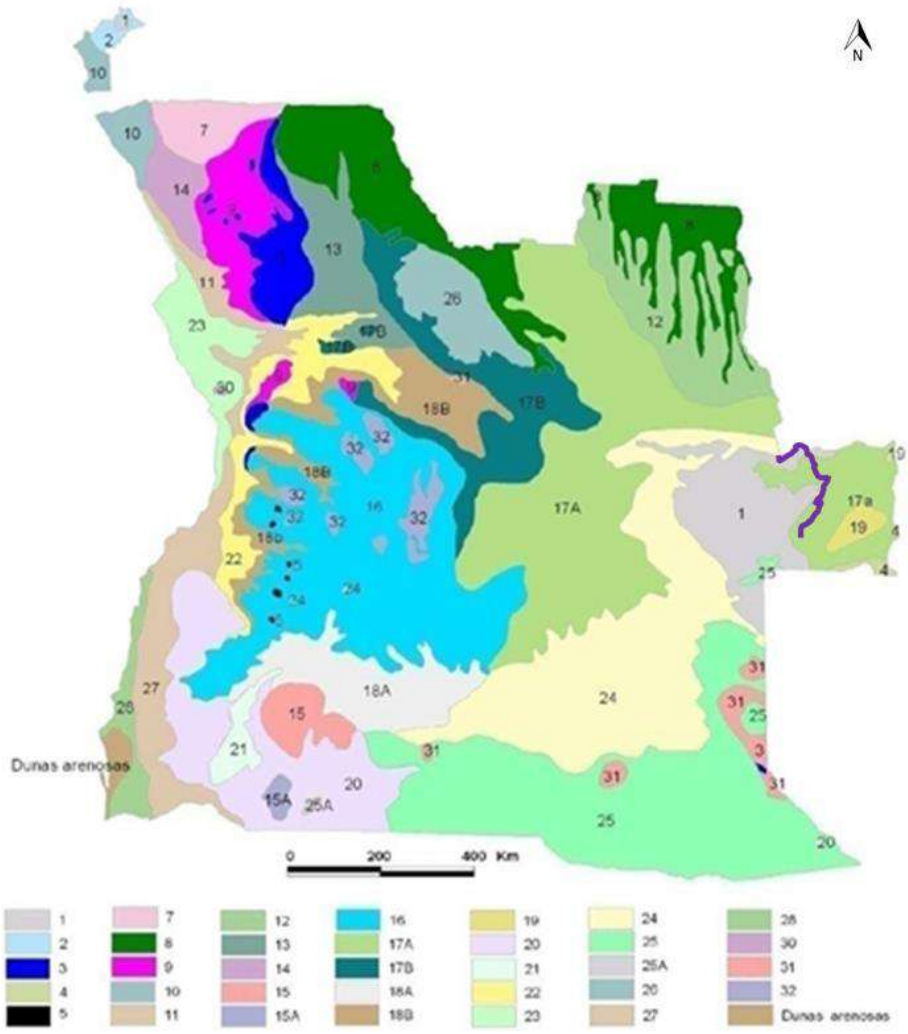


Figure 140 - Phytogeographic map of Angola (Barbosa, 1970) highlighting the location of the project (marked in purple).

The floristic diversity of a region is a good indicator of existing anthropic action, as it is directly the result of the interaction between the various biotic and abiotic factors, allowing the assessment of the degree of successional distancing in relation to the climax stage.

It should be noted that the miombo in the project's area of influence is a medium or tall Miombo measuring 10-25 meters, with a forest of *Brachystegia spiciformis var. latifoliolata*,

Julbernardia paniculata and *Brachystegia longifolia* in abundance and sometimes with stands of *Guibourtia, Marquesia* and *Cryptosephalum* (Diniz, 1973).

The *Chanas* present in the area of influence of the project, in general, are habitable land par excellence. In these zones the species of *Brachystegia* (*spiciformis, Glaberrima*) and *Julbernardia Paniculata* (Diniz, 1973) can be found.

In these places, different plant extracts were identified and each one has its own characteristics, as shown in **Figure 141**.

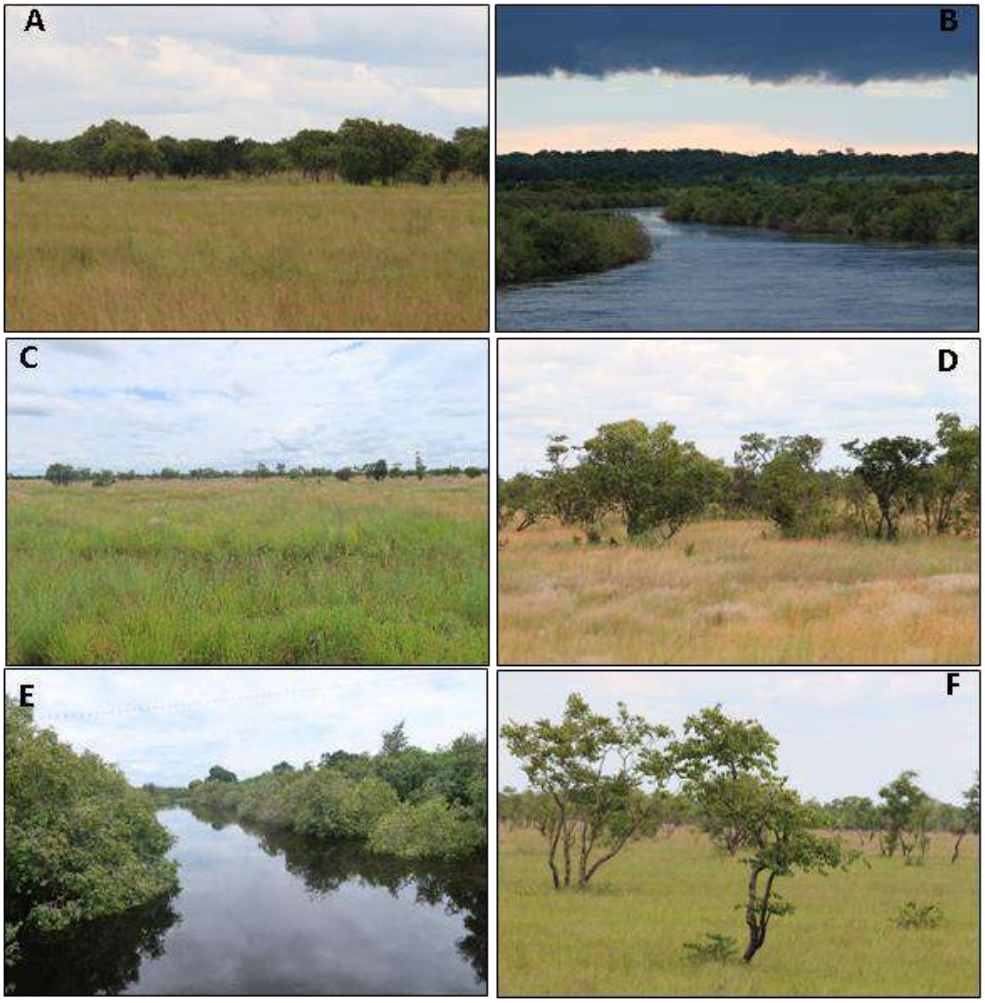


Figure 141 - Characteristics of the region's flora: A) zone of *chana* in the foreground and miombo in the background; B) riparian vegetation of the Zambezi River; C) *Chana* zone; D) Tree-shrub savannah; E) Riverside vegetation; F) shrubby savannah.

However, it is important to point out that the habitats related to the wetlands, existing in the surroundings of the project, are already influenced by the presence of the road section, so that, being a rehabilitation project, different allocations are not foreseen, to those already existing at the time, although it is considered that the implementation of the project may eventually exert greater anthropic pressure on the vegetation and biodiversity units.

6.9.3.2. Bio and Phytogeographic Framework

Plant formations are specific associations that develop according to the type of climate, relief and soil of the place where they are located, with the influence of Climate being the most relevant, with a relationship between plant formation and the characteristic climatic region (Faria, 2015). According to the Köppen-Geiger Climate Classification presented in **Chapter 6.1. Climate and Climate Change**, the area where the project will be implemented is part of a region classified as Aw "tropical climate with a dry winter season" (*see* **Figure 52**). Consequently, the distribution of biodiversity, that is, the variability of living organisms of all types, including the diversity of species and the diversity between individuals of the same species, can be divided into Biomes, which are geographic spaces that present a sum of neighboring ecosystems and similar and that can be divided into terrestrial and aquatic.

According to the Environmental and Social Framework and Management of the Water Sector Development Program (MINEA, 2016), the Republic of Angola has six different types of biomes, namely:

- **Guinea-Congolese Biome** that includes perennial forests of high biodiversity. This biome occurs in the provinces of Cabinda, Zaire, Uíge, Lunda Norte, Cuanza Norte and Cuanza Sul. Rainfall is high, between 1.200 and 1.800 mm per year. The Guinean-Congolese biome includes the gallery forests of the Cuango, Luachimo and Cassai Rivers in Lunda Norte Province, which flow northward on the Congo River;
- **Congolese Forest** – the Savannah occupies an area of approximately 519.001 km^2 composed of savanna trees. Within the savanna there are areas of Congolese forests along the main courses of rivers such as the Cuango, Luachimo and Cassai Rivers with tall trees of the genus Piptadeniastrum, Clorofora, Ceiba and Xilopia;
- **Zambezian Biome** - This is the largest biome that covers more than 80% of the country and includes a variety of forest types of which the Braquistegia (miombo) forest is the most important;
- **Afromontane Forest Biome** - Angola's Afromontane forests are important from a biogeographic and biodiversity perspective. These are unique temperate forests, which once had a much wider distribution in sub-Saharan Africa. Today, these forests only occur as small spaces on protected mudflats on the high mountains in the provinces of Huambo, Benguela, Cuanza Sul and Huíla;
- **Kalahari Biome** – Transitional Plateau and Escarpment zone is a transitional biome that occupies a region between the shrubs and thickets of the coastal belt of the

Karoo-Namibe zone and the Zambezian forests of *Brachystegia* of the interior plateau. It is characterized by a continuous series of wet vegetation types and extends southwards from the Guinea-Congolese and savannah forest systems following the escarpment to Campangombe. This steep area has affinities with the three biomes, also acting as a barrier between the two driest biomes allowing development between them. The ecosystems found in this zone include evergreen forest, deciduous forest and dry brush communities, all of which have important biogeographic characteristics;

- **Karoo-Namibe Biome** - The Karoo-Namibe region is a regional center of endemism and has an arid climate with prolonged dry seasons. The endemic plant *Welwitschia mirabilis* is common in these substrates.

It should be noted that the project under analysis in this ESIA is part of the Biome classified as *Zambezian*, as shown in the following figure (*see* **Figure 142**).

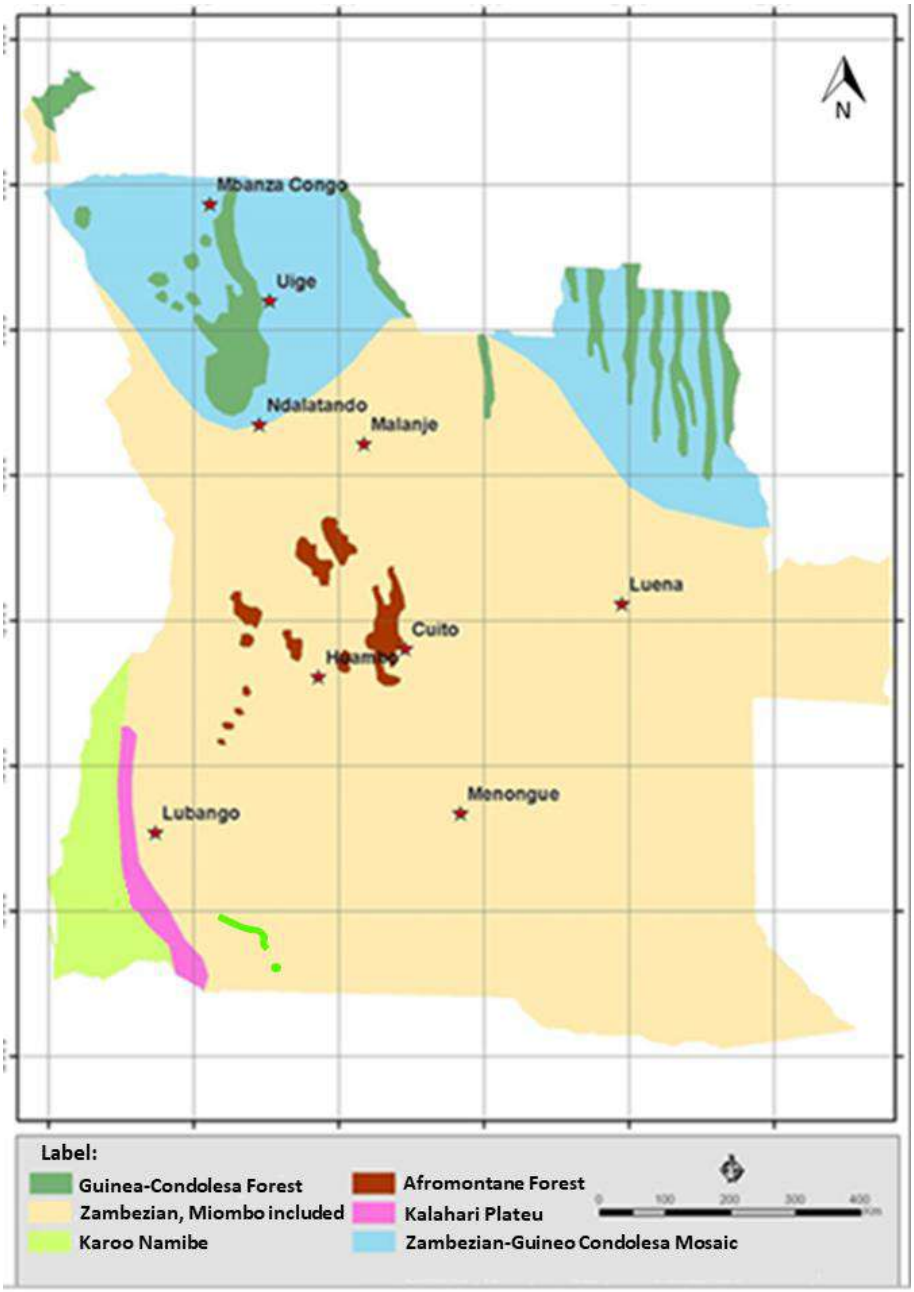


Figure 142 – Location of Angola's biomes with emphasis on the location of the project (marked in purple).

6.9.3.3. Interaction with Sensitive Areas

Angola has large protected areas, currently around 12.98% of the territory, are endowed with a special status with the aim of developing their protection, preservation and conservation.

In 2011, Law No. 38/11 of 29 December created three conservation areas, namely the Luengue-Luiana and Mavinga Parks (in Cuando Cubango) and Mayombe (in Cabinda), the latter being the last legal instrument relating to the establishment of new conservation areas in Angola.

The following conservation areas contribute to this:

- **9 National Parks**
  - Cameia National Park in the Province of Moxico;
  - Cangandala National Park in the Province of Malanje;
  - Mupa National Park in Cunene Province;
  - Quiçama National Park in the Province of Luanda;
  - Luengue-Luiana National Park in the Province of Cuando Cubango;
  - Mavinga National Park in the Province of Cuando Cubango;
  - Bicuar National Park in the Province of Huíla;
  - Iona National Park in Namibe Province;
  - Mayombe National Park in the Province of Cabinda.
- **1 Regional Park**
  - Chimalavera Regional Natural Park in the Province of Benguela.
- **4 Reserves**[1]
  - Luando Integral Natural Reserve in the Province of Malanje;
  - Integral Natural Reserve of Ilhéu dos Pássaros in the Province of Luanda;
  - Buffalo Partial Reserve in the Province of Benguela;
  - Namibe Partial Reserve in Namibe Province.

The following table (*see* **Table 37**) summarizes the Angolan territory's conservation areas, their statutes and the legal process for their establishment.

Table 37 - Creation and statutes of current conservation areas in Angola (adapted from Strategic Plan for the Angola Protected Areas System, 2018)

Conservation area	Province	Area (km²)	Creation and Bylaws
PARQUES NACIONAIS			
Bicuar National Park	Huíla	7.900	- Initially protected as a game reserve by Government Decree 2620 of 16 April 1938; - The limits were changed by Decree 4880 of 6 September 1944. As a result, a Partial Reserve statute was created by Legislative Diploma 2873 of 11 December 1957;

[1] Partial reserves in Cuando Cubango province are excluded as they were included in the two national parks created in Cuando Cubango under Law No. 38/11 of 29 December.

Conservation area	Province	Area (km²)	Creation and Bylaws
			- It was established as a National Park by Legislative Diploma 3527 of 26 December 1964. The new limits were redefined by Decree 384 of 13 June 1972.
Cameia National Park	Moxico	14.450	- Initially protected as a game reserve by Government Decree 1670 of 6 April 1935; - Confirmed as a Nature Reserve with the limits changed by Decree 2620 of 16 April 1938; - It was established as a National Park by Legislative Diploma 2873 of 11 December 1957.
Cangandala National Park	Malanje	630	- Initially classified as an Integral Nature Reserve by Legislative Diploma 3374 of 25 May 1963; - The initial limits were changed by Legislative Diploma 3529 of 26 December 1964; - It was established as a National Park by Legislative Diploma 4017 of 25 May 1970.
Iona National Park	Namibe	15.150	- Initially protected as a Hunting Park by Decree 2421 of 2 October 1937; - Updated as a Game Reserve by Decree 4880 of 6 September 1944; - Established as Porto Alexandre National Park by Legislative Diploma 2873 of December 11, 1957; - Renamed as Iona National Park with changes to the limits by Diploma 3524 of 26 December 1964.
Quiçama National Park	Luanda	9.960	- Initially protected as a game reserve by Government Decree 2620 of 16 April 1938. - Established as a National Park by Legislative Diploma 2873 of December 11, 1957.
Mupa National Park	Cunene	6.600	• Protegido inicialmente como uma reserva de caça por Decreto Governamental 2620 de 16 Abril 1938. • Os limites foram mudados pelo Decreto 4880 de 6 Setembro 1944, sendo dado o estatuto de Reserva Natural Integral pelo Diploma Legislativo 2873 de 11 Dezembro 1957. • Estabelecido como Parque Nacional pelo Diploma Legislativo 3527 de 26 Dezembro 1964. - Initially protected as a game reserve by Government Decree 2620 of 16 April 1938; - The limits were changed by Decree 4880 of 6 September 1944, being given the status of Integral Natural Reserve by Legislative Diploma 2873 of 11 December 1957; - Established as a National Park by Legislative Diploma 3527 of 26 December 1964.
Luengue-Luiana National Park	Cuando Cubango	45.818	- Established as a National Park by Law 38/11 of December 29, 2011.
Mavinga National Park	Cuando Cubango	46.072	- Established as a National Park by Law 38/11 of December 29, 2011.
Mayombe National Park	Cabinda	1.930	- Established as a National Park by Law 38/11 of December 29, 2011.
NATURAL PARKS			
Chimalavera Regional Natural Park	Benguela	150	- Initially protected as a Special Reserve by Legislative Diploma 4124 of 5 June 1971; - Established as a Regional Natural Park by Decree 352 of 15 April 1974.
RESERVES			

Conservation area	Province	Area (km²)	Creation and Bylaws
Luando Integral Natural Reserve	Malanje/ Bié	8.280	- Established as a Game Reserve by Government Decree 2620 of 16 April 1938; - Updated to Nature Reserve by Legislative Diploma 2873 of 11 December 1957.
Ilhéu dos Pássaros Integral Nature Reserve	Luanda	2	- Established as an Integral Nature Reserve by Provincial Decree 55 of December 21, 1973.
Namibe Partial Reserve	Namibe	4.450	- Established as a Partial Reserve by Legislative Diploma for the limited time period between 12 June 1957 to 31 December 1959; - Maintained for 3 years with changes to the limits by Legislative Diploma 3060 of 24 August 1960; - About 29,000 hectares around the city of Moçâmedes were annexed to the reserve area by Government Decree 480 of 28 July 1973.
Buffalo Partial Reserve	Benguela	400	- Established as a Partial Reserve by Government Decree 325 of 5 April 1974.
Total area, Km²		**162.558**	

Analyzing the information in the previous table (*see* **Table 37**) it appears that in Moxico Province there is an area with national conservation status, namely the Cameia National Park, which is in line with the information extracted from the World Database on Protected Areas (WDPA) which catalogs the IUCN definition of Protected Areas as shown in the following figure (*see* **Figure 143**).

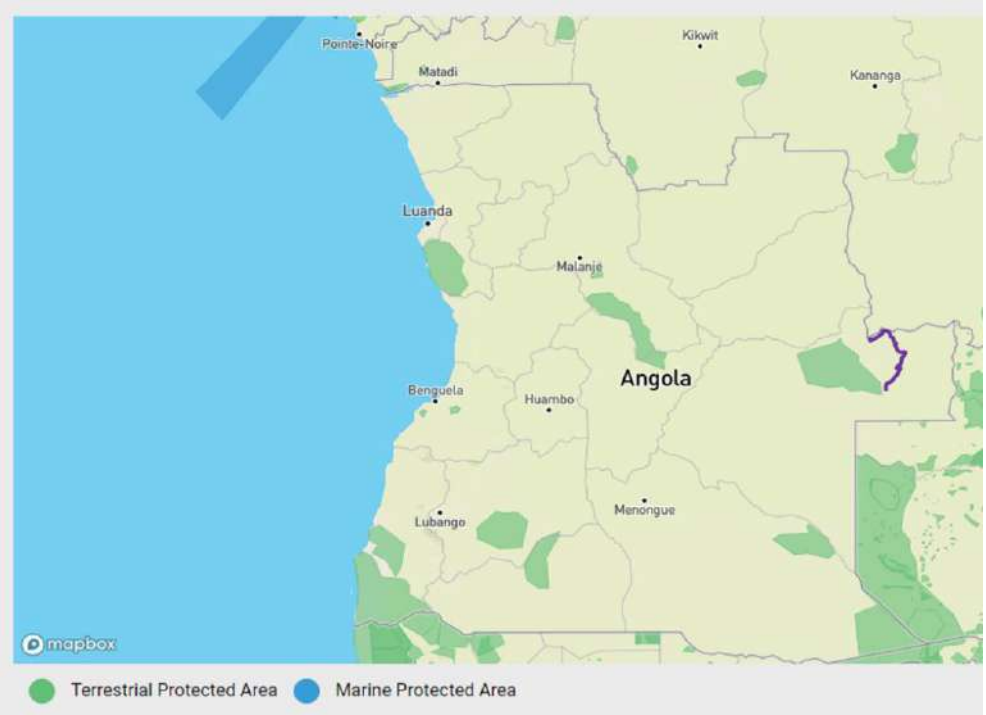


Figure 143 – Representation of protected areas in Angola, highlighting the location of the project marked in purple (IBAT, 2023).

It should be noted that the Key Biodiversity Areas (KBAs) defined by the IUCN are based on the Important Bird and Biodiversity Area (IBA). KBAs are sites that contribute significantly to the global persistence of biodiversity in terrestrial, freshwater and marine ecosystems. They are identified through national processes by local stakeholders using a globally agreed set of scientific criteria. The following figure (*see* **Figure 144**) shows the map of Angola with the overlapping of the KBAs with the Protected Areas of Angola, previously shown in **Figure 143**.

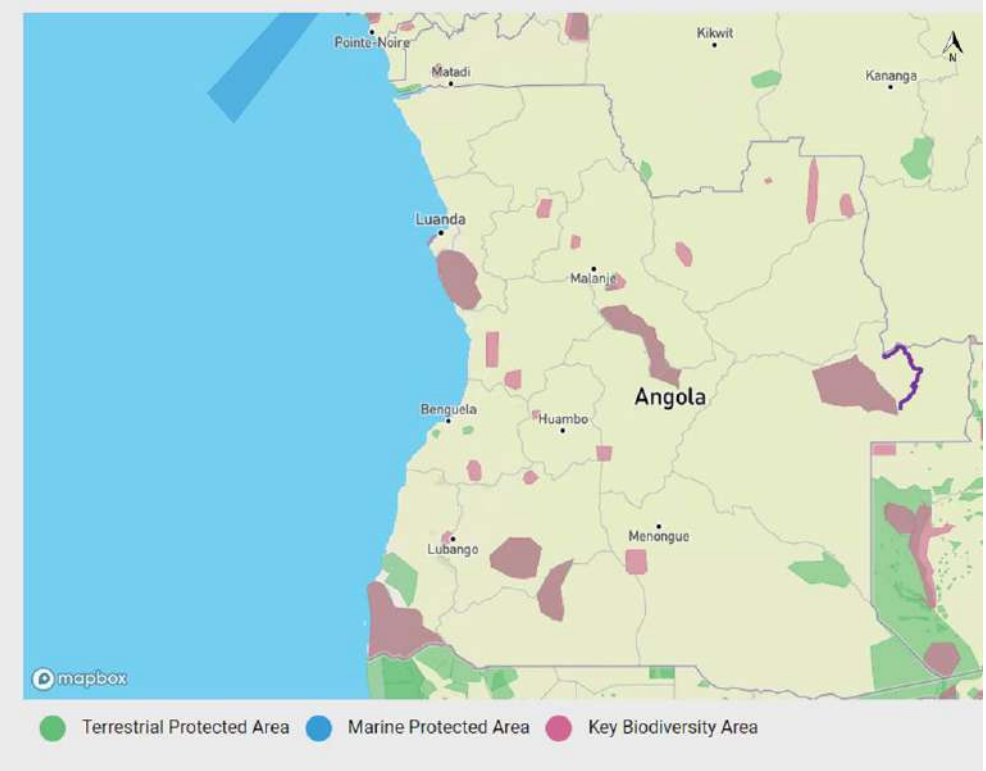


Figure 144 – Representation of Key Biodiversity Areas (KBAs), highlighting the location of the project, marked in purple (IBAT, 2023).

By analyzing the previous figure (*see* **Figure 144**), it can be seen that the project site does not intersect/overlap any conservation area and/or Key Biodiversity Areas, either in accordance with Angolan legislation or in accordance with the international conventions.

It should be noted that the Cameia National Park, referred to above, is located approximately 125 km east of the city of Luena (capital of the Province) and is approximately 47.972 km from the beginning of the road section, approximately 105.389 km from the intermediate section of the road section (*see* **Figure 145**) and, finally, about 5.718 km from the end of the road section (*see* **Figure 146**).

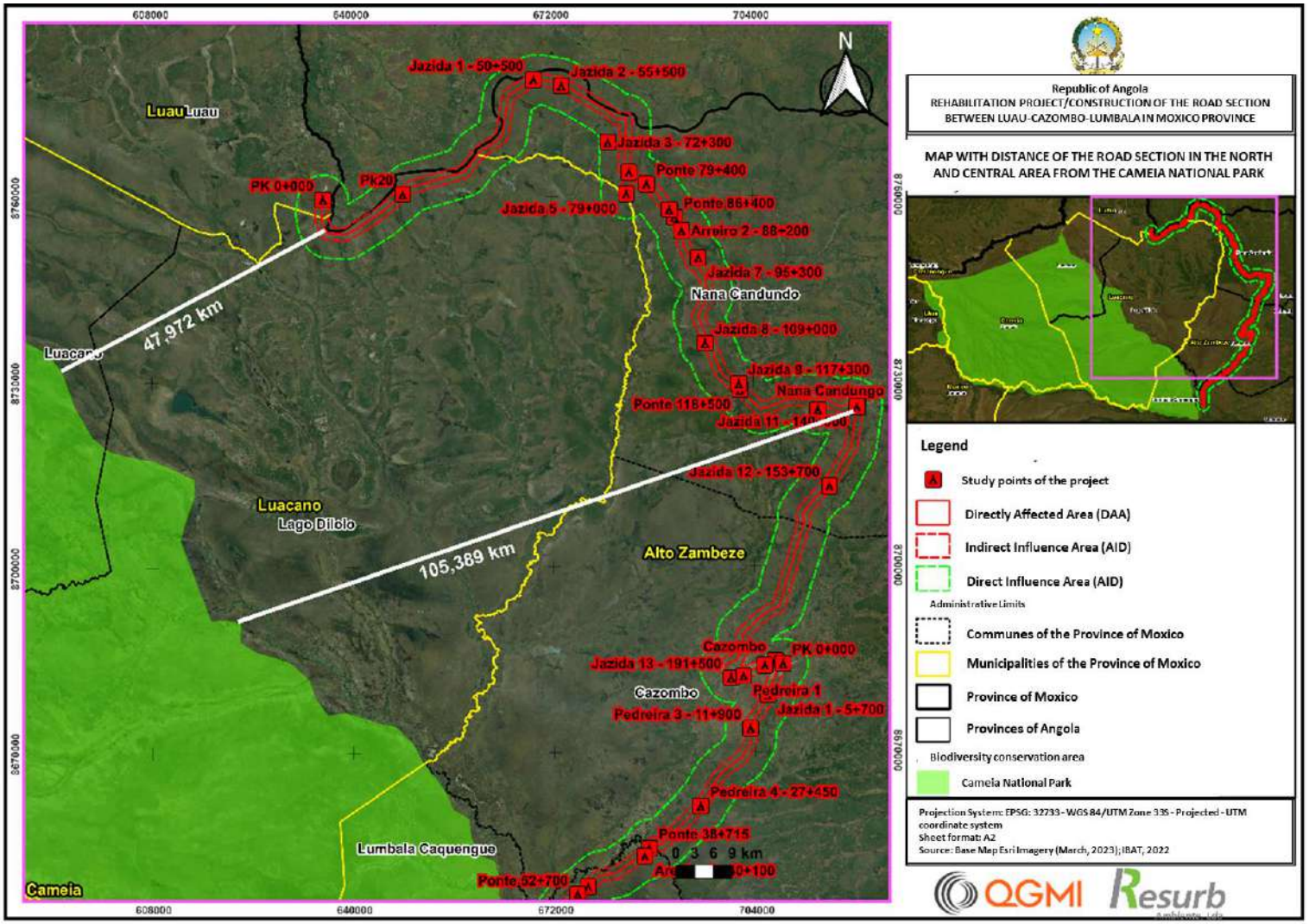


Figure 145 – Diagram of the distance between the beginning and the middle section of the road section in relation to the Cameia National Park.

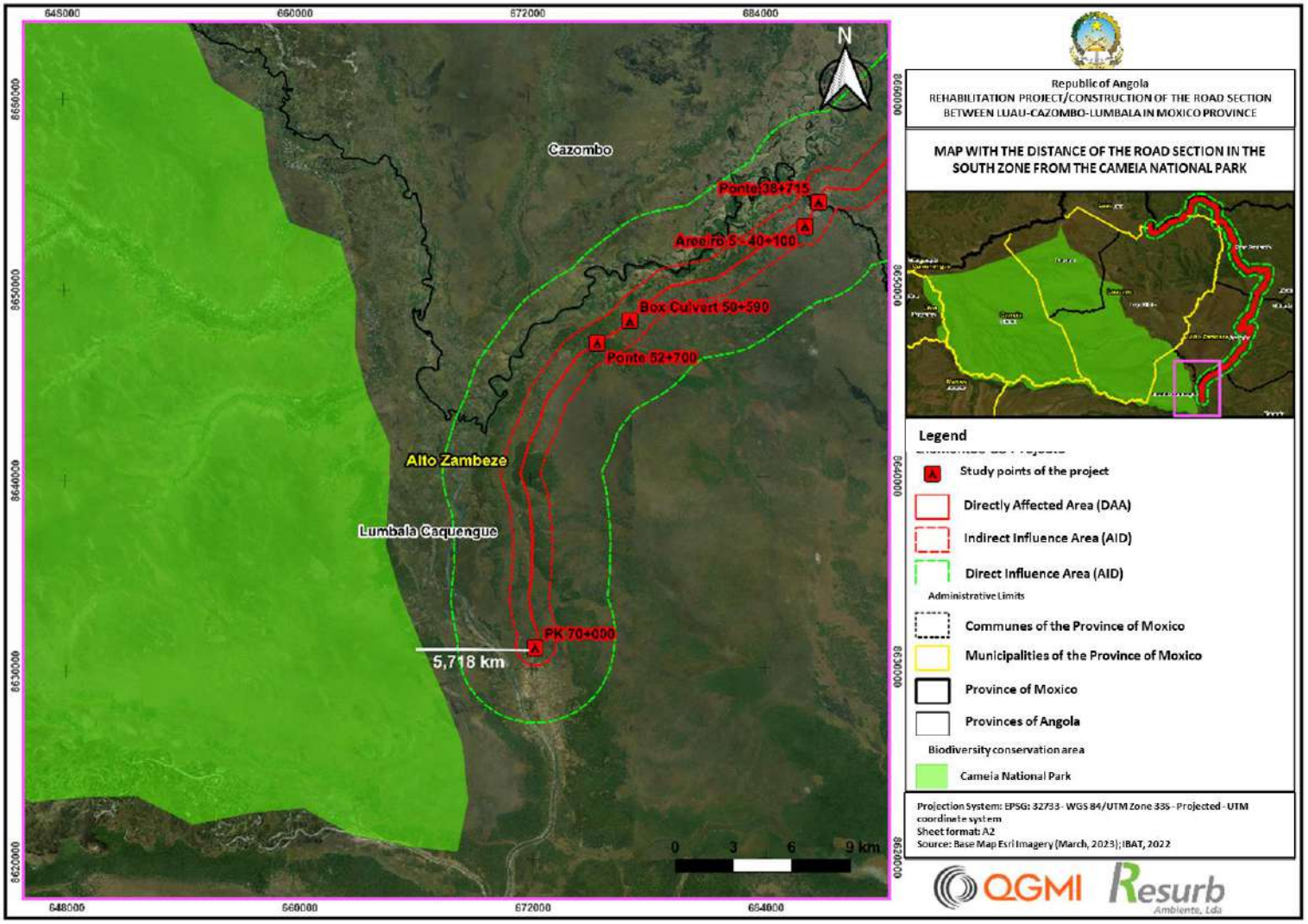


Figure 146 – Diagram of the distance at the end of the road section in relation to the Cameia National Park.

Thus, taking into account the above, it is considered that the project under analysis will not present ecological interaction with the surrounding sensitive/classified areas. However, it is considered that by adopting good environmental practices during the different phases of the project, such as, for example, planning construction activities so that the most disturbing actions do not take place during the nesting period of the species, defining circulation, protection of species with greater ecological value, as well as the implementation of a phased landscape integration project that selects local tree species that are suitable for the soil and climate conditions of the project site (indigenous species), could certainly reduce the magnitude of the impact.

6.9.3.4. Floristic Cast

This chapter presents the species inventoried during the technical visits made to the site where the project will be implemented and its surroundings. It should be noted that the common names adopted are those that are widespread in Angola. In some cases, no vernacular names were found, thus referring the identification of the species only to the scientific name.

The vegetation in the project's area of influence is mainly represented by arboreal strata and shrub strata. The tree stratum is represented by the following species: *Terminalia brachystemma, Albizia adianthifolia, Cryptosephalum exfoliatum subspecies Pseudotaxus sp, Pterocarpus angolensis, monotes sp, Combretum zeyheri, Guibourtia coleosperma, burkea africana, Dialium engleranum, Swartzia madascariensis*; and the shrub layer is represented by the following species: D*iplorhynchus condylocarpon being the most dominant, Copaifera baumiana*, having also identified in this place the presence of the following species: *ochna pulchra* and *Uapaka kirkiana*.

According to the IUCN (2022), in the Project's area of influence, there are at least 135 species of flora (*see* **Annex XI - Table 1**), subdivided into 25 families, with emphasis on the *Cyperaceae* family with 34 species listed, followed by the *Hydrocharitaceae,* with 13 species, and by the *Asteraceae* families, with 10 species. Families with less than 6 species were included in the "Others" category, making a total of 50 species (*see* **Figure 147**).

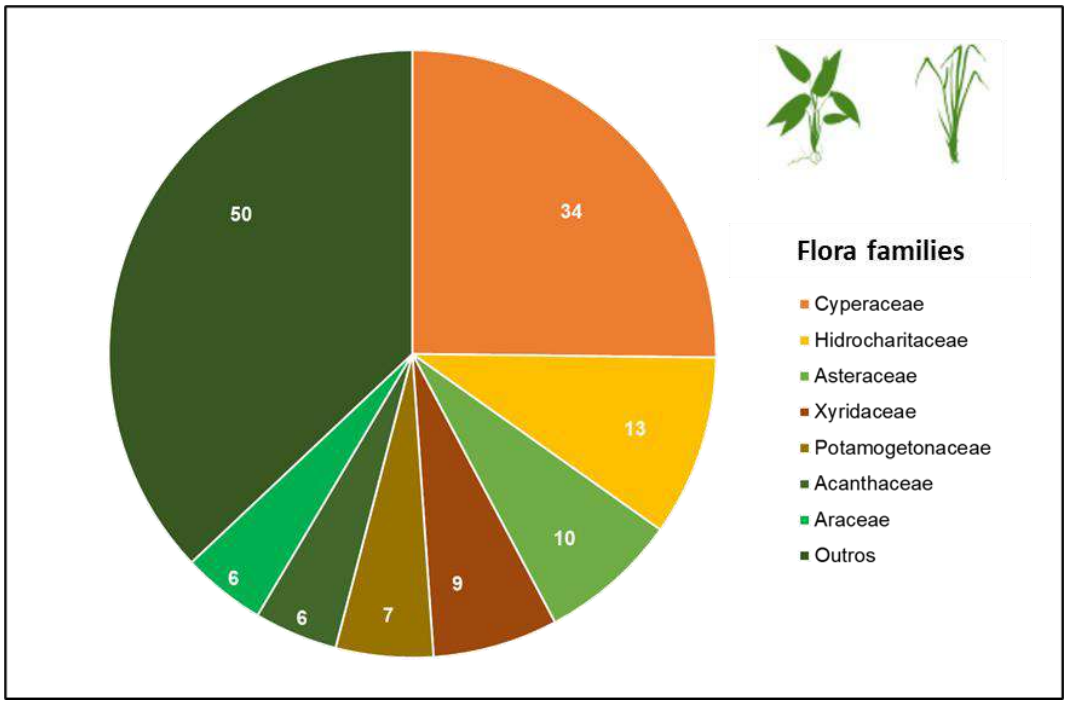


Figure 147 - Schematization of the number of potential *taxa* of Plants per Family.

All listed native species were evaluated by the IUCN (2022). Of these, according to the IUCN, 7 correspond to threatened species (*see* **Annex XI - Table 1**) the following species:

- Two species with Critically Endangered (CR) status: *Rotala robynsiana* and *Xyris exigua*;
- Three species with Endangered (EN) status, *Genlisea angolensis, Psilotrichum axilliflorum, Nymphoides tenuissima*;
- Two species with Vulnerable (VU) status, *Inversodicraea cristata* and *Rotala smithii*.

During the field surveys, 28 plant species abundant in the region were identified, namely: *Uapaca kirkiana, Syzigium guineense, Strychnos Cocculoides, Pterocarpus angolensis, Poliostigma thonningii, Opuntia ficus indica, Diplorynchus condylocarpon, Brachystegia spiciformis, Albizia antunesiana, Parinari curatellifolia, Nymphea alba, Brachystegia tamarindoides, Btachystegia boehmii, Terminalia brachystemma, Ochna pulchra, Rafia textilis, Eulophia sp, Harungana madagascarensis, Senna siamea, Vernonia conferta, Hellichrisum sp., Bignoniaceae, Hallea stipulosa, Erythrophleum africanum, Vitex madiensis, Englerophytum sp* and *Burkea africana*.

The following figures (*see* **Figures 148** to **159**) illustrate some floristic species identified during the field survey in the area surrounding the project. At the same time, **Annex XII** presents the photographic record of some floristic species identified during the field surveys.

Figure 148 – Photographic record of *Parinari curatellifolia.*

Figure 149 – Photographic record of *Poliostigma thonningii.*

Figure 150 – Photographic record of *Pterocarpus angolensis.*

Figure 151 – Photographic record of *Strychnos cocculoides.*

Figure 152 – Photographic record of *Syzygium guineense.*

Figure 153 – Photographic record of *Terminalia brachystemma.*

Figure 154 – Photographic record of *Diplorynchus condylocarpon.*

Figure 155 – photographic record of *Brachystegia spiciformis.*

Figure 156 – photographic record of *Brachystegia boehmii.*

Figure 157 – Photographic record of banyan tree - *Opuntia ficus-indica.*

Figure 158 – Photographic record of white water lily - *Nymphaea alba*.

Figure 159 – Photographic record of cabbages sold by the local population - *Brassica olerácea*.

As mentioned in **Chapter 6.8.1**, the project under analysis concerns the rehabilitation of an existing road section located in the road easement area, which is why it is not foreseen that the local community's means of subsistence will be allocated (areas of cultivation, forests and/or housing, among others) existing in the surroundings of the project.

The following figure (*see* **Figure 160**) shows a map with the occurrence of floristic species identified in the areas of influence of the project, during the fieldwork carried out by Resurb.

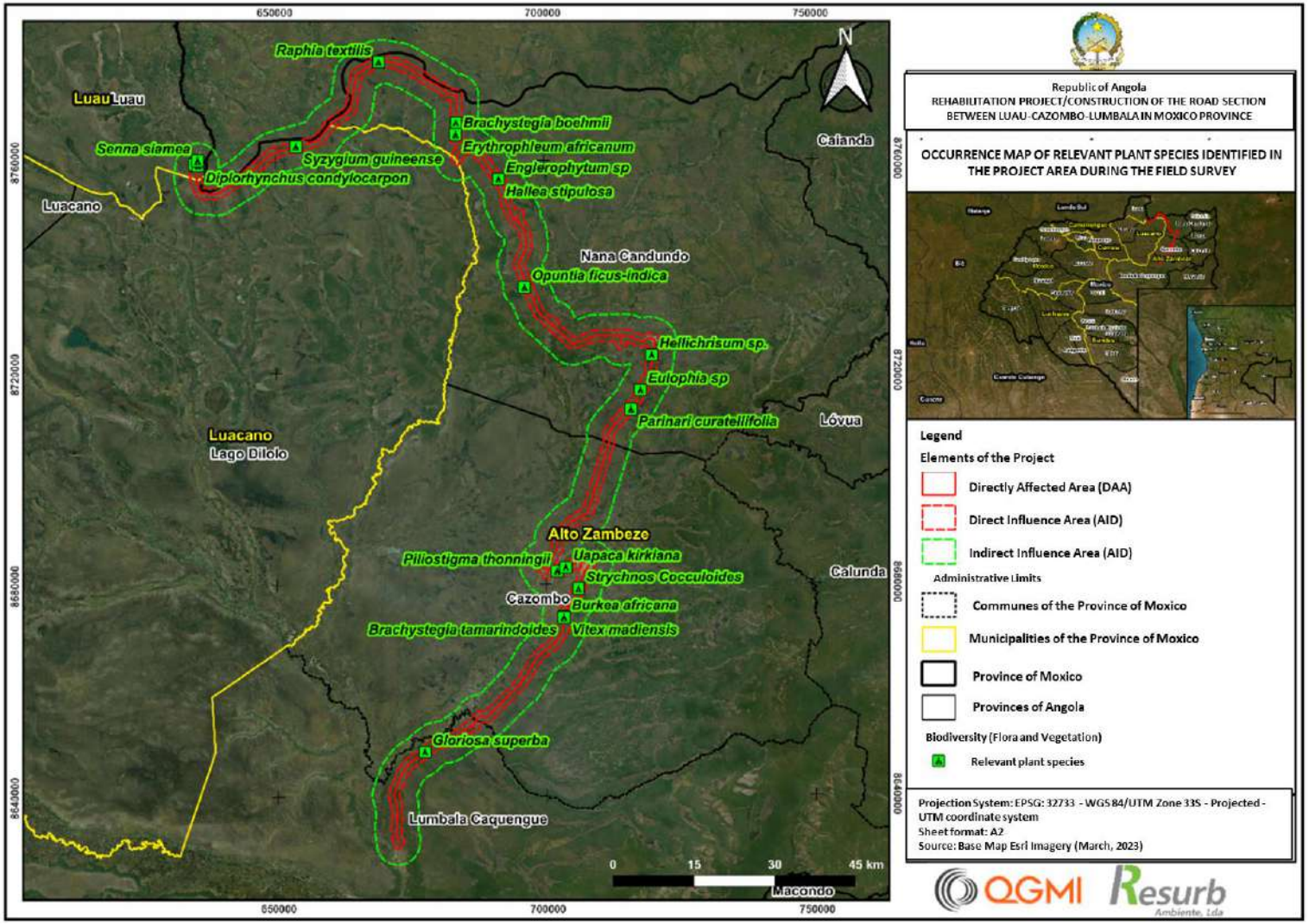


Figure 160 – Map of occurrences of relevant plant species identified in the project area during the field survey.

When conducting community surveys, it was noted that a wide variety of plant species were used for food, housing construction, charcoal making, heating (firewood) and the manufacture of domestic and commercial utensils.

6.9.3.5. Plant Species at Risk

The following table presents the floristic species included in the Red List of Species in Angola (*see* **Table 38**).

Table 38 – Angola Red Species List – 2018-2023 (Source: Ministry of the Environment)

Scientific Name	Common Name	Category	Historial Occurrence
Chiorophora excelsa	Moreira	Vulnerable	Humid Tropical Forest of Cabinda, Uíge and Kwanza Norte Provinces
Entandrophragma utile	Munguba	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Albizia glaberrima	Muanza	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Khaya anthotheca	Undianuno/Kibaba	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Pterocarpus angolensis	Tacula	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Antiaris welwitschii	N´dulo-Ako	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Gambeya africana	Longui	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Ceiba pentandra	Mafumeira	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Adansonia digitata	Embondeiro	Vulnerable	Wet Tropical Savanas
Ricinodendron heudeloti	Munguela	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Entandrophragma angolensis	Kitiba	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Diospyros mespiliformis	Ebano	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Caesalpinia leostachya	Pau Ferro	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Dalbergia latifolia	Pau Preto	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Santalum album	Sandalo Africano	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Khaya sp	Mogno	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Swartzia fistuloide	Pau Rosa	Vulnerable	Humid Tropical Forest of Cabinda
Autrenella congolensis	Kungulo-Mukungulo	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Brachystegia spiciformis	Mupanda	Vulnerable	Humid Tropical Forest of Cabinda, Bengo, Uíge and Kwanza Norte Provinces
Welwitschia	Welwitschia mirabilis	Vulnerable	Namibe Desert
Lannea welwitschii	Mukumbi-kumbi	Vulnerable	Humid Tropical Forest
Celtis mildbraedii	Kababa-Ohia	Vulnerable	Humid Tropical Forest
R. Mucronata	Mangais vermelho	Vulnerable	Cabinda, Zaire, Bengo and Luanda

Scientific Name	Common Name	Category	Historial Occurrence
Bruguiera gymnorrhiza	Mangais Pretos	Vulnerable	Cabinda, Zaire, Bengo and Luanda
Gnetum africanum	N´fumbua	Vulnerable	Uíge, Cabinda, Zaire and Bengo Provinces
Harpagophytum procumbens	Makakata	Vulnerable	Cuando Cubango Province
Pausinystalia macroceras	*Pau de Cabinda*	Vulnerable	Cabinda Province
Hyphaene coriacea	Palmeira Real	Vulnerable	Luanda Province

Analyzing the previous table (*see* **Table 38**) it is verified that there are no historical occurrences of the presence of vulnerable species included in the Red List of Species of Angola in the Province of Moxico.

The following table (*see* **Table 39**) presents the floristic species identified during the fieldwork, their respective conservation status (Red List of Angolan Species - Executive Decree No. 252/18 of 13th July and Red List of IUCN Species, 2022) and where they were identified.

Table 39 – List of flora species identified during the field surveys carried out in the areas of influence of the project

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Communes	Municipalities
1	*Brachystegia boehmii*	Fabaceae	Little Concern	-	683709.21	8767230.07	Nana Candundo	Alto Zambeze
2	*Brachystegia spiciformis*	Fabaceae	Little Concern	Vulnerable	703282.62	8673849.24	Cazombo	Alto Zambeze
3	*Brachystegia tamarindoides*	Fabaceae	Little Concern	-	703275.67	8673694.61	Cazombo	Alto Zambeze
4	*Burkea africana*	Fabaceae	Little Concern	-	703306.19	8673825.21	Cazombo	Alto Zambeze
5	*Diplorhynchus condylocarpon*	Apocynaceae	Little Concern	-	635571.76	8759310.69	Luau	Luau
6	*Englerophytum sp*	Sapotaceae	-	-	691602.28	8756520.48	Nana Candundo	Alto Zambeze
7	*Erythrophleum africanum*	Fabaceae	Little Concern	-	683623.92	8765037.22	Nana Candundo	Alto Zambeze
8	*Eulophia sp*	Orchidaceae	-	-	717818.00	8716564.21	Nana Candundo	Alto Zambeze
9	*Gloriosa superba*	Colchicaceae	Little Concern	-	677296.73	8648424.95	Lumbala Caquengue	Alto Zambeze
10	*Hallea stipulosa*	Rubiaceae	Near threatened	-	691548.75	8756493.16	Nana Candundo	Alto Zambeze
11	*Harungana madagascariensis*	Hypericaceae	Little Concern	-	691550.03	8756544.66	Nana Candundo	Alto Zambeze
12	*Hellichrisum sp.*	Asteraceae	-	-	719973.71	8723158.54	Nana Candundo	Alto Zambeze
13	*Opuntia ficus-indica*	Cactaceae	Deficient data	-	696328.86	8736090.60	Nana Candundo	Alto Zambeze
14	*Parinari curatellifolia*	Chrysobalanaceae	Little Concern	-	716011.00	8712938.73	Nana Candundo	Alto Zambeze
15	*Piliostigma thonningii*	Fabaceae	-	-	702084.86	8682447.68	Cazombo	Alto Zambeze
16	*Pterocarpus angolensis*	Fabaceae	Little Concern	Vulnerable	683636.76	8765095.22	Nana Candundo	Alto Zambeze
17	*Raphia textilis*	Arecaceae	Little Concern	-	669341.97	8778751.87	Nana Candundo	Alto Zambeze
18	*Senna siamea*	Fabaceae	Little Concern	-	635515.45	8760276.98	Luau	Luau
19	*Strychnos Cocculoides*	Loganiaceae	Little Concern	-	706024.81	8679125.45	Cazombo	Alto Zambeze
20	*Syzygium guineense*	Myrtaceae	Little Concern	-	653820.32	8762821.61	Lago Dilolo	Luacano
21	*Terminalia brachystemma*	Combretaceae	-	-	635030.33	8759583.33	Luau	Luau
22	*Uapaca kirkiana*	Phyllanthaceae	Little Concern	-	703674.51	8683150.95	Cazombo	Alto Zambeze
23	*Vernonia conferta*	Asteraceae	-	-	635312.88	8759270.14	Luau	Luau
24	*Vitex madiensis*	Lamiaceae	Little Concern	-	703311.01	8673700.48	Cazombo	Alto Zambeze
25	-	Bignoniaceae	-	-	691563.49	8756520.26	Nana Candundo	Alto Zambeze

During the field work carried out by Resurb, two species were identified that require special attention, due to the fact that these (*Pterocarpus angolensis, Brachystegia spiciformis*) are classified as vulnerable in the Red List of Species of Angola (Executive Decree n.º 252/18 of 13th July) (*see* **Table 38**) due to the excessive exploitation of wood in this region, which has negatively affected the species richness of the region. The absence of these species could lead to changes in the landscape and consequently the development of competing species.

With regard to the IUCN Red List of Species (2022) (*see* **Table 39**), of the 25 plant species identified during fieldwork, 16 species are classified as Least Concern, one Near Threatened species, Data Deficient species and 7 species are not classified.

6.9.4. Fauna

According to the thematic studies carried out under the National Biodiversity Strategy and Action Plan (NBSAP) it was established that 275 species of mammals, 900 species of avifauna components of international importance, 15 species of fruit bats, 100 species of amphibians were identified of which 19 are endemic, 16 species of antelope including the giant sable.

Fauna in Moxico Province is abundant, especially in the northern part, where Cameia National Park has an animal reserve. There, we can find animals such as the Elephant, the Sable, the Lion, the Leopard, the Jackal, the Jaguar, the Antelope, the Hippopotamus, the Blue Monkey, etc. (*in* wordpress.com).

In the following subchapters (**Chapters 6.9.3.1.** to **6.9.3.3.**), the faunal biodiversity and biological/biotic factors of the project implementation area are described, also influenced by the ecological factors (physical/abiotic) previously described in the environmental descriptors presented above.

6.9.4.1. Faunistic Cast

6.9.4.1.1. Terrestrial and Freshwater Invertebrates

Freshwater invertebrates are distributed in lentic ecosystems, characterized by still water (lakes, ponds and swamps) and lotic ecosystems, which have moving water (streams, springs and rivers).

According to IUCN (2022), throughout the project's area of influence, there are at least 16 species of freshwater molluscs (*see* **Annex XI - Table 2**), subdivided into 10 families, with emphasis on the *Planorbidae family* with 4 listed species, followed by *Sphaeriidae* with 3 species (*see* **Figure 161**). None of the 16 species has threatened status according to the IUCN

(2022), nor are they included in the Red List of Species of Angola (Executive Decree n.º 252/18 of 13 July).

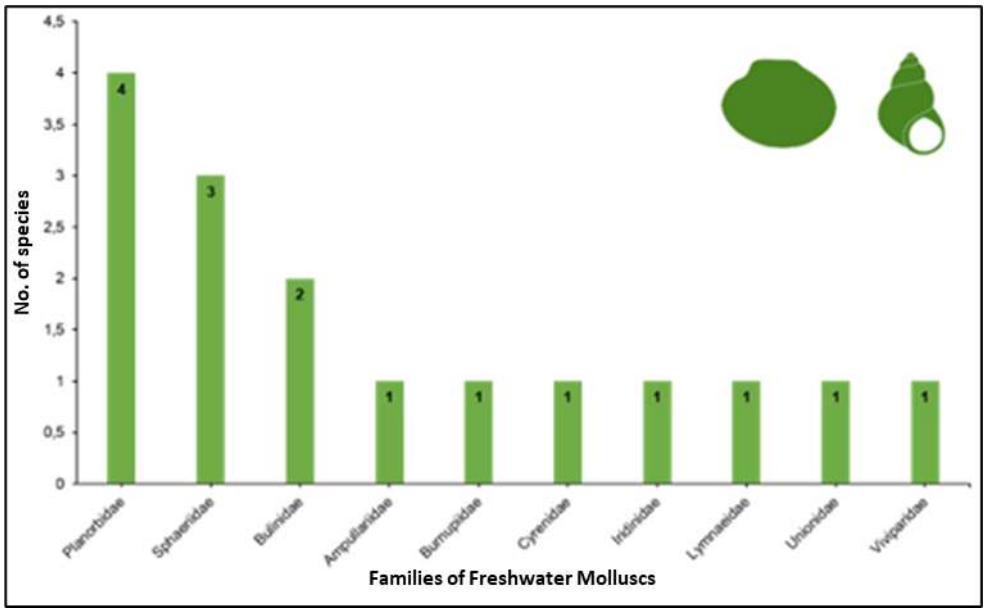


Figure 161 - Number of potential species of freshwater molluscs, per family, present in the project's area of influence.

With regard to arthropods associated with freshwater ecosystems, according to the IUCN (2022) there is a potential presence of 223 species throughout the project's area of influence. Potential species belong to the orders *Araneae* (spiders), *Coleoptera* (beetles), *Decapoda* (crustaceans), *Lepidoptera* (butterflies and moths), *Odonata* (damselflies) and *Orthoptera* (locusts, crickets, hopes, wetas and paquitos) (*see* **Appendix X – Table 3**). The best represented families are the *Libellulidae* (order *Odonata*), with 83 species, and the *Coenagrionidae* (order *Odonata*), with 36 species (*see* **Figure 162**). It should be noted that none of the 223 species has threatened status according to the IUCN (2022), nor are they on the Red List of Species in Angola.

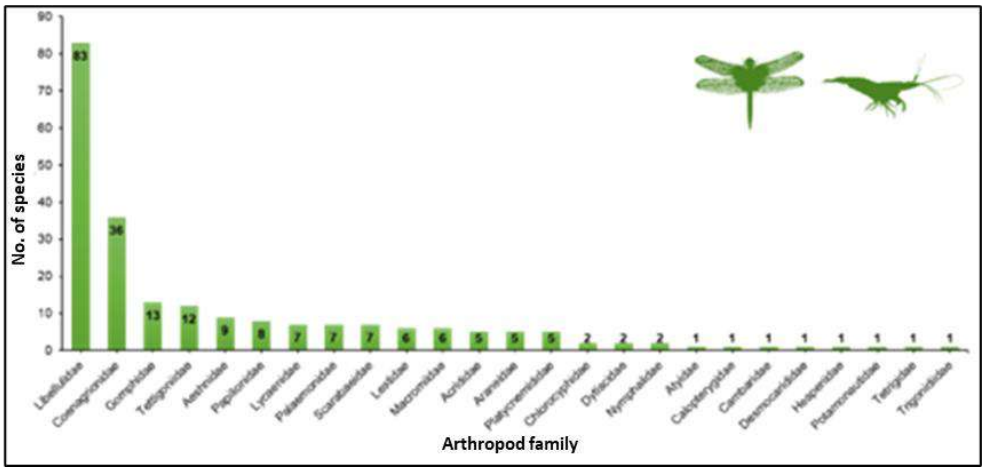


Figure 162 – Number of potential species of freshwater arthropods, per family, present in the project's area of influence.

During the field surveys carried out in the area of influence of the project, it was possible to verify the presence of 4 species of Dragonflies (*Olpagastra lugubris, Orthetrum macrostigma, Palpopleura lucia, Tramea basilaris*), a species of spider (*Argiope australis*) and a species of butterflies (*Danaus plexippus*) (*see* **Figures 163** to **165**).

Figure 163 - Diversity of dragonflies identified throughout the project's area of influence.

Figure 164 - Species of spider (*Argiope australis*) identified in the project's area of influence.

Figure 165 – Species of butterfly (*Danaus plexippus*) identified in the project's area of influence.

The following figure (*see* **Figure 166**) shows a map with the occurrence of terrestrial and freshwater invertebrate species identified in the areas of influence of the project, during the fieldwork carried out by Resurb.

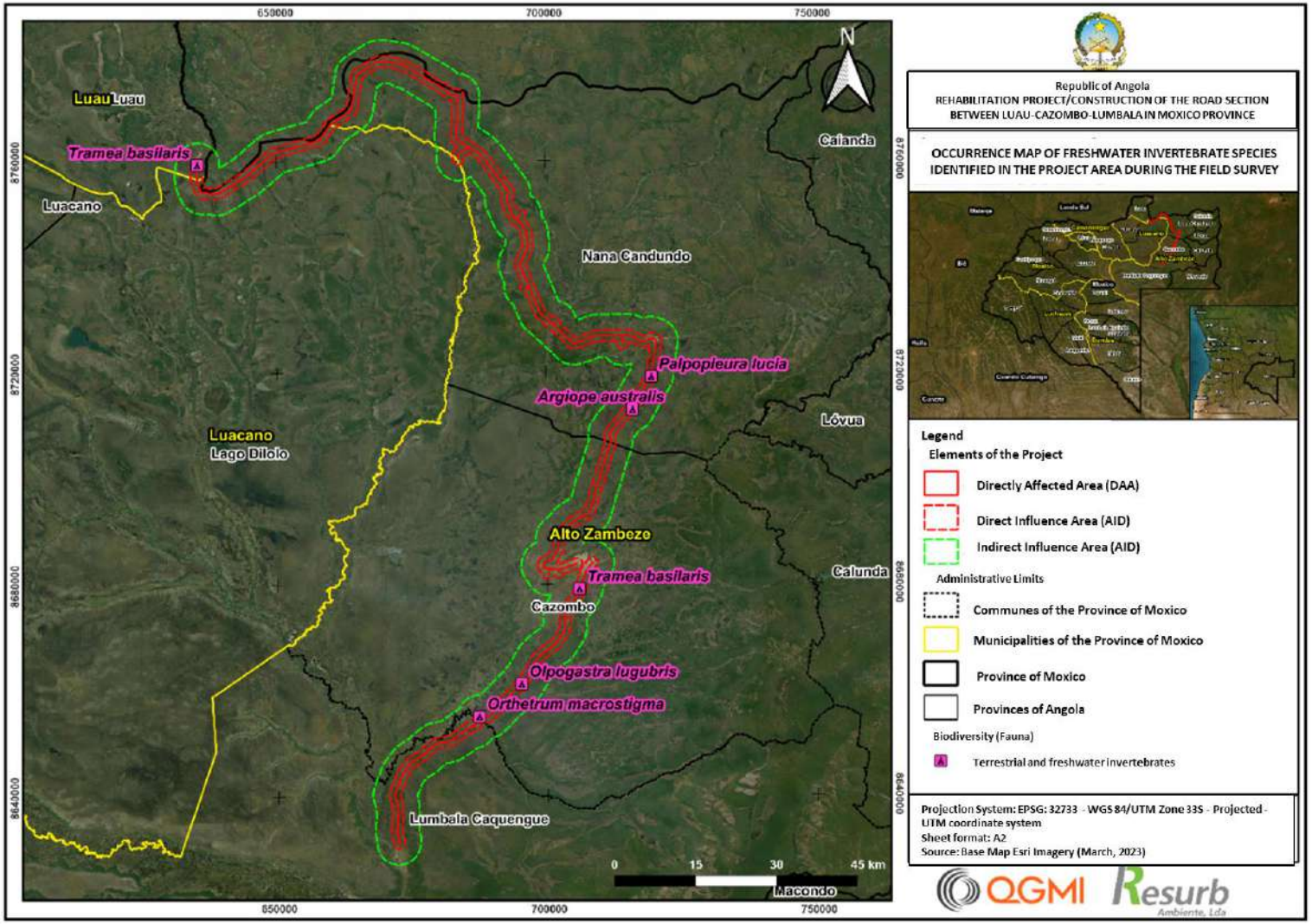


Figure 166 – Map of occurrences of relevant terrestrial and freshwater invertebrate species identified in the project area during the field survey.

The following table (*see* **Table 40**) shows the species of terrestrial and freshwater invertebrates identified during the fieldwork, the respective conservation status (Red List of Species of Angola - Executive Decree No. 252/18 of 13 July and IUCN Red List of Species, 2022) and where they were identified.

Table 40 – List of species of Odonatas and Spider species identified during field surveys

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Comunas	Munícipios
1	*Argiope australis*	Araneidae	-	-	716023.17	8712944.83	Nana Candundo	Alto Zambeze
2	*Olpogastra lugubris*	Libellulidae	Little Concern	-	695139.60	8661179.84	Cazombo	Alto Zambeze
3	*Orthetrum macrostigma*	Libellulidae	Little Concern	-	687282.35	8655077.51	Cazombo	Alto Zambeze
4	*Palpopleura lucia*	Libellulidae	Little Concern	-	719561.98	8719111.76	Nana Candundo	Alto Zambeze
5	*Tramea basilaris*	Libellulidae	Little Concern	-	635307.22	8759352.19	Luau	Luau
6	*Tramea basilaris*	Libellulidae	Little Concern	-	705995.02	8679101.61	Cazombo	Alto Zambeze

Through the analysis of the previous table, it is verified that the six species identified belonging to the Order Odonata and Arane, are not included in the Red List of Species of Angola, however, the species belonging to Odonata, according to the IUCN Red List of Species (2022) are classified as Least Concern, and the Arane species is not classified.

6.9.4.1.2. Freshwater Ichthyofauna

The freshwater ichthyofauna is distributed in lentic ecosystems, characterized by still waters (lakes, ponds and swamps) and lotic ecosystems, which have moving waters (streams, springs and rivers).

The ichthyofauna of the Upper Zambezi is characteristic in several respects, in particular the relatively abundant endemic Synodontis catfish and Serranochromis cichlids (Trewavas, 1964; Bell-Cross, 1975; Greenwood, 1993; Day *et al*., 2009; Pinton *et al*., 2013). In general, the Angolan fauna is ecologically in tune with the extensive infiltration and floodplain drainages within a strip of miombo savannah in Kalahari sand deposits.

In general terms, the known Angolan ichthyofauna from the Upper Zambezi is similar to that of the Cubango basin (often with the same or closely related species, for example*, Mormyridae* of the genera *Hippopotamyrus, Marcusenius, Petrocephalus, Pollimyrus in* Kramer *et al*., 2003, 2004, 2012, 2014, and the species Zaireichthys in Eccles *et al*., 2011). Although there are some endemic species, only one, Paramormyrops jacksoni (*in* Poll 1967), is limited to Angola. The isolated *Neolebias lozii* is known only from the Barotse floodplains of Zambia.

Upper Zambezi fish are well studied and documented (*in* Jackson, 1961; Jubb, 1961, 1967; Balon, 1974; Bell-Cross & Minshull, 1988; Tweddle, 2010), with numbers currently estimated at around 100–120 species (Appendix 11.3; Tweddle *et al*., 2004), possibly with as many as 20-25 not yet described. However, the published records concerning the Angolan territory are scarce and are limited in the literature to the 41 species of Poll (1967) (against the respective list of species with 62), collected mainly in two localities close to the watershed (*Lagoa Calundo* and the tributary *Lunga-Luena*).

According to the IUCN (2022), in the Project's area of influence, there are at least 61 species of freshwater ichthyofauna (*see* **Annex XI - Table 4**), subdivided into 15 families, with emphasis on the *Cyprinidae* family with 21 listed species, followed by Cichlid with 9 species (*see* **Figure 167**). Of the 61 species, only one species has “Vulnerable” status according to the IUCN (2022), which is the *Oreochromis macrochir*, from the *Cichlidae* family.

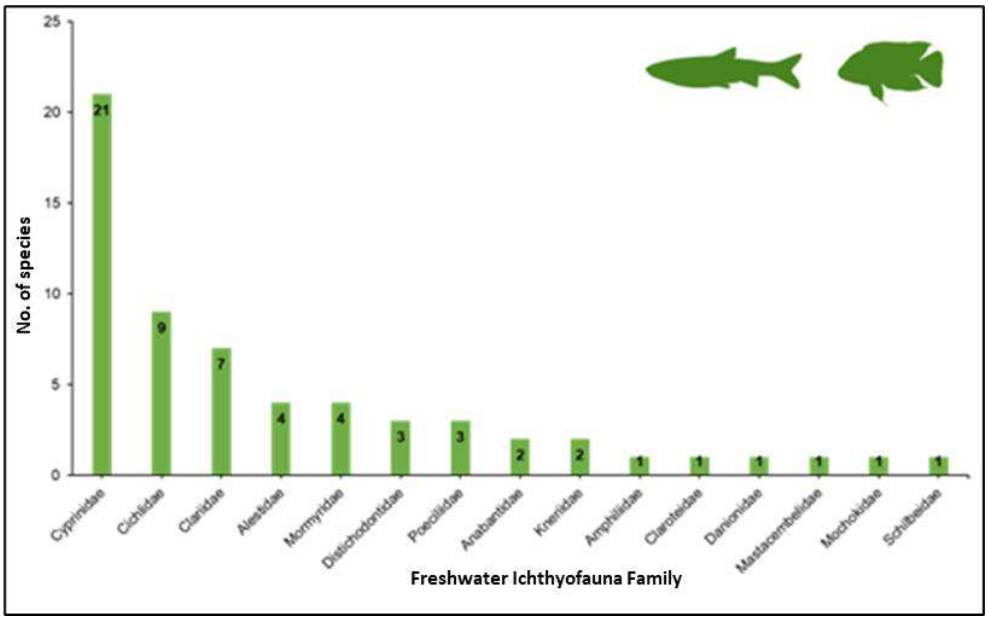


Figure 167 - Number of potential species of freshwater ichthyofauna per family in the project's area of influence.

During the field surveys, 7 species were identified in the study area (*Hepsetus cuvieri, Tilapia rendalli, Oreochromis andersonii, Clarias gariepinus, Mormyrus lacerda, Synodontis leopardinus* and *Synodontis nigromaculatus*), these being the most abundant in the region during this time of year (*see* **Figures 168** to **174**).

Figure 168 - Specimen of *Tilapia rendalli* identified in the study area.

Figure 169 - Specimen of *Synodontis leopardinus* identified in the study area.

Figure 170 - Specimen of *Hepsetus cuvieri* identified in the study area.

Figure 171 - Specimen of *Clarias gariepinus* identified in the study area.

Figure 172 - Specimen of *Oreochromis andersonii* identified in the study area.

Figure 173 - Specimen of *Mormyrus lacerda* identified in the study area.

Figure 174 - Specimen of *Synodontis nigromaculatus* identified in the study area.

The following figure (*see* **Figure 175**) shows a map with the occurrence of species of freshwater fish fauna identified in the areas of influence of the project, during the fieldwork carried out by Resurb.

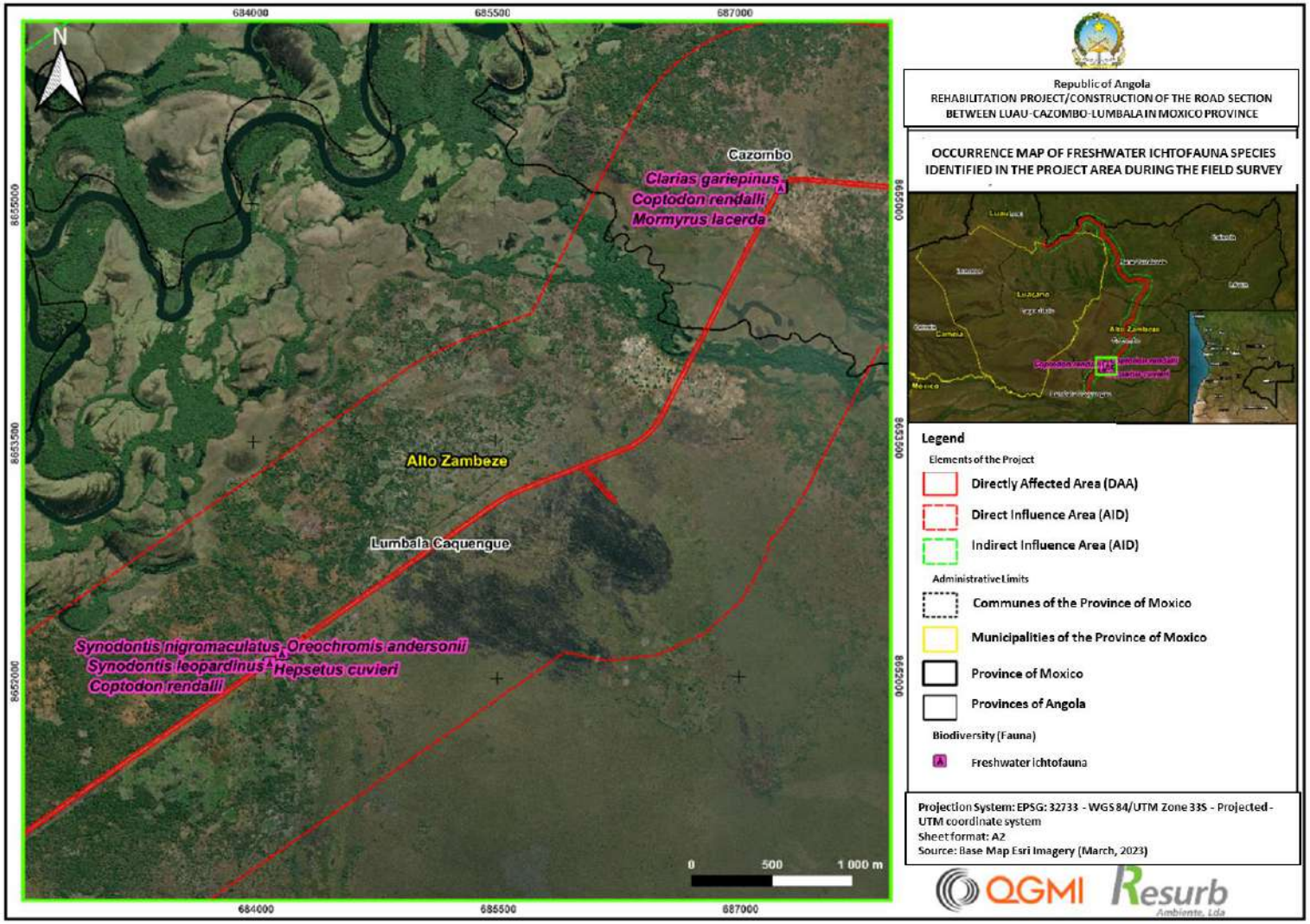


Figure 175 – Map of occurrences of freshwater ichtofauna species identified in the project area during the field survey.

The following table (*see* **Table 41**) presents the species of freshwater ichthyofauna identified during the fieldwork, their respective conservation status (Red List of Species in Angola - Executive Decree No. 252/18 of 13 July and List Red List of IUCN Species, 2022) and the place where they were identified.

Table 41 – Conservation status of freshwater fish species identified during field surveys

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Comunas	Munícipios
1	*Clarias gariepinus*	Clariidae	Little Concern	-	687281.83	8655090.42	Cazombo	Alto Zambeze
2	*Coptodon rendalli*	Cichlidae	Little Concern	-	684090.74	8652103.83	Lumbala Caquengue	Alto Zambeze
3	*Coptodon rendalli*	Cichlidae	Little Concern	-	687284.47	8655083.61	Cazombo	Alto Zambeze
4	*Hepsetus cuvieri*	Hepsetidae	Little Concern	-	684092.93	8652104.37	Lumbala Caquengue	Alto Zambeze
5	*Mormyrus lacerda*	Mormyridae	Little Concern	-	687276.38	8655079.94	Cazombo	Alto Zambeze
6	*Oreochromis andersonii*	Cichlidae	Vulnerable	-	684181.53	8652165.03	Lumbala Caquengue	Alto Zambeze
7	*Synodontis leopardinus*	Mochokidae	Little Concern	-	684088.82	8652102.01	Lumbala Caquengue	Alto Zambeze
8	*Synodontis nigromaculatus*	Mochokidae	Little Concern	-	684169.72	8652162.65	Lumbala Caquengue	Alto Zambeze

By analyzing the table above, it appears that the eight species identified in the areas of influence of the project are not included in the Red List of Species in Angola, however, seven of the species are classified as Least Concern, and only one as vulnerable according to the ICUN Red List of Species (2022).

6.9.4.1.3. Herpetofauna

- **Amphibians**

Amphibians are a highly diverse group that play crucial ecological roles (Beard *et al*., 2002; Davic & Welsh, 2004; Regester *et al*., 2006) and are useful as indicators of ecosystem health (Waddle, 2006), so the relevance of his study goes beyond herpetological curiosity. Currently, 111 species of amphibians are registered in the country (of which 21 are endemic), but according to the aforementioned authors, this number is merely an underestimate and the various taxonomic issues still unresolved challenge the study of all the other aspects relating to this group.

For the region under study (Province of Moxico) about 39 species are described. It should be noted that there are species that require a certain degree of conservation as a result of their biological needs as well as the pressure they have been suffering. Thus, the following species stand out: *Kassinula wittei, Breviceps adspersus, Sclerophrys lemairii*, and these three are classified as "Near Endangered" according to the IUCN, and the species *Xenopus poweri* is the only species classified as "Near Threatened".

According to IUCN (2022), 51 species of amphibians, distributed in 12 families, are potentially present throughout the project's area of influence (*see* **Annex XI -Table 5**). The families with the greatest representation in the area under analysis are the *Ptychadenidae*, with 15 species, followed by the *Hyperoliidae* with 11 species (*see* **Figure 176**). None of the 51 species have threatened status according to the IUCN (2022), nor are they listed on the Angolan Red List of Species.

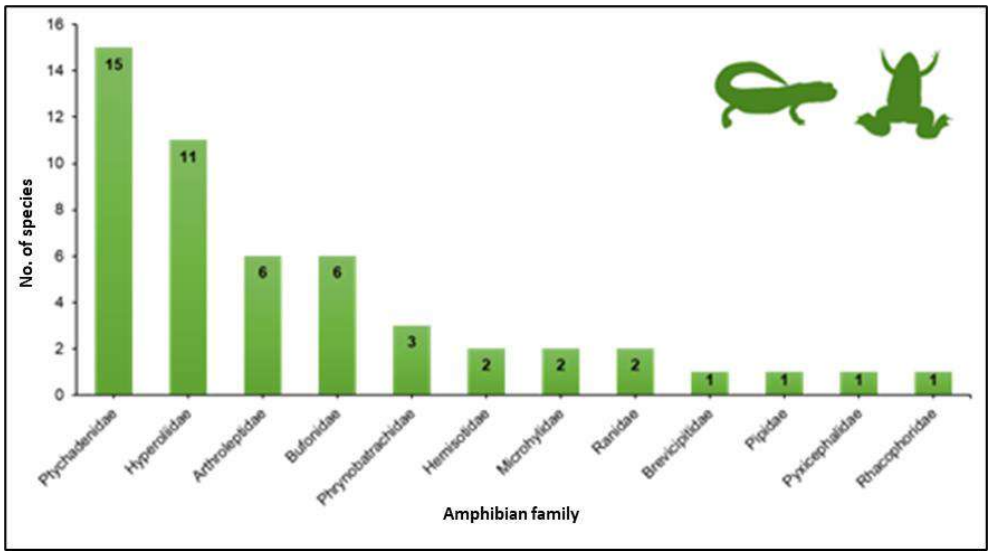


Figure 176 - Number of potential amphibian species, by family, present in the project's area of influence.

Despite the rich diversity of amphibians in this part of the country, as a result of the diversity of habitats, during the field surveys only a single species was observed and photographed (*Hyperolius angolensis angolensis*) (*see* **Figure 177**).

Figure 177 - Amphibian species recorded during field surveys in the project's area of influence (*Hyperolius angolensis angolensis*).

- **Reptiles**

With regard to reptiles, in the area of influence of the project, 75 species are potentially present throughout the entire extension (*see* **Annex XI - Table 6**), subdivided into 20 families, with emphasis on the *Colubridae* family with 16 listed species, followed by *Scincidae* with 7 species (*see* **Figure 178**). None of the 75 species have threatened status according to the IUCN (2022), nor are they listed on the Angolan Red List of Species.

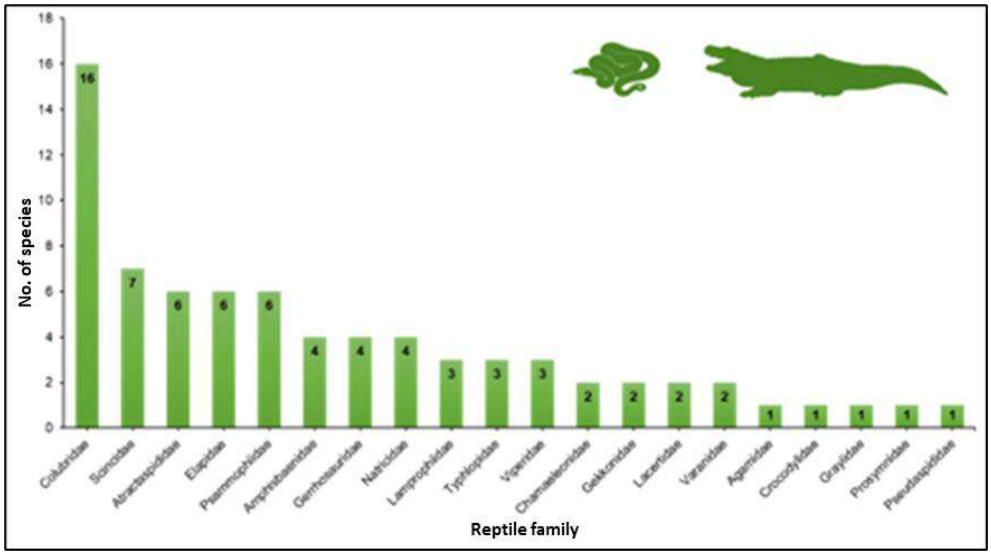


Figure 178 - Number of potential species of reptiles, per family, present in the project's area of influence.

Currently (as of mid-2018), 278 species of reptiles are registered in Angola, comprising 15 chelonians, 3 crocodilians, 132 lizards and 128 snakes. Scaled reptiles (*Squamata*) constitute

the main component of reptile diversity (Pincheira-Donoso *et al*., 2013), with more than 10.000 species currently recognized, of which more than 60% are lizards. The 132 species of Angolan lizards are currently contained in 9 families, with the lizards of the family *Scincidae* (scincids) constituting the group with the greatest diversity.

At the same time, it should be noted that 49 species of reptiles are registered for the study area, however, only 4 were observed and identified (*see* **Figure 179**). The presence of the following species in this region stands out: Pelusios nanus (Laurent 1956), *Lygodactylus angolensis* (Bocage, 1896); *Dalophia angolensis* (Gans, 1865); *Gerrrhosaurus bulsi* (Laurent, 1954); *Varanus albigularis angolensis* (Schmidt, 1933); *Varanus niloticus* (Linnaeus, 1758); *Acanthocercus cyanocephalus* (Falk, 1925); *Python natalensis* (Smith, 1840) and *Crocodylus niloticus* (Laurenti, 1768). Despite not being observed in the project implementation area, there are reports of the regular presence of crocodiles (*Crocodilus niloticus*) in the region's rivers, with several recorded incidents.

Figure 179 - Species of reptiles identified in the project's area of influence.

The following figure (*see* **Figure 180**) shows a map with the occurrence of amphibian species identified in the areas of influence of the project, during the fieldwork carried out by Resurb.

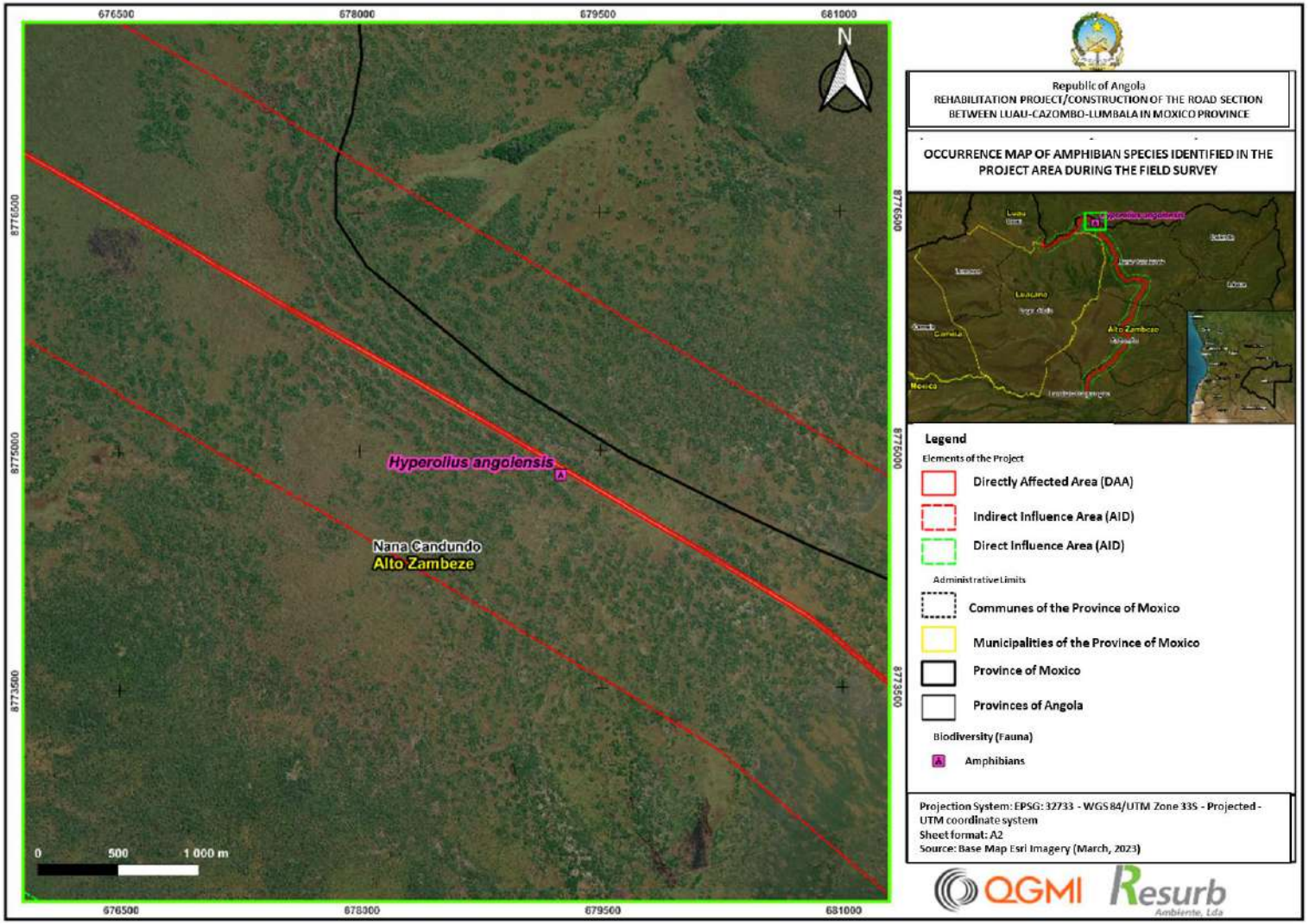


Figure 180 – Map of occurrences of amphibian species, identified in the project area, during the field survey.

The following table (*see* **Table 42**) shows the species of amphibians identified during the fieldwork, their respective conservation status (Red List of Species in Angola - Executive Decree No. 252/18 of 13 July and Red List of IUCN Species, 2022) and where they were identified.

Table 42 – Conservation status of amphibian species identified during field surveys

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Comuna	Munícipio
1	*Hyperolius angolensis*	Hyperoliidae	-	-	679251.68	8774845.95	Nana Candundo	Alto Zambeze

By analyzing the table above, it can be seen that the amphibian species identified is not classified in the IUCN Red List of Species (2022) and is not included in the Red List of Species of Angola (Executive Decree n.º 252/18 of 13 July).

6.9.4.1.4. Birds

The information available for the Project's area of influence points to the potential occurrence of 427 species of avifauna (IUCN, 2022) (*see* **Annex XI - Table 7**), subdivided into 84 families, highlighting the *Accipitridae* family with 35 species listed, followed by *Cisticolidae* with 22 species. The other families whose number of species varied from two to one were grouped in the group Others, which is represented by 57 species (*see* **Figure 181**).

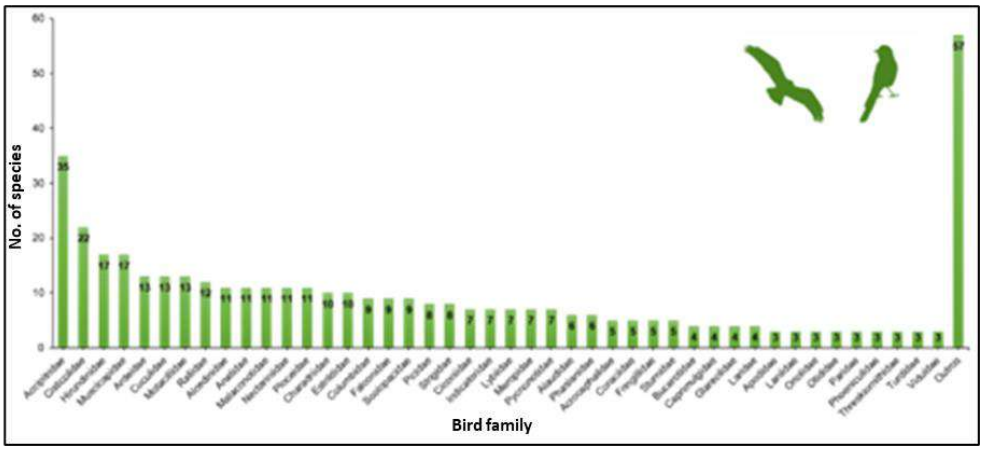


Figure 181 - Number of potential bird species, per family, present in the project's area of influence.

Of the 427 potential bird species present in the project area, 11 species have threatened status (IUCN, 2022) (*see* **Annex XI - Table 7**) namely:

- Four species with Vulnerable status (VU), the *Aquila rapax* (tawny eagle), *Bucorvus leadbeateri, Bugeranus carunculatus* and *Falco vespertinus*;

- Four endangered (EN) species, *Polemaetus bellicosus* (martial eagle), *Sagittarius serpentarius* (secretary), *Terathopius ecaudatus* (dancing eagle) and *Aquila nipalensis*;
- Three Critically Endangered (CR) species, Gyps africanus (White-backed Vulture), *Trigonoceps occipitalis* and *Necrosyrtes monachus* (Hooded Vulture).

During the field surveys carried out, 34 birds were recorded in the project's area of influence. It should be noted that taking into account the climatic conditions verified during the field surveys, the sample is considered to be significant, taking into account that 20% of the existing species in this area of the country were identified for this region.

The various bird species identified during the field surveys carried out in the project's area of influence are described below.

- **Birds Associated with Water Sources**

Birds associated with water courses can be found in a variety of humid habitats, including humid shrubs, riparian vegetation, pastures and swamps, with the following species standing out: *Podiceps cristatus, Podica senegalensis, Phalacrocorax lucidus, Alcedo cristata, Bocagia minuta*. These species have a diet composed mostly of fish, aquatic insects, frogs and derivatives of water sources.

The following figure (*see* **Figure 182**) shows the bird species associated with water sources identified during fieldwork in the project's area of influence.

Figure 182 – Bird species associated with water sources found in the project's area of influence: A) *Podiceps cristatus*; B) *Podica senegalensis*; C) *Alcedo cristata*; D) *Phalacrocorax lucidus*.

- **Cosmopolitan Birds**

These birds are adapted to the urban lifestyle and can be observed with a certain ease, where their occurrence is associated with the presence of urban solid waste (dumps) that in many cases are incorrectly disposed. Thus, these species end up being an indicator of pollution. These birds are well adapted to human contact, with the following species standing out: *Corvus albus, Passer griseus, Pycnonotus tricolor, Bubulcus ibis, Uraeginthus angolensis* and *Lonchura cucullata*.

The following figure (*see* **Figure 183**) shows the cosmopolitan bird species identified during fieldwork in the project's area of influence.

Figure 183 – Cosmopolitan bird species identified in the project's area of influence: A) *Passer griseus*; B) *Corvus albus*; C) *Lonchura cucullata*; D) *Bubulcus ibis*.

- **Vegetation Cover Birds**

Vegetation cover birds, namely *Poicephalus meyeri* and *Centropus senegalensis*, have the characteristic of living in forest galleries, spending most of their time in the shade, making their observation and recording difficult. They are very vocal birds, which often allows their identification through bioacoustics and are an indicator of little human intervention in certain places or the conservation of certain remaining forest patches, the result of logging or inert. These birds end up being the most affected in case of disturbance in the environment due to the restrictions and habits resulting from their lifestyle.

The following figure (*see* **Figure 184**) shows the vegetation cover bird species identified during field work in the project's area of influence.

Figure 184 – Species of vegetation cover birds identified in the project's area of influence: A) *Poicephalus meyeri*; B) *Musophaga rossae*.

Finally, it should be noted that the birds that were observed in areas such as savannah, shrubby savannah and Zambezian forest, are mostly small birds, granivorous and whose diversity is abundant in these areas. In these regions, the diversity of species is considerably high, as a result of good visibility, which allows recording of the same, as well as the abundance of food, which allows a high concentration of birds in relation to forest galleries and wetlands and water courses, as can be seen in the following figures (*see* **Figures 185** and **186**).

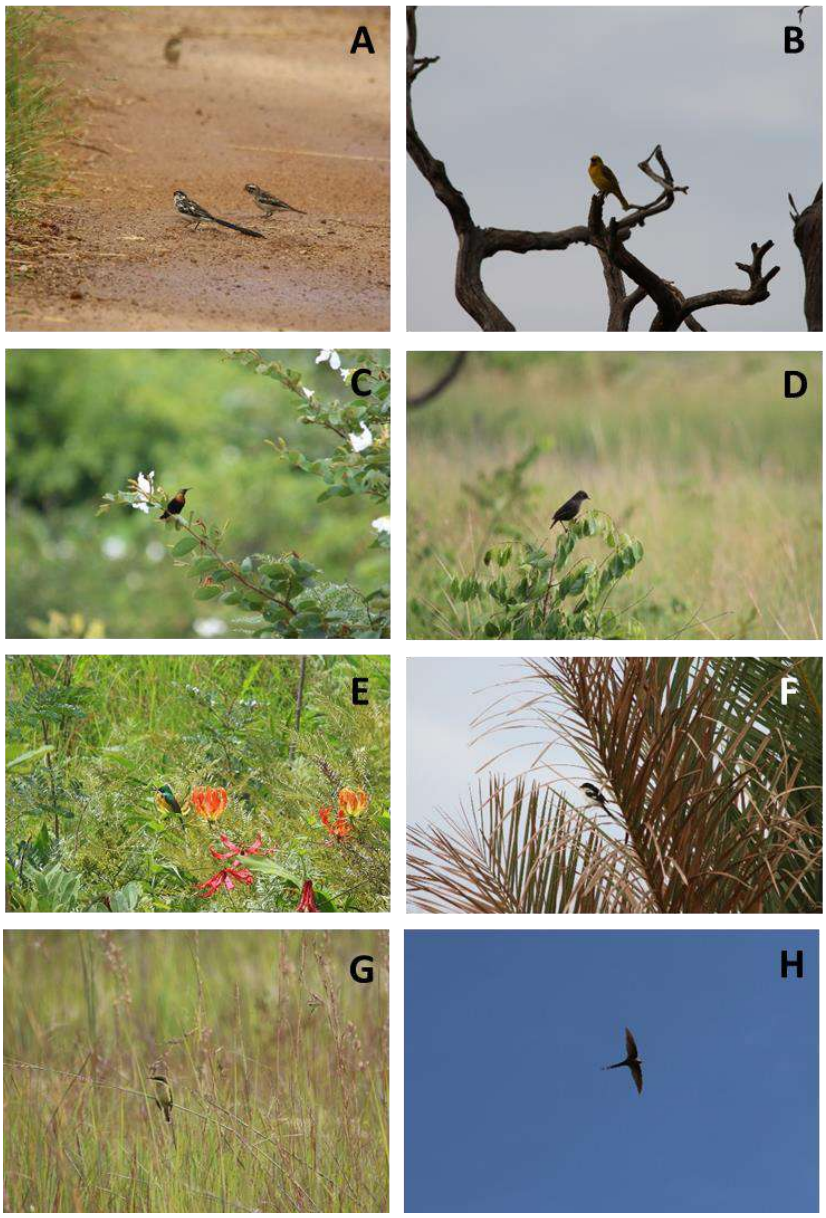


Figure 185 - Diversity of birds identified in savannas, shrub savannah and Zambezia forest: A) *Vidua macroura*; B) *Ploceus capensis*; C) *Nectarinia kilimensis*; D) *Myrmecocichla nigra*; E) *Cinnyris venustus*; F) *Lanius humeralis*; G) *Merops pusillus*; H) *Cypsiurus parvus*.

Figure 186 - Diversity of birds identified in savannas, shrub savannah and Zambezia forest: A) *Apus affinis*; B) *Bocagia minuta*; C) *Estrilda perreini*; D) *Euplectes macroura*; E) *Euplectes orix*; F) *Eremopterix verticalis*.

The following figure (*see* **Figure 187**) shows a map with the occurrences of birds species identified in the areas of influence of the project, during the fieldwork carried out by Resurb.

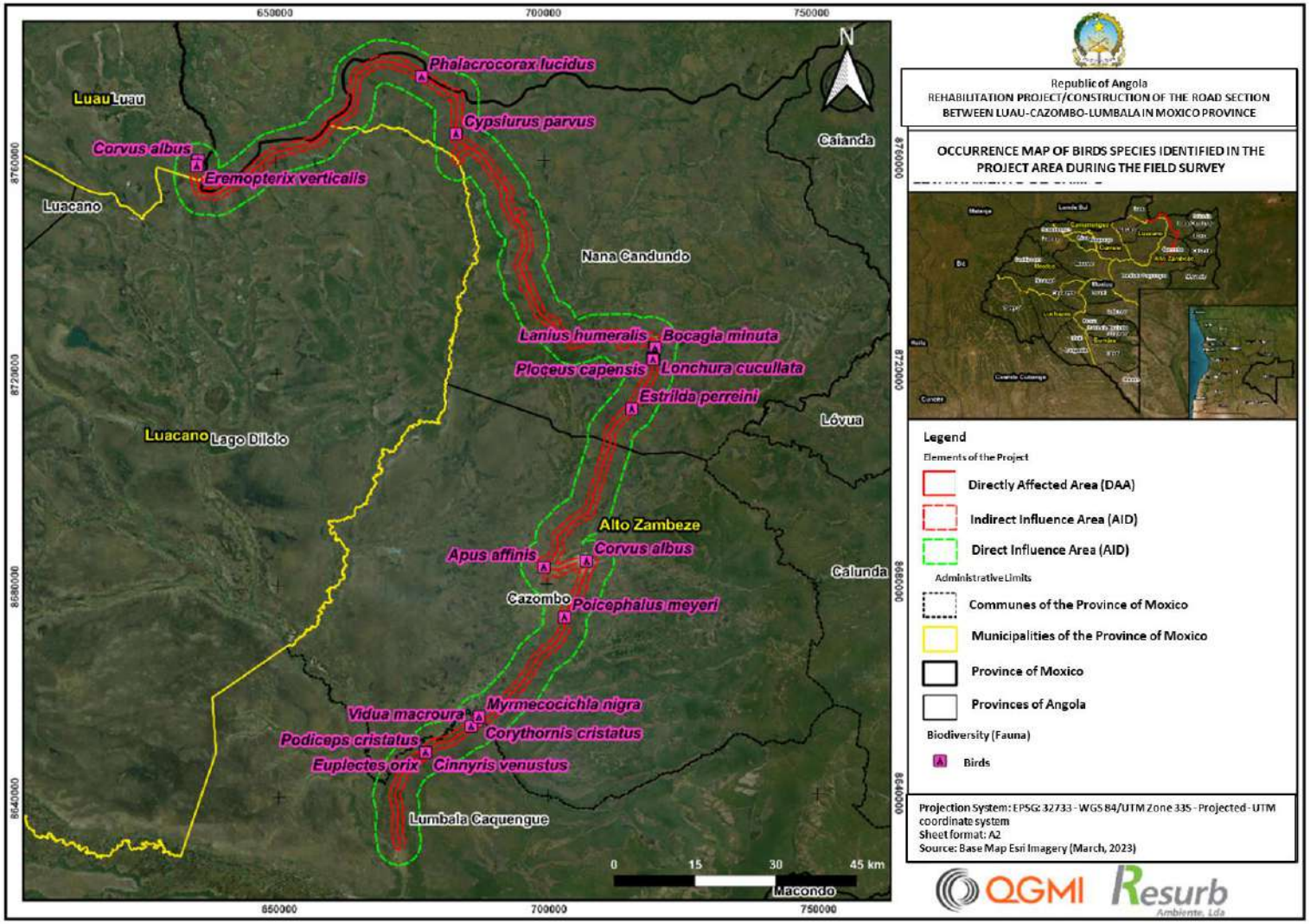


Figure 187 – Map of occurrences of birds species, identified in the project area, during the field survey.

The following table (*see* **Table 43**) shows the species of birds identified during the fieldwork, their conservation status (Red List of Angolan Species - Executive Decree No. 252/18 of 13 July and Red List of IUCN Species, 2022) and where they were identified.

Table 43 – Conservation status of bird species identified during field surveys

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Comunas	Munícipios
1	Apus affinis	Apodidae	Little Concern	-	699448.90	8683173.30	Cazombo	Alto Zambeze
2	Bocagia minuta	Malaconotidae	Little Concern	-	720413.95	8724473.00	Nana Candundo	Alto Zambeze
3	Bubulcus ibis	Ardeidae	Little Concern	-	720157.35	8723549.01	Nana Candundo	Alto Zambeze
4	Centropus senegalensis	Cuculidae	Little Concern	-	719966.56	8722370.76	Nana Candundo	Alto Zambeze
5	Cinnyris venustus	Nectariniidae	Little Concern	-	677279.45	8648401.37	Lumbala Caquengue	Alto Zambeze
6	Corvus albus	Corvidae	Little Concern	-	635535.15	8760262.35	Luau	Luau
7	Corvus albus	Corvidae	Little Concern	-	707390.76	8684331.20	Cazombo	Alto Zambeze
8	Corythornis cristatus	Alcedinidae	Little Concern	-	686905.68	8654317.04	Cazombo	Alto Zambeze
9	Cypsiurus parvus	Apodidae	Little Concern	-	683627.85	8765139.54	Nana Candundo	Alto Zambeze
10	Eremopterix verticalis	Alaudidae	Little Concern	-	635312.63	8759343.82	Luau	Luau
11	Estrilda astrild	Estrildidae	Little Concern	-	720005.42	8722287.23	Nana Candundo	Alto Zambeze
12	Estrilda perreini	Estrildidae	Little Concern	-	715988.68	8713001.40	Nana Candundo	Alto Zambeze
13	Euplectes hartlaubi	Ploceidae	Little Concern	-	720005.90	8722454.21	Nana Candundo	Alto Zambeze
14	Euplectes macroura	Ploceidae	Little Concern	-	635313.46	8759276.94	Luau	Luau
15	Euplectes orix	Ploceidae	Little Concern	-	677260.69	8648380.06	Lumbala Caquengue	Alto Zambeze
16	Lanius humeralis	Laniidae	-	-	720237.82	8724498.14	Nana Candundo	Alto Zambeze
17	Lonchura cucullata	Estrildidae	Little Concern	-	720100.64	8723105.33	Nana Candundo	Alto Zambeze
18	Merops pusillus	Meropidae	Little Concern	-	720046.73	8723392.47	Nana Candundo	Alto Zambeze
19	Myrmecocichla nigra	Muscicapidae	Little Concern	-	687246.15	8655040.93	Cazombo	Alto Zambeze
20	Nectarinia kilimensis	Nectariniidae	Little Concern	-	677297.69	8648420.68	Lumbala Caquengue	Alto Zambeze

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Comunas	Munícipios
21	Passer griseus	Passeridae	Little Concern	-	635577.02	8760351.64	Luau	Luau
22	Phalacrocorax lucidus	Phalacrocoracidae	-	-	677270.20	8775966.68	Nana Candundo	Alto Zambeze
23	Ploceus capensis	Ploceidae	Little Concern	-	719984.75	8722789.51	Nana Candundo	Alto Zambeze
24	Podiceps cristatus	Podicipedidae	Little Concern	-	677249.86	8648344.03	Lumbala Caquengue	Alto Zambeze
25	Poicephalus meyeri	Psittacidae	Little Concern	-	703214.23	8673723.84	Cazombo	Alto Zambeze
26	Saxicola torquatus	Muscicapidae	Little Concern	-	720010.48	8722516.91	Nana Candundo	Alto Zambeze
27	Vidua macroura	Viduidae	Little Concern	-	685762.94	8653209.65	Lumbala Caquengue	Alto Zambeze

Through the analysis of the previous table it is verified that there is no bird with relevant conservation status, according to the Red List of Species of Angola. With regard to the IUCN Red List of Species (2022), 25 of the identified species are classified as Least Concern, and the remaining (two) are not classified according to this list.

6.9.4.1.5. Land Mammals

The information available for the project's area of influence points to the potential occurrence of 125 species of terrestrial mammals (IUCN, 2022) (*see* **Annex XI - Table 8**), subdivided into 34 families, with emphasis on the *Muridae* family (of the order *Rodentia*) with 14 listed species, followed by *Bovidae* and *Vespertilionidae*, both with 13 species (*see* **Figure 188**).

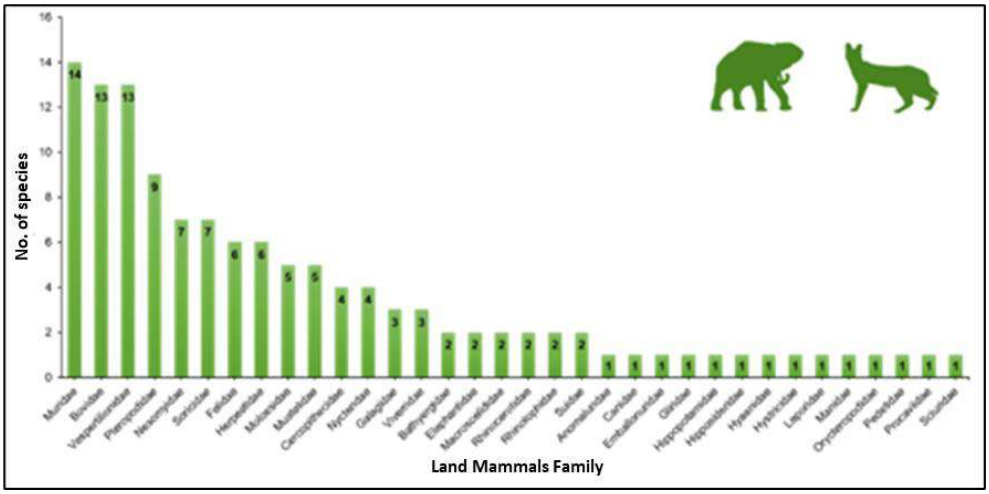


Figure 188 - Number of potential species of terrestrial mammals, per family, present in the project's area of influence.

Of the 125 potential species of terrestrial mammals present in the project area, eight species have threatened status (IUCN, 2022) (*see* **Annex XI - Table 8**), namely:

- Five species with Vulnerable status (VU), *Colobus angolensis, Panthera leo, Hippopotamus amphibius, Panthera pardus* (leopard) and *Acinonyx jubatus* (Cheetah);
- Two species with Endangered (EN) status, *Phataginus tricuspis* (white-bellied pangolin) and *Loxodonta africana* (savannah elephant);
- A Critically Endangered (CR) species, respectively, the *Diceros bicornis* (black rhino).

It should be noted that during the field surveys, few mammals were identified in the study area, with two species of wild mammals and two species of terrestrial mammals observed, as can be seen in the following figures (*see* **Figures 189** to **193**).

Figure 189 - Large cane rat specimen commonly called *Paca* (*Thryonomys swinderianus*).

Carnivore droppings were also observed (*see* **Figure 190**), which reveals their presence for this region according to Huntley *et al*. 2019. Despite being registered, it was not possible to identify them due to the limited reference bibliography for this purpose.

Figure 190 – Excrement of unidentified carnivore.

A rodent was also recorded (*see* **Figure 191**), but it was not possible to identify it using available methods.

Figure 191 - Species of rodent registered in the study area, without identification.

Finally, it is important to highlight the two species of domestic mammals identified in the project's area of influence, namely dogs (*see* **Figure 192**) and goats (*see* **Figure 193**).

Figure 192 – Photographic record of dogs - *Canis lupus familiaris*.

Figure 193 - Photographic record of domestic goats - *Capra aegagrus hircus*.

It should be noted that the species of mammals most likely to occur in the study area are those that have a preferential connection with the human presence (anthropophiles) such as goats, dogs, etc.

The following figure (*see* **Figure 194**) shows a map with the occurrence of relevant mammalian species identified in the project's areas of influence during the fieldwork carried out by Resurb.

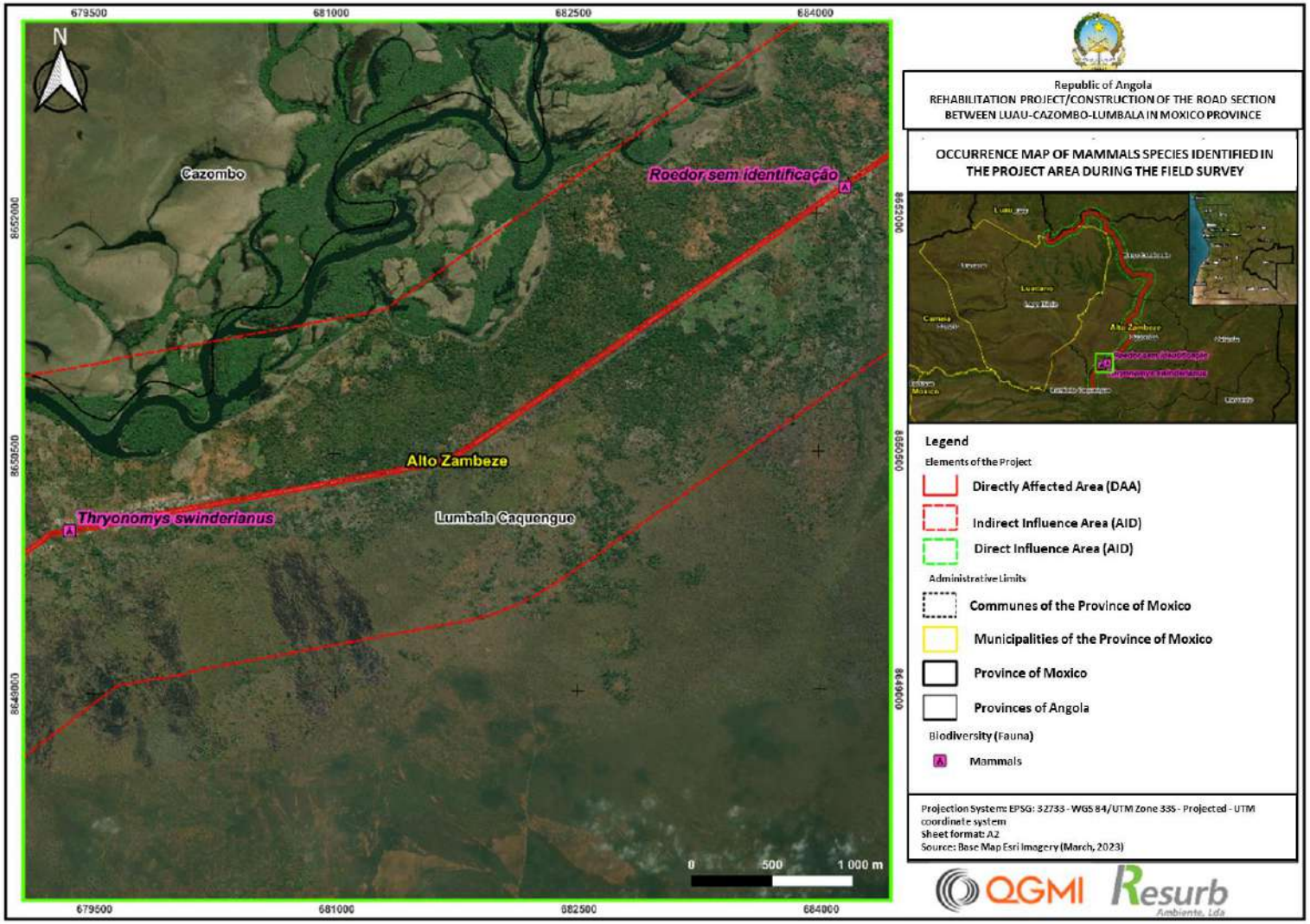


Figure 194 – Map of occurrences of relevant mammalian species identified in the project area during the field survey.

The following table (*see* **Table 44**) shows the species of mammals identified during the fieldwork, their conservation status (Red List of Angolan Species - Executive Decree No. 252/18 of 13 July and Red List of IUCN Species, 2022) and where they were identified.

Table 44 – Conservation status of mammal species identified during field surveys

Nº	Cientific name	Family	Conservation status		Coordinates UTM		Administrative division	
			IUCN, 2022	Executive Decree No. 252/18 of July 13	Longitude (E)	Latitude (S)	Comunas	Munícipios
1	Thryonomys swinderianus	Thryonomydae	Little Concern	-	679359.50	8650027.60	Lumbala Caquengue	Alto Zambeze
2	Rodent without identification	-	-	-	684176.08	8652163.53	Lumbala Caquengue	Alto Zambeze

The *Thryonomys swinderianus* population is not endangered, although individual populations may become locally extinct due primarily to overhunting. By analyzing the table above, it can be seen that this species is classified as Least Concern according to the IUCN Red List of Species (2022) and is not included in the Red List of Angolan species.

6.9.4.2. Faunistic Species at Risk

The following table presents the faunal species included in the Red List of Species in Angola (*see* **Table 45**).

Table 45 – Angola Red Species List – 2018-2023 (Source: Ministry of the Environment)

Scientific Name	Common Name	Category	Historial Occurrence
Lycaon pictus	Mabeco	Threat of extinction	Almost every country, except Cabinda province and Iona National Park, in Namibe
Crocuta crocuta	Hiena Malhada	Threat of extinction	Practically every country except Cabinda province
Proteles cristatus	Protelo	Threat of extinction	All southern provinces of the country
Panthera leo	Leão	Threat of extinction	Every country except Cabinda province
Acinonyx Jubatus	Chita ou Onça	Threat of extinction	All Southern and Eastern Provinces of the Country
Equus zebra hartmannae	Zebra de montanha	Threat of extinction	Iona National Park, Namibe Province
Gorilla gorilla gorilla	Gorila	Threat of extinction	Maiombe Forest, Cabinda Province
Syncerus caffer nanus	Pacaça ou Búfalo vermelho	Threat of extinction	Forest and Savannas in the northern provinces of Angola
Pan troglodytes	Chimpanzé	Threat of extinction	Maiombe Forest - Cabinda Province
Trichechus senegalensis	Manatin	Threat of extinction	Mouth and Lower Course of the Chiloango, Zaire, Bengo, Dande, M'bridge, Longa and

Scientific Name	Common Name	Category	Historial Occurrence
			Kwanza Rivers
Hippotragus niger variani	Palanca Negra Gigante	Threat of extinction	Cangandala National Park and Luando Integral Reserve, Malanje
Cercopithecus neglectus	Macaco de Brazza	Threat of extinction	Lunda Norte, Zaire and Uíge Provinces
Colobus angolensis	Colobo	Threat of extinction	Dense forests in the provinces of Zaíre, Uíge, Lunda Norte, Cuanza Norte and Bengo
Vulpes chama	Raposa das Areias	Threat of extinction	Iona National Park, Namibe
Suricata suricata	Suricata	Threat of extinction	Iona National Park, Namibe
Papio ursinus	Babuíno (Macaco Cão-Cinzento)	Threat of extinction	Iona National Park, Namibe
Syncerus caffer caffer	Búfalo	Threat of extinction	Buffalo Reserve (Benguela) Moxico and Cuando Cubango provinces
Giraffa camelopardalis angolensis	Girafa de Angola	Threat of extinction	Cunene and Cuando Cubango Provinces
Dermochelys coreacea	Tartaruga de Couro	Threat of extinction	Along the Angolan Atlantic Coast
Psittacus erithacus	Papagaio Cinzento	Threat of extinction	Maiombe Forest, Cabinda Province
Xenocopsychus ansorgei	Tordu das furnas	Threat of extinction	In a strip of Forests and Rocks in the provinces of Cuanza Sul and Benguela
Estrilda thomensis	Cinzentinho	Threat of extinction	Benguela and Namibe southern coastal strip
Egretta vinaceigula	Garça de garganta vermelha	Threat of extinction	Swamps of the Extreme Southeast of Cuando Cubango (Bico de Angola)
Ardeola rufiventris	Garça-de-barriga-vermelha	Threat of extinction	River marshes in Cuando Cubango and Moxico Provinces
Balearica regulorum	Grou Coroado	Threat of extinction	River marshes in Cuando Cubango and Moxico Provinces
Bugeranus carunculatus	Grou Carunculado	Threat of extinction	River marshes in Cuando Cubango and Moxico Provinces
Manta birostris	Raia Manta	Threat of extinction	Angolan Atlantic Coast
Prionacea glauca	Tubarão azul	Threat of extinction	Angolan Atlantic Coast
Galeocerdo curvier	Tubarão Tigre	Threat of extinction	Angolan Atlantic Coast
Equus burchellii	Zebra de Planície	Vulnerable	Southern Provinces of Angola
Loxodonta africana cyclotis	Elefante da Floresta	Vulnerable	Cabinda, Zaire, Uíge, Bengo and Cuanza Norte provinces
Loxodonta africana africana	Elefante da Savana	Vulnerable	All Provinces except Bié and Huambo
Orycteropus afer	Gimbo	Vulnerable	All provinces except Cabinda
Manis temminckii	Pangolim vulgar	Vulnerable	Southern provinces except Namibe
Manis tetredactyla	Pangolim de Floresta	Vulnerable	Rainforests of the Northern Provinces
Panthera pardus	Leopardo	Vulnerable	Every country
Felis sylvestris	Gato Selvagem	Vulnerable	Every country
Caracal caracal	Caracal	Vulnerable	Southern Provinces
Leptailurus serval	Serval	Vulnerable	Every country
Civecttictis civetta	Civeta	Vulnerable	Every country

Scientific Name	Common Name	Category	Historial Occurrence
Genetta tigrina	Geneta	Vulnerable	Every country
Lutra maculicolis	Lontra malhada	Vulnerable	Rivers, lakes and swamps across the country
Mellivora capensis	Ratel	Vulnerable	Every country
Otocyon megalotis	Raposa Orelhuda	Vulnerable	Southern Provinces
Canis mesomelas	Chacal de dorso Preto	Vulnerable	South Central Coastal Provinces
Canis adustus	Chacal de flancos raiado	Vulnerable	All provinces except Benguela and Namibe
Papio cynocephalus	Babuino (Macaco-Cão-Amarelo)	Vulnerable	All provinces except Benguela and Namibe
Platysteira albifrons	Olho de curúncula de testa branca	Vulnerable	In the Mangrove Forests along the coast from Cabinda to Benguela
Pternistis griseostriatus	Perdriz de Estrias Cinzenta	Vulnerable	Bordering forests and cultivated areas in the provinces of Zaire, Bengo, Luanda and Cuanza Sul
Pternistis swierstrai	Perdriz de Montanha	Vulnerable	Mountain and Riparian Forests of Huambo Province
Tauraco erythrolophus	Ândua de Crista Vermelha	Vulnerable	Mountain and Miombo forests in the provinces of Zaire, Uíge, Kwanza Norte, Bengo, Kwanza Sul and Huambo
Colius castanotus	Rabo de Junco de Rabadilha Vermelha	Vulnerable	Forests and Gardens in the Provinces of Bengo, Luanda Cuanza Sul and Benguela
Sheppardia gabela	Tordito de Gabela	Vulnerable	Altitude forests and secondary zones of Gabela-Provincia do Cuanza Sul
Macrosphenus pilitzeri	Rouxinol de Pulitzer	Vulnerable	Forests with coffee in the province of Kwanza Sul
Melaenornis brunneus	Papa-moscas de Angola	Vulnerable	Miombo Forests Province of Huambo
Prionops gabela	Altador-de-poupa de Gabela	Vulnerable	Forests of Gabela, Province of Kwanza Sul
Phoeniculus damarensis	Zomboteiro de Damaralandia	Vulnerable	Open watercourses and forests in the provinces of Huila and Cunene
Tockus damarensis	Bico de Serra vermelha	Vulnerable	Open watercourses and forests in the provinces of Huila and Cunene
Tockus monteiri	Bico de Serra Monteiro	Vulnerable	Open watercourses and forests in Namibe and Cunene provinces
Mirafra angolensis	Cotovia angolana	Vulnerable	Mid-Eastern Savannas in Malange, Bié, Huambo and Moxico Provinces
Ammomanopsis grayi	--	Vulnerable	Iona National Park, Namibe Province
Certhilauda benguelensis	Cotovia de bico comprido	Vulnerable	Iona National Park, Namibe Province
Macronyx grimwoodi	Unha longa de Grimwood	Vulnerable	Eastern Provinces
Parus carpi	--	Vulnerable	Semi-arid savanna, Benguela, Namibe and Cunene provinces
Phyllastrephus cabanisi	Chiricuata de cabanis	Vulnerable	Middle East Forests; Bié, Lundas and Moxico
Namibornis herero	--	Vulnerable	Acacia forests in Namibe and Cunene provinces
Cisticola luapula	--	Vulnerable	Swamps of Cunene and Cuando Cubango Provinces
Cisticola rufilatus	Boita de ansorge	Vulnerable	Moxico and Cuando Cubango savannas
Cisticola dambo	Boita de ansorge	Vulnerable	Savannas of Lunda Norte and Cazombo,

Scientific Name	Common Name	Category	Historial Occurrence
			Moxico Province
Muscicapa boehmi	Papa-moscas de Bohm	Vulnerable	Huambo Miombo Forests
Muscicapa infuscata	Papa-mosca fuliginoso	Vulnerable	Forests of Maquela do Zombo in Uíge
Batis minulla	Batis de Angola	Vulnerable	Galleries forests in the Central North and South provinces (Uíge, Malange and Huambo)
Lanioturdus torquatus	Picanço Pairador	Vulnerable	Dry and semi-desert savannas of Benguela, Namibe and Cunene
Ploceus temporalis	Tecelão de Bocage	Vulnerable	Savannas and Riverbeds in the Center East (Huambo, Bié and Moxico)
Euschistospiza cinereovinacea	Cor de Cinza	Vulnerable	Along the coast of Cuanza Sul and Benguela
Struthio camelus	Avestruz	Vulnerable	Iona National Park, Namibe
Lepidochelys olivacea	Tartaruga Oliva	Vulnerable	Along the Angolan coast
Caretta caretta	Tartaruga Cabeçuda	Vulnerable	Along the Angolan coast
Chelonia mydas	Tartaruga Verde	Vulnerable	Along the Angolan coast
Eretmochelys imbricata	Tartaruga de Pente	Vulnerable	Along the Angolan coast
Eretmochelys imbricata	Tartaruga (Cágado) de dobradiças de Bell	Vulnerable	Forests and Rivers
Crocodylos nilocotis	Crocodilo	Vulnerable	Great Rivers of Angola
Mecistops cataphractus	Crocodilo de focinho pontiagudo africano	Vulnerable	Great Rivers of Angola
Pelusios subniger subniger	Cágado de lama Negra da África Oriental	Vulnerable	Forests and Savannas
Pelusios sinuatus	Cágado de dobradiças serrilhadas	Vulnerable	Forests and Savannas
Boa sp	Jibóia	Vulnerable	Forests and Savannas
Chaceon maritae	Caranguejo do fundo	Vulnerable	Coast from 300m to 700m in depth
Balaenoptera musculus	Baleia Azul	Vulnerable	All Angolan coast
Kogia sima	Cachalote-anão	Vulnerable	All Angolan coast
Pseudorca crassidens	Falsa Orca	Vulnerable	All Angolan coast
Megaptera novaeangliae	Baleia de Bossa	Vulnerable	All Angolan coast
Balaenoptera borealis	Baleia Sardinheira	Vulnerable	All Angolan coast
Delphinus delphis	Golfinho Comum	Vulnerable	All Angolan coast
Decapterus punctatus	Carapau	Vulnerable	All Angolan coast
Dentex angolensis	Dentão	Vulnerable	All Angolan coast
Ethmalosa fimbriata	Savelha, Galucha e Quilucha	Vulnerable	Along the coast found in higher concentrations in lagoons and estuaries
Arnoglussus capensis	Linguado	Vulnerable	Muddy and sandy bottoms of the North and Central Coast of Angola

Scientific Name	Common Name	Category	Historial Occurrence
Umma femina	Angola Sparklewing	Vulnerable	In a radius from the Bié Plateau to the Chela-Huíla mountain range
Chlorocypha crocea	Angola Jewel	Vulnerable	Cunene Rivers and the use of coastal rivers
Macrotermes subhyalinus	Salalé (Térmitas)	Vulnerable	Savannas in the Central and Northern Provinces
Rhynchophorus phoenicis	Zitsombe	Vulnerable	Uíge and Zaire Provinces

As mentioned in the previous subchapters, during the field work carried out by the technical team of Resurb Ambiente, Lda., no species were identified on the Red List of Species of Angola that have a threatened status (*see* **Tables 40** to **45**) or on the List IUCN Red Species (2022) (*see* **Tables 40** to **44**).

6.9.4.3. Hunting Interest

In Moxico Province there is no Controlled Hunting Area, called “Coutadas”. The only hunting exercise that may exist in the Province in accordance with the new Basic Law for the Forest and Wild Fauna of Angola, is that of "subsistence hunting" whose natural persons and families that make up the rural communities have, in the locality of their residence, the right to carry out subsistence hunting, only "small hunting" as referred to in the aforementioned legal diploma. Thus, given the location of the project, no kind of hunting relevance is foreseen in the area of influence of the project that could interfere with it.

During the fieldwork, a situation was identified that shows the practice of poaching animals in uncontrolled areas (*see* **Figure 195**).

Figure 195 - Photographic record *Paca* (*Thryonomys swinderianus*), mammal target of poaching for subsistence of the local population.

6.9.5. Forecast in the Absence of the Project

Based on the characterization presented for the Reference Situation, before the intervention of the project, and in view of the identified constraints, it is considered that in the absence of the project, the ecological evolution of the area under study will follow the pattern verified to date, that is, of socio-economic growth and development, and eventually promoting the reduction of miombo forest areas.

6.10. Landscape

The landscape is a complex system, permanently dynamic, in which different natural and cultural factors influence each other and change over time, determining and being determined by the global structure (Forman and Godron, 1986; Naveh and Lieberman, 1994; Zoneveld 1990). In addition to the more material or objective characteristics, the landscape is also affected by a subjective component, directly linked to the observer and conditioning the sensations he experiences when he is in front of it (Froment, 1987; Saraiva, 1999). Therefore, it is considered that the landscape combines natural and cultural aspects, expressing and at the same time supporting the spatial and temporal interaction between man and the environment, in all its diversity and creativity (Green, 2000; Wolters, 2000). In this sense, when carrying out the fieldwork and in order to reach a global understanding of the landscape, in order to carry out a holistic approach to the landscape, the landscape units that integrate the ecological dimensions were identified (which includes the physical and biological aspects of ecosystems), cultural (in which both historical factors and issues of identity and narrative capacity of the landscape are considered), socio-economic (referring to social factors and human activities, which permanently build and change the landscape) and sensory (linked to how landscapes are appreciated by different people or groups of people). The latter is, of course, the most subjective dimension of the landscape, but it cannot be forgotten, because as Angolan landscapes are strongly humanized, their future management will have to consider the feelings of the communities that maintain and transform them, that live in them or, simply, visit and appreciate them.

Combining all these aspects of the same reality, the landscape units identified in this study are areas with relatively homogeneous characteristics, with a specific pattern that is repeated inside and that differentiates them from their surroundings. The determining factors for the individualization of units vary and may result from morphology or geological nature, land use, proximity to the ocean, or a balanced combination of several factors. Thus, the approach selected for this study combined desk work with field work.

Next, the landscape units identified during the technical visits to the project's areas of influence are presented.

- ✓ **Natural Landscape**

The following figure (*see* **Figure 196**) shows the natural landscape of Moxico Province characterized by *miombo forests*.

Figure 196 – Photographic record of the natural landscape of the Province of Moxico.

The clarity and purity of the water are the characteristics that most stand out when talking about water in the Province of Moxico, which is in line with the results obtained when monitoring the water quality of surface water resources (*see* **Table 24**).

Winding paths and oxbow lakes are typical features, particularly along the Cuito and Cuando rivers (Source: Atlas e perfil do Moxico, Angola, 2015). **Figure 197** highlights the influence of water lines on the natural landscape of the Moxico Province.

Figure 197 – Photographic record of the natural landscape of Moxico influenced by the presence of surface water resources: A) Luanguinga River north of Cangamba, B) Zambeze River in Cazombo, C) Cuito River south of Tempué and D) Casai River in Camanongue (Source: Atlas e perfil do Moxico, Angola, 2015).

Below are presented other landscape units identified during the technical visits to the project's areas of influence.

- ✓ **Cultural or Humanized Landscape**

Figure 198 illustrates a church that could represent the cultural and humanized landscape of the Province of Moxico with religious influence.

Figure 198 – Photographic record of the cultural landscape of Moxico – Church.

The following figures (*see* **Figures 199** to **200**) represent the humanized landscape unit of the Province of Moxico, which results from the multi-secular, continuous or intermittent action of Man on the natural landscape, with special emphasis on the presence of consolidated, precarious dwellings, agricultural activity and monuments and places of memory of the historical and cultural heritage of the region.

Figure 199 – Photographic record of the humanized landscape in Moxico, highlighting the consolidated housing, built with blocks.

Figure 200 – Photographic record of the humanized rural landscape of Moxico, highlighting the precarious dwellings built in adobe and covered with thatch.

The following figure represents (*see* **Figure 201**) the humanized landscape unit that highlights some of the socioeconomic activities of the Province of Moxico.

Figure 201 – Photographic record of the humanized landscape inherent to socioeconomic activities – informal sale.

✓ **Sensory Landscape**

During interviews with the population, it was possible to collect some perceptions and/or feelings about the unity of the "sensory" landscape on the part of the community. It is possible to notice that the landscape of Moxico, even today, presents several landscape elements from the time referring to the armed conflict that lasted almost three decades. In this sense, these influences are notorious, in the Province, in terms of the historical and cultural heritage of the region. As far as the cultural and humanized landscape is concerned, although some buildings have been subject to renovations since the post-war period, there is still a lot of damaged built heritage.

It should also be noted that the Province of Moxico has natural landscapes, predominantly miombo forests, influenced by morphology and/or geological nature, land use, presence of water resources, which, as a whole, contribute to a landscape of high value scenic.

6.10.1. Forecast in the Absence of the Project

In the absence of the project, it is foreseeable that the landscape in the area of direct influence of the project will continue with the same initial characteristics, without any type of modification being expected.

6.11. Socio-economy

6.11.1. Metodology

For the characterization of the social and economic environment of this project, the applicable Angolan Legislation and the Guidelines of the World Bank are considered. In addition to these, environmental matters contained in the SADC Environmental Legislation Handbook 2012, DBSA, the Handbook on Environmental Assessment Legislation in the SADC Region, National Institute of Statistics of Angola, among others, will be considered. In the absence of specific diplomas, the international legislation in force will be considered.

The scales of analysis adopted are the national, regional and local levels, whenever the existing and collected data allow it and/or are relevant for the present environmental assessment, which is intended to be as objective as possible and incident on aspects of a social and economic nature more sensitive in a project of this nature.

The characterization of the reference situation in the project implementation area begins with a brief overview of the Angolan territory and the recent evolution of the economy and society of the Republic of Angola, as a whole, presenting a set of demographic, macroeconomic and social indicators.

The macroeconomic characterization of the Republic of Angola will be based, among other sources of general information, on the National Development Plan (PND) for 2018 - 2022, in particular for the Province of Moxico (based on the fact that, at the time, the current is under development), the information available at the National Bank of Angola and in the African Economic Outlook, Southern Africa, Trading Economics, among other reference documents, as mentioned above.

At the regional level, several indicators are considered that allow characterizing the Province of Moxico compared to the others. At this level of characterization, preferably, the elements contained in the Portal of the Ministry of Territorial Administration and in other governmental portals, with information applicable to the Province of Moxico and respective Municipalities, are considered. At the local level, Municipalities, Communes, Urban Districts and Neighborhoods or Villages are considered, with the disaggregation of genesis as local as the available data allow, complemented with direct observations. It will be at the level of the territory and local communities that the direct impact of the project will be most felt.

In summary, the economic and social characterization will be based on the elements available and collected locally, focusing on aspects related to the territory and population, economic activity, levels of activity, social conditions and quality of life of the populations residing in the Municipalities covered by the project (Municipality of Luau, Lucano and Alto Zambeze) and, whenever possible, in local communities.

Within the scope of this characterization, special attention is given to the ways of life and livelihood of local communities (production framework and employment and economic activities), educational infrastructure, health, existing accessibility, water, sanitation and energy, which affect the local population and other stakeholders, in order to evaluate the implementation of the project.

6.11.2. Territorial Framework and Administrative Organization

The Republic of Angola is the sixth largest African country, with an area of 1.246.700 km^2, with a coastline of 1.650 km with the Atlantic Ocean to the west and a land border of 4.837 km (Definitive Report of the General Population and Housing Census, 2014). In terms of land borders, Angola faces 4 states, namely, the Republic of Namibia, to the south; Republic of Zambia, to the east; Democratic Republic of Congo – Kinshasa (formerly Zaire) to the East and North; and Congo – Brazzaville), to the North, as can be seen in the following figure (*see* **Figure 202**).

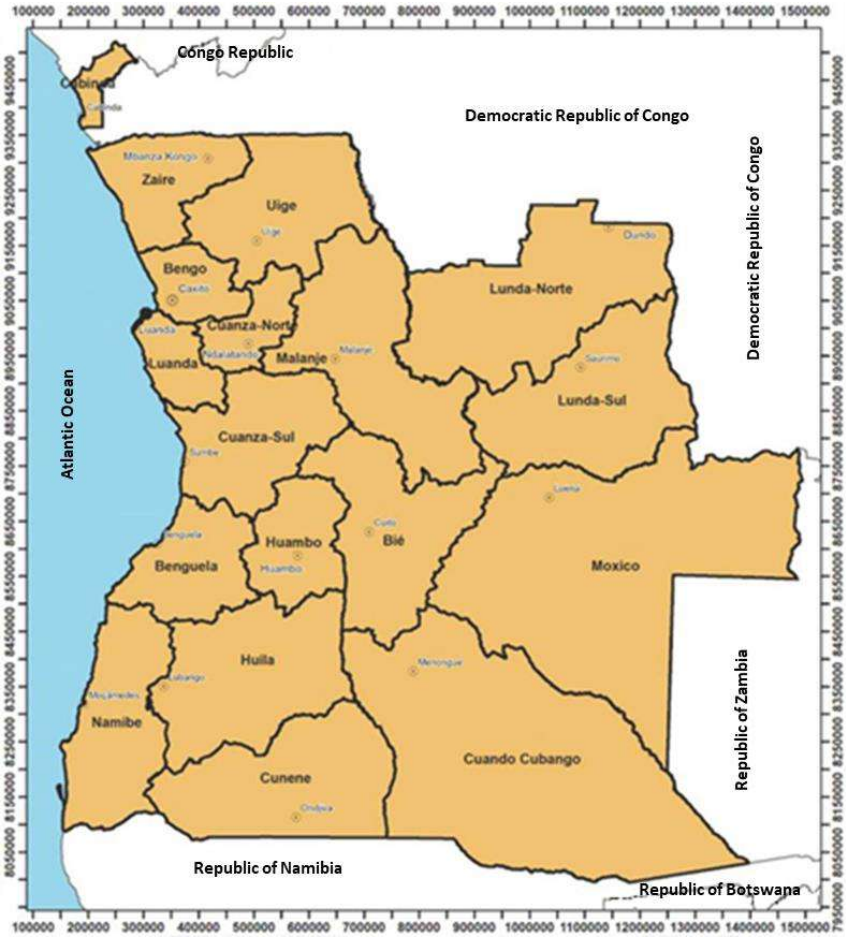


Figure 202 - Administrative Framework of the Republic of Angola (Source: Adapted from the official page of the Government of Angola, 2022).

For the purposes of local administration of the State, the territory of Angola is divided into Provinces, Municipalities, Communes and Neighborhoods or Villages. Neighborhoods or Villages are grouped into Communes, Communes into Municipalities and Municipalities into Provinces.

The local government bodies are subdivided into the following collegiate bodies:

- **Provincial Government**, responsible for economic and social development:

- Promote and encourage local development initiatives;
- Stimulate increased production and productivity in companies that produce goods and provide essential services;
- Promote the installation and reactivation of the industry for the production of construction materials, agricultural, livestock, food and other industries for the development of the Province.

- **Municipal Administration**, who are responsible in the field of economic and social development:
  - Stimulate the increase in production and productivity in goods production companies and providing services at the municipal level;
  - Promote and organize municipal fairs;
  - Develop community integration programs to combat poverty;
  - Licensing, regulating and supervising the commercial activity of retail and street vendors
  - Ensure social, educational and health assistance, contributing to the maintenance of the population's living conditions;
  - Preserve the buildings, monuments and sites classified as national historical patrimony (heritage) and located in the municipality's territory;
  - Promote the creation of municipal and communal libraries, as well as ensure their equipping with bibliographic material;
  - Ensure the maintenance, distribution and management of water and electricity in its area of jurisdiction, with the possibility of creating local companies for this purpose.
- **Communal Administration**, with specific competences in the domains of planning and budget, sanitation and rural and urban equipment, social and cultural development, institutional coordination, but without specific competences in the domain of economic development.

Angola is administratively divided into 18 Provinces, led by Provincial Governors, appointed by the President of the Republic, who is also the Head of Government, and it was planned that the autarchies would be created by the end of 2022 in order to hold the bodies accountable, following the publication, in February 2010, of the new Constitution of the Republic of Angola,

which introduced a chapter called "Local Power", which determined the existence of autonomous bodies of local power and the possibility of creating local authorities.

The Constitution determines that the organization and functioning of local authorities, as well as the competence of their bodies, be regulated by law in harmony with the principle of administrative decentralization.

The following table (*see* **Table 46**) presents Angola's territorial structure, as well as a brief description of its local power.

Table 46 – Territorial Structure in Angola and Local Authorities (Source: adapted from Law No. 18 of October 17, 2016)

Territorial Unit	Total	Designation/Nomination/Assignments
Provinces	18	The maximum representative is the provincial governor named by the President of the Republic to ensure the proper functioning of the local administration organs.
Municipalities	164	The maximum representative is the Municipal Administrator named by the dispatch of the provincial Governor with prior consultation with the Ministry of State Administration. The Municipal Administrator is responsible for district governance.
Communes	518	The maximum representative is the Communal Administrator named by order of the Provincial Governor on the proposal of the Municipal Administrator. It is responsible for ensuring the regular functioning of the local administration organs.
Urban Districts	44	The maximum representative is the Urban District Administrator. It is his function to ensure the regular functioning of the urban district.
Traditional Authorities	a)	Represented by the great soba, soba and "século". Formally recognized, the role of traditional authorities is to exercise the prerogatives of traditional power, provided they do not violate state law.

a) Values not shown.

6.11.2.1. Resources

The resources of the Province of Moxico are closely related to the soil and climate conditions described in the corresponding previous subchapters. In view of its climate and soil characteristics, the Province is not conducive to developing agricultural activities, as previously mentioned.

The population of the Moxico region essentially lives off the sale of cattle in Zambia and dried fish from the Bulozi flood plains. The urban area of the region lives mainly from commerce and the provision of services and the rural area from the primary sector (agriculture, hunting, fishing and picking wild fruits). Cassava is the main food produced, followed by maize, sweet potato and rice. Other crops include melon, *ginguba* and banana. With regard to livestock activity, the production of goats and poultry stands out (Atlas e perfil do Moxico, 2015).

In view of the economic difficulties, other sources of income for the rural population in the Moxico region also include the sale of fish, home-made alcoholic beverages, charcoal, game meat and the sale of some manufactured goods.

The strategy for adapting to climate change with the effects of extreme drought involves adapting agricultural activity to fishing and hunting and, sometimes, rural exodus in search of temporary jobs (Atlas e Perfil do Moxico, 2015).

6.11.3. Population

The Angolan territory has an enormous diversity in terms of physical and human occupation. The following table (*see* **Table 47**) presents a brief characterization of the Angolan Provinces, in terms of surface area and population.

Table 47 – Provinces of Angola, Surface, Population and Administrative Division

Province	Capital	Surface (km^2)	Total Population (Estimated)	Populational Density Hab./km^2	Municipalities	Communes
Bengo	Caxito	33 016	356 641	10,8	6	23
Benguela	Benguela	31 780	2 231 385	70,2	10	38
Bié	Kuito	70 314	1 455 255	20,7	9	39
Cabinda	Cabinda	7 270	716 076	98,5	4	12
Cuando Cubango	Menongue	199 049	534 002	2,7	9	31
Kuanza Norte	N' Dalatando	24 110	443 386	18,4	10	31
Kuanza Sul	Sumbe	55 660	1 881 873	33,8	12	36
Cunene	Ondjiva	87 342	990 087	11,3	6	20
Huambo	Huambo	34 270	2 019 555	58,9	11	37
Huíla	Lubango	75 002	2 497 422	33,3	14	52
Luanda	Luanda	18 826	6 945 386	368,9	9	14
Lunda Norte	Lucapa	103 000	862 566	8,4	10	25
Lunda Sul	Saurimo	77 637	537 587	6,9	4	14
Malange	Malange	97 602	986 363	10,1	14	52
Moxico	**Luena**	**223 023**	**758 568**	**3,4**	**9**	**30**
Namibe	Namibe	58 137	495 326	8,5	5	14
Uíge	Uíge	58 698	1 483 118	25,3	16	47
Zaire	M'banza Congo	40 130	594 428	14,8	6	25
Angola		**1 278 297**	**25 789 024**	**20,2**	**162**	**558**

Source: NIS, República of Angola; General Census of Population and Housing in Angola, 2014; Consulate General in Porto – Republic of Angola.

According to the Definitive Results of the 2014 Census, the population in Angola was 25.789.024 people, of which 62.6% live in urban areas and 37.4% in rural areas. The female gender dominates in Angola with a population of 13.289.983, corresponding to 52% of the total, while the male population is 12.499.041, representing 48% of the total population.

Analyzing the previous table (*see* **Table 47**) it appears that at the time of the General Population and Housing Census, carried out in 2014, the Province of Moxico registered 758.568 inhabitants, of which 369.437 were male and the remaining 389.131 were female. According to the same source, the Municipality of Luena is the most populous, concentrating 48% of the Province's population, followed by the Municipalities of Alto Zambeze with 14%, Luau with 12% and Budas-Lumbala, Nguimbo with 9%. These 4 Municipalities concentrate 83% of the total resident population in the Province. The Municipality of Luchazes registers the smallest number of residents with 2% of the population of the Province. Four other Municipalities follow with a population of less than 5% of the province's population, namely Camanongue with 5%, Léua with 4%, Cameia with 4% and Luacano with 3%. These five Municipalities concentrate only 17% of the Province's population.

The masculinity index at provincial level is 95, that is, in Moxico Province there are 95 men for every 100 women, which means that the population of Moxico is made up mostly of women. The Municipality of Luau has the lowest masculinity rate with about 92 men for every 100 women (Census, 2014).

6.11.3.1. Ethnic Groups and Language

Angolan History and Anthropology tell us that the fundamental difference between the nine most representative Angolan ethnic groups is linguistic. Hence, it becomes relevant to look at Angola as a multicultural society where there is a majority, or majority group, and minorities. The majority group is made up of the Angolan community of Bantu origin that coexists with non-Bantu minorities (of African and European origin) (ovimbundu.org).

The people that inhabit Angola have been considered “tribes”, “ethnicities”, “ethnic groups” over time, but the surveys produced do not correctly testify to reality, since the vast majority of the information reproduced in the “Ethnic Chart of Angola” constitute an authentic illusion since there are a series of designations that do not correspond to reality and, on the other hand, because they do not respect the attributions that are given by the people themselves (that is, their ethnic self-consciousness), (*in* The ethnographic classification of the people of Angola (1st part)).

According to Coelho (2015) it is also important to reflect on the use of ethnic groups to refer to different communities, geographically distributed, in the post-independence period of Angola, since the current reality is quite different.

The most important tribal groups in Moxico Province are Ambuela (including Cangala), Chokwe, Luvale, Luchazi, Luena, Lunda (including Lunda-Ndembo and Luanda-Lua-Chinde) and

Mbunda (including Camachi, Gengista, Iahumha and Ncoia). Tribal groups from Moxico are also found in other Provinces of Angola and in Zambia (Atlas and profile of Moxico, Angola, 2015).

With regard to ethnic groups, the Province of Moxico is the territory of the Bantu people who are subdivided into 4 ethnic groups, namely Cokwe, Lunda, Ganguela (or Nganguela) and Lubas. Thus, the following figure (*see* **Figure 203**) shows the distribution of the main ethnic groups in Angola.

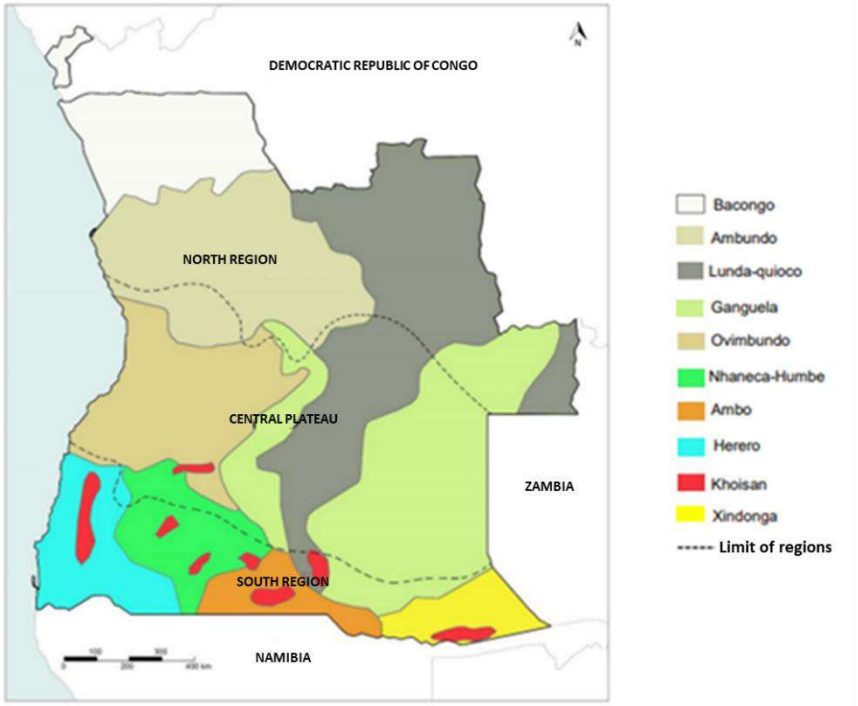


Figure 203 – Illustration of the ethnic groups of Angola (Source: adapted from Redinha, 2009).

Through the analysis of the previous figure (*see* **Figure 203**) it can be seen that the project implementation area located in the Province of Moxico, intersects the Ganguela (or Ngangela) ethnic group.

It should be noted that in Angola, the linguistic situation is quite complex, coexisting in a single territory several linguistic groups and more than hundreds of languages, where the Portuguese language coexists with the languages of the Bantu and non-Bantu groups, which is why the Portuguese language was adopted as the official language. Furthermore, the Portuguese language works as a vehicle of communication between people whose mother tongues may be different from Angola.

The following figure (*see* **Figure 204**) presents an overview of the Republic of Angola with the distribution of ethnolinguistic groups according to information from the 2014 Census.

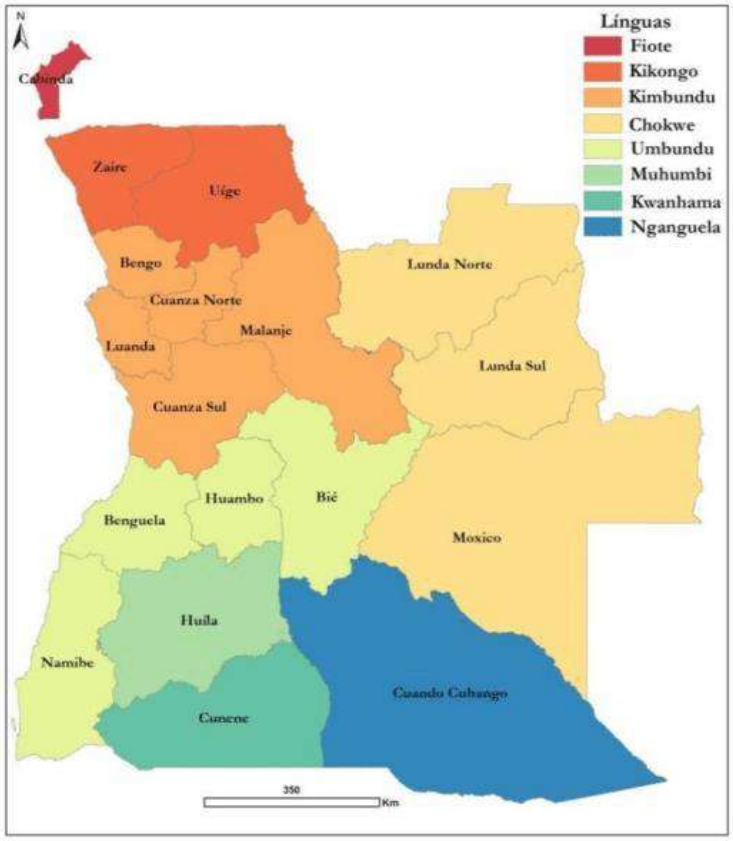


Figure 204 - African languages in Angola according to the results of the 2014 Census Extracted from INE, 2016: 51.

Portuguese is the only official language in Angola, however, given the existence of different ethnic groups, shown above and given the ethnic heterogeneity of the Province of Moxico, the Portuguese language coexists with other native languages of that region (*see* **Figure 204**). Most of the population of Moxico Province is bilingual or multilingual, due to contact and reciprocal influences between languages and people. After Portuguese, the most widely spoken languages in Moxico Province are Tchokwe, Luvale, Lutchaz and Mbunda (the last two are variants of Nganguela), related to the respective groups that occupy vast areas and have a large number of speakers (FTP, 1973). The following table (*see* **Table 48**) shows the distribution of ethnic groups and languages spoken in the Municipalities and Communes that make up the Province of Moxico.

Table 48 – Ethnic groups and languages spoken in Moxico Province (Source: Gino, C., 2017)

Municipalities	Communes	Ethnic group	Spoken languages
Moxico	Luena	Lunda-Tchokwe	Tchokwe
		Luvale	Luvale
		Nganguela	Luchaze
		Nganguela	Mbunda/Bunda
		Lunda-Tchokwe	Lunda-Ndembo
		Ovimbundo	Umbundo

Municipalities	Communes	Ethnic group	Spoken languages
	Muangai	Nganguela	Luimbi, Nhemba, Luchaze
		Lunda-Tchokwe	Tchokwe
	Cachipoque	Lunda-Tchokwe	Tchokwe
		Nganguela	Luimbi, Nhemba
	Lucusse	Luvale	Luvale
		Lunda-Tchokwe	Tchokwe
Luchazes	Cassamba	Nganguela	Mbunda, Lutchaze
		Lunda-Tchokwe	Tchokwe
	Cangamba	Nganguela	Mbunda, Luchaze, Khangala
		Lunda-Tchokwe	Tchokwe
		Khoisan	Camussekele
	Tempué	Nganguela	Nhemba, Khangala, Mbunda
	Muié	Nganguela	Luchaze, Mbunda, Kamaxi, Iuma
	Cangombe	Nganguela	Kamaxi, Yuma,Mbunda
Alto Zambeze	Cazombo	Luvale	Luvale
		Lunda-Dembo	Lunda
	Calunda	Lunda-Dembo	Lunda
	Lóvua	Lunda-Dembo	Lunda
	Macondo	Lunda-Dembo	Lunda
	Lumbala Caquengue	Luvale	Luvale
	Caianda	Luvale	Luvale
		Lunda-Dembo	Luvale
	Nana Candundo	Luvale	Luvale
Bundas	Ninda	Nganguela	Mbunda, Niengo, Kamakoma, Maxi
	Lumbala Nguimbo	Nganguela	Mbunda, Lutchaze,Kamakoma, Khangala
		Ovimbundo	Umbundo
	Lutembo	Nganguela	Khangala
		Luvale	Luvale
		Nganguela	Luchaze, Mbunda
	Luvuei	Luvale	Luvale
		Nganguela	Mbunda, Lutchaze
	Sessa	Nganguela	Luchaze, Mbunda, Khangala
	Chiume	Nganguela	Khangala, Maxi, Niengo, Kamakoma, Mbunda
	Mussuma	Nganguela	Mbunda, Kamakoma, Khangala, Niengo
Luacano	Luacano	Luvale	Luvale
		Nganguela	Minungo
	Lago Dilolo	Luvale	Luvale
Léua	Léua	Lunda-Tchokwe	Tchokwe
	Liangongo	Lunda-Tchokwe	Tchokwe
		Luvale	Luvale
Camanongue	--	Lunda-Tchokwe	Tchokwe
Luau	--	Lunda-Tchokwe	Tchokwe
		Ovimbundo	Umbundo
		Luvale	Luvale
		Nganguela	Minungo
Cameia	--	Lunda-Tchokwe	Tchokwe
		Luvale	Luvale

By analyzing the table above (*see* **Table 48**), 15 languages are spoken throughout the entire territory of Moxico, namely, Lunda-Ndembo, Mbunda, Luvale, Lutchaze, Tchokwe, Luimbi, Nyemba, Kamussekele, Minungu, Khangala, kamaxi, yuma, kamakoma, nyengo and umbundu. It is also verified that there is a reduced proportion of groups and languages that form an exclusive community in a given region. In most cases, the languages coexist. In a detailed analysis of the project implementation area, it is concluded that most of the languages spoken, in addition to Portuguese, are: Luvale, Lunda, Minungo, Tchokwe and Umbundo. However, there are other relatively small subgroups and native languages, often dispersed in small ethnic spots, but which are still significant or important in the diversification and enrichment of the region's culture.

Finally, it should be noted that the community surveyed during the fieldwork, although they also speak some dialects/mother tongues, speak the official language (Portuguese) and do not self-identify as belonging to a distinct indigenous cultural group that be recognized by others. At the same time, they are fully integrated into society.

6. 11.3.2. Social Framework and Housing Conditions

The characterization of the current social and economic framework is essential when a socio-environmental assessment is being carried out for projects of this nature, as this is the only way to assess and foresee possible consequences in these areas, resulting from the execution of the project in question.

Considering that Moxico was the Province that most suffered the effects of the war, since it was where it began and ended, the consequences are still very evident, isolation being one of them. This fact becomes clear due to the lack of access and connection to the other Provinces, since the means that existed were destroyed (VIS, 2012). In addition to the lack of roads, “there are still mined areas that affect the mobility of the population” and the progress of the Province itself (VIS - International Volunteering for Development, 2012).

In 2012, VIS carried out a survey of the main socioeconomic and health problems in the city of Luena: “illiteracy”, which is mainly associated with the female population and which in a certain way influences the normal growth of children, “malnutrition and undernourishment”, which is related to the isolation of the Province and the much higher value of any product, since most products come from other Provinces. Furthermore, “the Tchokwe are, by tradition, a population dedicated to nomadism and hunting. This nomadic nature is reflected in the scarce presence of agricultural crops in the territory, although there are rivers and abundant land to cultivate” (VIS, 2012). Other problems are “precarious housing”, which mainly concerns

housing on the outskirts of cities where houses are built with sand, wood or sheet metal, not guaranteeing the minimum conditions of hygiene, safety or well-being; “precarious sanitary conditions” which are associated with difficult access to drinking water, little knowledge of basic rules of hygiene and disease prevention; and, finally, “environmental degradation and loss of land”, which is related to burning, a very common practice among the population. This practice leads to greater soil wear and consequently reduces the fertilization potential. In addition, the garbage accumulated on the land leads to its contamination (VIS, 2012).

In certain areas of the Province of Moxico, earth from the *salalé hills* (termites) is used to manufacture blocks used in the construction of housing (Source: Atlas e perfil do Moxico, Angola, 2015).

According to the Report on Multidimensional Poverty in Angola, dated July 2020, prepared by the National Institute of Statistics, the Provinces of Bié, Cunene, Lunda Norte Moxico, Cuando Cubango, Uíge, Huíla, Cuanza Sul and Huambo have an incidence rate of poverty greater than 70%. While the Province of Luanda has the lowest incidence rate of poverty, with 23.7%. According to the IPM-M, the Provinces with the 10 poorest Municipalities in the country are: Cunene, Namibe, Malange, Moxico Cuando Cubango and Lunda Norte. While, the Province of Luanda (capital of the Country), has 5 of the least poor Municipalities in the Country. The Province of Moxico has a poverty incidence rate of over 70%, which means that at least 7 out of 10 people in this Province are multidimensionally poor.

The theme of habitability/housing is also very problematic in Angola. The war was responsible for the destruction of much of Angola's housing stock, as well as for the displacement of populations from their traditional environments and ways of life.

Housing constitutes the most important support of all forms of community life, being subsidiary in its various forms, from collective to isolated housing, to a broader set of functions and activities that, together, define the urban or rural environment, and whose articulation constitutes the economy of a given place.

At a more local level, in the area of direct influence of the project, it was found that most of the existing houses surrounding the project's implantation area are precarious houses covered with sheet metal (*see* **Figure 205**), with no basic sanitation and no connection to the water supply and electricity from the public network.

Figure 205 – Illustration of precarious housing existing in the project's area of influence.

As in the rest of Angola, the Province of Moxico has several shortcomings in the social, economic and infrastructure areas. Although the progress made since the end of the civil war is evident, the rural exodus and the consequent population growth have not been accompanied by the necessary increase in the supply of equipment and basic services.

At the same time, in the Province of Moxico there are many vulnerable children and young people living on the streets, mainly in the city of Luena. The escape from fatherhood influences the number of children and adolescents on the cold streets of the Moxico capital. To help with hunger, many children sell plastic waste they find in rubbish bins. The Province has only one social reintegration centre, Ana Jetu Home, belonging to the Catholic Church, which welcomes abandoned children and adolescents. The center has capacity for around 150 people, but currently houses 19 children due to lack of beds and other means. It is also mentioned that in the city of Luena alone, around 300 children live on the streets (*in* www.dw.com).

6.11.3.3. Sanitary Framework

In most areas, populations use septic tanks or latrines, access to sanitary facilities is practically non-existent in rural areas. Access to sanitary facilities exists in the more developed areas and where there are population centers made up of more structured housing, mostly located near urban centres.

Regular access to tap water is rare in coastal regions, as in the rest of the country. Sanitation facilities are even more limited. Wastewater from the few flushing toilets and septic tanks is discharged into the environment, without any treatment, and some runoff with a strong odor was found, which shows that it comes from domestic sewage.

According to data from the Multiple and Health Indicators Survey (IIMS 2015-2016), 30% of households in Angola do not have sanitary facilities, which leaves them vulnerable to diseases such as cholera and diarrhea.

The following figure (*see* **Figure 206**) represents access to sanitary facilities in the country, according to each Province.

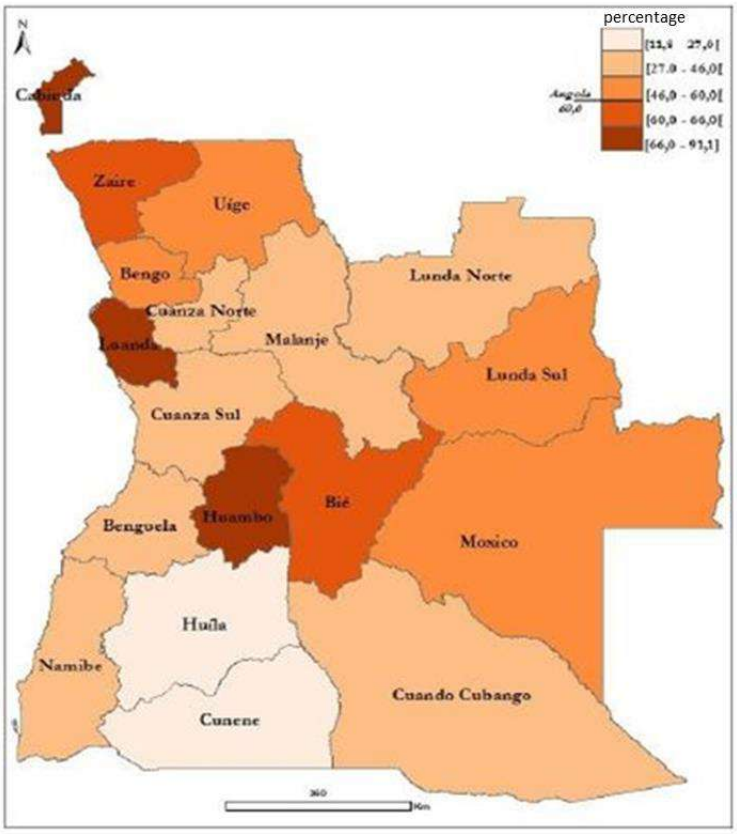


Figure 206 – Cartogram indicating the percentage of households using appropriate sanitation facilities, according to the Province (Source: 2014 Census).

Analyzing the previous figure (*see* **Figure 206**) it can be seen that around 46.0% to 60.0% (less than the Angolan average) of households in the Province of Moxico use appropriate sanitary facilities.

With regard to basic sanitation in homes, 100% of respondents said they had no connection to the public sanitation network.

To address the lack of sanitary facilities, the Angolan Government is promoting the use of latrines and raising awareness about community health, thus helping to ensure the health of the community, as well as programs to combat poverty implemented by various NGOs and by the United Nations.

6.11.3.4. Health

In a brief summary, it should be noted that the health sector is one of the most critical and sensitive aspects in the territory of Angola, not least because of financial resources are just one of the parts, perhaps the easiest to overcome, of the problem. The lack of qualified staff and health equipment equipped with all the necessary means for its proper functioning will certainly be the tip of the most difficult problem to solve in the short and medium term.

Angola is faced with the lack of a health network that covers the entire territory and with a lack of personnel to provide the current equipment, even though these are in small and insufficient number.

The National Health Development Plan 2012 – 2025 (PNDS), prepared by a Multisectoral Commission, created by the Presidential initiative, through Presidential Order no. 84/11 of October 27 established in the Long-Term Development Strategy "Angola 2025" and in the National Health Policy, within the scope of the reform of the National Health System. [2]

According to the PNDS 2012 - 2025, indicators point to the fact that there are currently two doctors for every 10.000 inhabitants (2/10.000), nineteen nursing professionals (19/10.000), four diagnostic and therapeutic technicians (4/10.000), five workers hospital support (5/10.000) and eleven general regime workers (11/10.000).

The prevalence of HIV/AIDS remains low in Angola. The HIV epidemic in Angola decreased by 5% in the period from 2000 to 2012. The estimated HIV prevalence in Angola is 1.98%. The occurrence of new infections (incidence) is 0.2%, being higher in urban areas with 0.4% than in rural areas with 0.16%. HIV transmission is predominantly heterosexual with 79.2% of cases reported.

The biggest health problem is the lack of basic sanitation that leads to the emergence of malaria and other diseases, but most of these diseases are preventable as long as vaccination campaigns are promoted, thus raising the protection rates of the population. Public health campaigns mobilize community members and local organizations such as churches and schools, community groups and city administration to work together to promote a healthy environment. Public health campaigns help people understand how to prevent epidemics such as polio, malaria and yellow fever and also to distribute vaccines. Volunteers are essential for

[2] Plano Nacional de Desenvolvimento Sanitário 2012-2025 (PNDS). http://www.minsa.gov.ao/VerPublicacao.aspx?id=1136.

the success of the campaigns as they visit people directly in their homes, thus reaching a wider range of population (adapted from Fórum de Viana | 2014 Atlas).

It also refers to the lack of access to drinking water, which results in a high incidence of waterborne diseases such as acute diarrheal diseases, cholera, typhoid, meningitis, etc., which have decimated a high number of human lives, especially children. This problem is more related to the quality and distribution of drinking water, not having its origin in natural factors.

Moxico's health sector has seen significant improvements, with deaths from malaria falling, according to statistics from the main health units in the Province. According to data from the Provincial Health Office, in 2017 there were 167.077 cases of malaria, with 1.274 deaths, and, with the implementation of the public health operational plan, in 2018 the numbers decreased to 155.162, with a record of 300 deaths (*in* www.jornaldeangola.ao). However, one of the major problems in the Province is due to the distance between existing health units. According to LAULEMO, an association that fights to defend the rights of communities in Moxico Province, the population living in remote areas is obliged to travel to Zambia to receive medical treatment. It was also mentioned that "of the hospitals that exist, some are so far from the communities that to gain access it is necessary to walk hundreds of kilometers, while in other units there is no medicine or food, which makes some inhabitants prefer to go to Zambia in search of of medical assistance" (at flyingportugues.com). However, when carrying out the social consultation process, it was concluded that 91% of the interviewees reported having access to health infrastructure (hospital and health post or center) close to their Commune, to the detriment of 9% who mentioned not have access to them. They also highlighted the need for rehabilitation and better conditions for these infrastructures.

According to information from *Jornal de Angola*, Moxico Province currently has 2.422 health professionals, who ensure the functioning of the Health Sector, including doctors, nurses, diagnostic technicians, therapists and administrative staff (*in* www.jornaldeangola.ao).

In Moxico Province, the main health facility is the Moxico General Hospital shown in the following figure (*see* **Figure 207**).

Figure 207 – Moxico General Hospital, located in Luena (Source: www.jornaldeangola.ao).

The following figures (*see* **Figures 208** and **209**) show the remaining larger health infrastructures identified during the fieldwork carried out.

Figure 208 – Photographic record of the Municipal Hospital of Alto Zambeze.

Figure 209 – Photographic record of the Medical Center located in Kassau neighborhood, Commune of Nana Candungo.

6.11.3.5. Educational Framework

At the national level, there are several problems related to education: the country's weak monetary capacities, as well as the lack of qualified teachers, insufficient public schools, high dropout rates and children excluded from school because they do not have a birth certificate or because they are people with a disability. In addition to these, there is also corruption, sexual harassment and teacher absenteeism. The levels of schooling at the country and provincial level are mostly in Primary Education, but the percentage of the population without any level of education remains high.

Human resources remain a major obstacle in the education and health sectors. It is still very difficult to convince teachers and qualified health professionals to work in rural areas, far from the capital, Luanda, which itself suffers from a shortage of qualified personnel. The administration and execution of public planning suffers from the same problem. Already scarce, skilled labor is concentrated in the main urban centers, which continues to jeopardize the realization of some of the projects of the Angolan Government.

Figure 210 shows the proportion of the population aged 18 or over, by age group, according to the level of education completed.

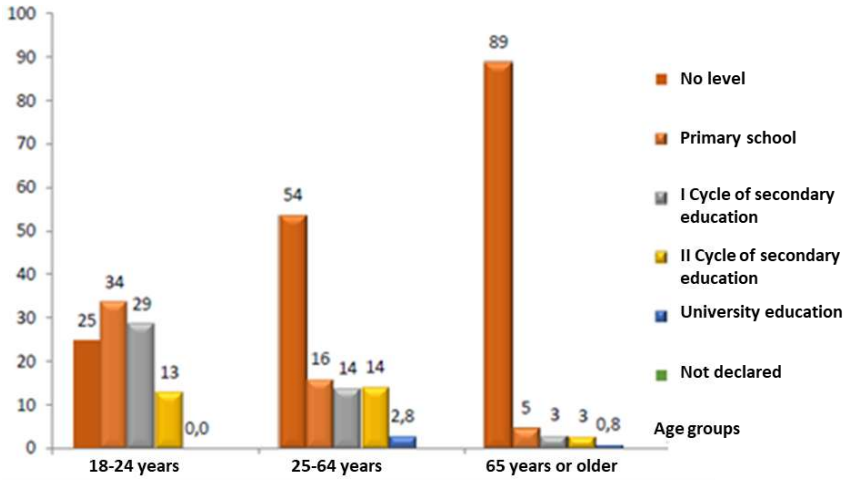


Figure 210 – Proportion of the population aged 18 or over, by age group, according to the level of education completed (Source: Census, 2014).

Analyzing the previous figure (*see* **Figure 210**) it is possible to conclude that there is a clear generational improvement in terms of completion of studies (at least primary education), a fact reflected by the non-completion of any level of schooling for 89% of the population over 65 years of age, 54% for the population between 25 and 64 years of age and 25% for the population between 18 and 24 years of age.

The following figure (*see* **Figure 211**) shows a graph with an indication of the population aged 24 or over, who completed higher education, according to age groups and by sex.

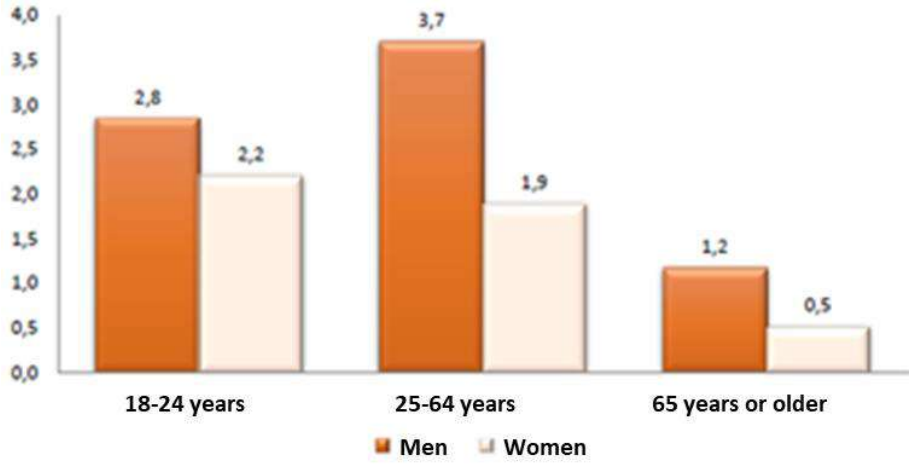


Figure 211 – Population aged 24 and over, who completed higher education, according to age groups, by sex (Source: Census, 2014).

In terms of age groups, and according to **Figure 211**, it can be seen that the differentiation between sexual genders is lower in the 24-34 age group, which may reveal a tendency to change mentalities and equal opportunities Angolan women.

Figure 212 shows a graph of the population, aged 24 or over, who completed higher education, distributed by Province.

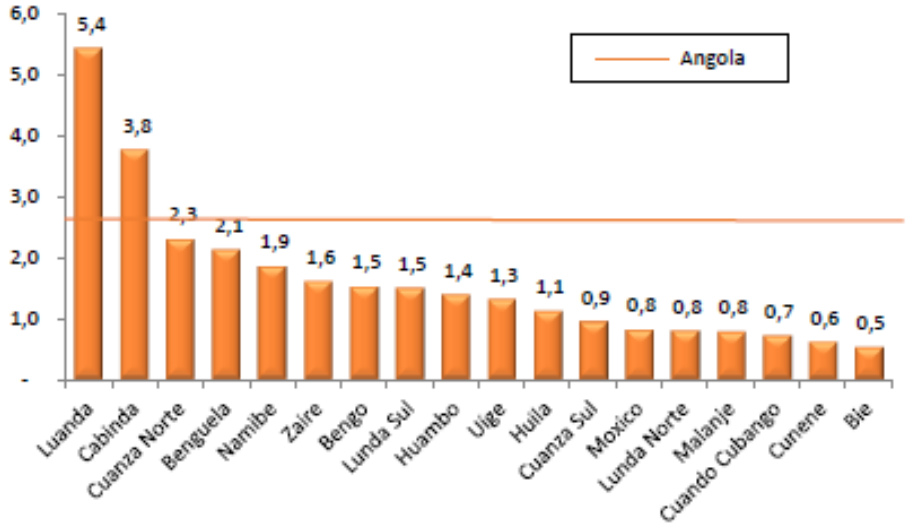


Figure 212 – Population aged 24 or over, who completed higher education, distributed by Province (Source: Census, 2014).

It is possible to verify, through the interpretation of the previous figure (*see* **Figure 212**) that it is in the Province of Luanda, where the highest numbers of completion of secondary education are obtained, as would be expected. Here, the numbers are much higher than the Angolan

average. In global terms, only the Province of Cabinda, along with the Province of Luanda, are above the country's average. However, the Province of Cunene presents a value of completion of secondary education below the national average.

However, it should be noted that the literacy rate (population aged 15 or over who can read and write and the total population aged 15 or over) in Cunene Province is 54%. In 2014, in the Province of Cunene, 23.8% of the population aged 18 or over did not have any level of schooling completed, and 0.6% of the population had completed higher education (Census, 2014). However, from the sample of the population interviewed when characterizing the reference situation, there was a literacy rate of 98%, 66% had secondary education, 29% primary education and 2% had a degree.

Distance to schools has been identified as a factor that inhibits access for vulnerable populations, especially in rural areas with a more dispersed population, negatively influencing school performance. This situation is especially serious in the Province of Moxico, with around 40.000 children currently outside the school system (*in* www.dn.pt). However, curiously, in terms of the region, the Province of Moxico has the highest ratio of schools per inhabitant, which is possibly related to the terrain of the area, with the concentration of its inhabitants in medium-sized households, and the fact that it did not attract outside populations (Journal of Education, Vol. 10, 2022). When carrying out field work and carrying out surveys of the population, it was found that most school-age children in rural areas do not attend school due to lack of financial resources, lack of parental interest, maternity/pregnancy and lack of time to combine with work. The population also refers to the lack of teachers in the existing education infrastructures in their Commune/Neighborhood, a situation aggravated by the inexistence and/or extreme degradation of road accessibility, which does not allow for safe road circulation, and on the other hand promotes the isolation from more rural communities.

The Education and Culture Sector of the Province of Moxico is characterized by two branches, the public and the private, which operate with some difficulties, as this was one of the Provinces most affected by the war. The Public Sector of Education focuses on the nine Municipalities of the Province. The Private Sector is limited to the city of Luena, with an Agrarian Institute, a Seventh-day Adventist College, a Pentecostal Institute and a Dom Bosco Center (*in* Governo de Angola, 2022).

Regarding the availability of education infrastructure, according to statistics provided by the provincial education directorates of the eastern region to the Statistical Study and Planning Office (GEPE), until 2018 there were 490 schools in Moxico Province.

The following figures (*see* **Figures 213** to **216**) present the photographic record of some educational institutions identified in the area of influence of the project.

Figure 213 – Photographic Record of Primary School No. 18 – Headquarters Manguxi.

Figure 214 – Photographic Record of high school n.º 7 – Cazombo, Alto Zambeze Municipality.

Figure 215 – Photographic Record of College No. 229 Chipola - Cazombo.

Figure 216 – Photographic record of the residence for teachers located in Comuna de Cavungo – Neighborhood Kassau.

6.11.3.6. Water

Despite the investments and improvements registered in the Province of Moxico, there are still significant shortages of water supply. However, there are ongoing programs and investments in order to counteract this reality in the coming years.

During the consultation process, the interviewed community called for improvements in living conditions such as, for example, access to drinking water, basic sanitation and road transport

routes/bridges in good condition that allow circulation and connection with other surrounding communities.

With regard to water supply, 100% of respondents when characterizing the reference situation and public consultation declared that they did not have access to potable water. At the same time, with regard to the origin of the water consumed, 79% of the interviewees mentioned that they supplied water from the river and the remaining 21% mentioned that they used other sources (eg, fountains, wells/cacimbas, etc.), as illustrated in the following figure (*see* **Figure 217**).

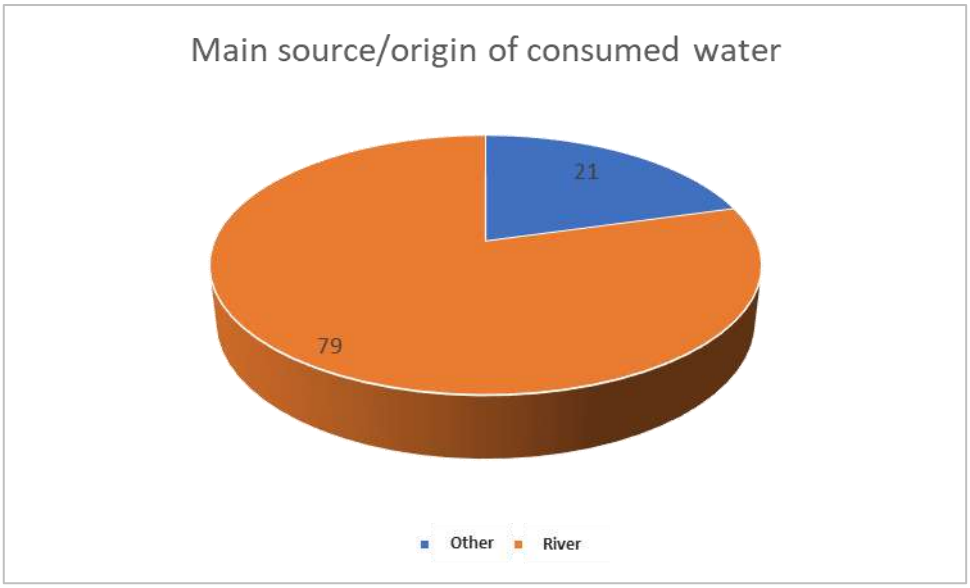


Figure 217 - Graphic treatment of the question: "Main source/origin of consumed water".

In the surroundings of the project, it was found that the population resorted to public fountains, ponds and rivers to fill the water tanks, take baths and wash their clothes, as can be seen in the following figures (*see* **Figures 218** and **219**). With the lack of water supply, a large part of the population still gets their water for consumption directly or indirectly from the nearest rivers, through tanker trucks that sell it, without any type of quality control.

Figure 218 - Photographic record of washing clothes and vehicles by the local population on the Sapo River, Luau.

Figure 219 - Photographic record of washing of clothes, personal hygiene and washing of vehicles by the local population in the river.

During the field work and given the unavailability of reference values for the characterization of water quality in the area of influence of the project, RESURB carried out *in situ* monitoring at the sampling points presented in **Subchapter 6.3.3. Water Quality**.

6.11.3.7. Energy

Currently, an estimated 60 million people use solar energy as a source of electricity in Africa, a continent where nearly 87% of low-income people living in sub-Saharan rural areas do not have access to electricity (*in* www.embaixadadeangola.pt).

The World Bank forecasts that the Angolan economy will grow by 3.1% in 2022, from 0.8% in the previous year and slow down to less than 3% by 2024, thus maintaining growth below the regional average, due to the deceleration in the production of oil (Africa's Pulse, an Analysis of Issues Shaping Africa's Economic Future, October 2022).

The 0.2% increase in growth from the April 2022 projections reflects the contribution of a better-than-expected improvement in oil prices, averaging around US$100 per barrel in 2022. On the demand side, the economy's performance is supported by the increase in private consumption, government expenditures and a positive current account surplus. World Bank

economists consider that the government of Angola is beginning to enjoy the benefits inherent to the efforts implemented to improve revenue mobilization, increasing tax and collection efficiency and reducing tax evasion. With these measures, the fiscal balance recorded a surplus of 1% of GDP.

In this sense, in order not to excessively depend on oil and to diversify its economy in order to achieve sustainable economic growth, the Republic of Angola prepared the long-term development policy called Vision 2025 and the National Development Plan 2018-2022 (PND 2018-2022), having identified, to date, some problems such as the electricity tariff set at a low price of around 5 AOA/kWh for a supply cost of around 40 AOA/kWh, the vulnerability of generation of hydroelectric power, which represents about 60% of the electricity generated, seasonal fluctuation (drought), low electrification rate with a national average of about 30% (*see* **Figure 120**), transmission and distribution losses of about of 55% (about 15% of technical losses and about 40% of non-technical losses), as well as the low level of collection of the energy tariff due to insufficient measurement means represented by the high rate of non-technical losses (Source: Draft of the Master Plan for Electricity Development in the Republic of Angola - Draft Final Report, May 2018).

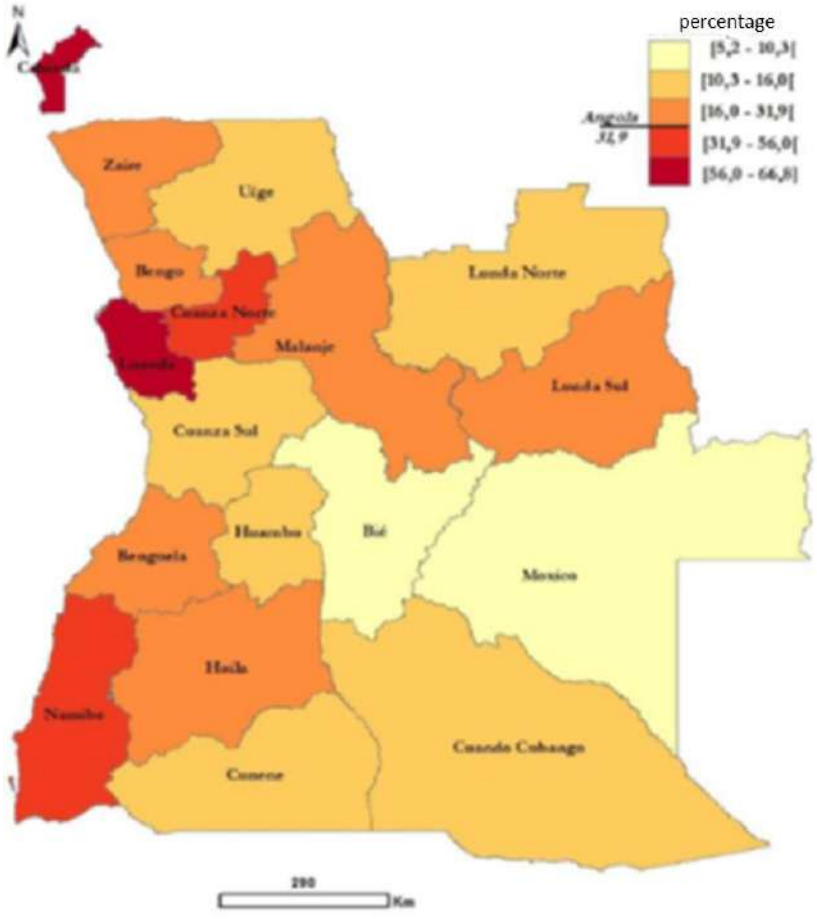


Figure 220 – Percentage of access to electricity from the grid, by Province (Source: Census, 2014).

In terms of access to electricity from the grid, only the Provinces of Luanda, Cabinda, Namibe and Cuanza Norte are above the Angolan average for access to electricity.

As can be seen from the analysis of the previous figure (*see* **Figure 121**), the Province of Moxico has an electricity coverage rate well below the national average (31.9%), namely from 5.2% to 10.3%. %.

Figure 189 shows the proportion of households, according to the main source of energy they have.

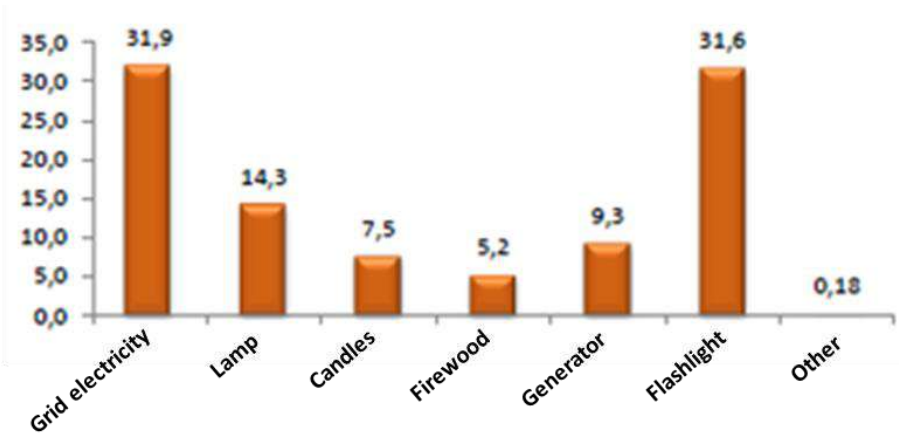


Figure 221 – Proportion of households, by main type of lighting (Source: Census, 2014).

Analyzing the figure above (*see* **Figure 122**), it is possible to conclude that of the households that have access to any source of lighting, 31.9% of the households access electricity from the grid and 31.6% access lighting through a flashlight.

It refers that there is currently a project for the Province of Moxico for the construction of a Photovoltaic Power Station, with a power of 32.2 Megawatts, which will be installed to electrify the border Municipality of Luau in an area of 67 hectares (*in* www.jornaldeangola.ao).

When carrying out the fieldwork, it was found that the most rural local communities do not have a connection to the public power grid, resorting mostly to generators. During the consultation process and public consultation, 100% of the interviewees stated that they did not have access to energy in their homes from the public network. At the same time, with regard to the main source of energy and lighting, 41% of respondents said they used battery-powered light bulbs, 37% used candles, 18% used other sources of energy and only 5% of respondents said that energy came from of generators, as illustrated in the following figure (*see* **Figure 122**).

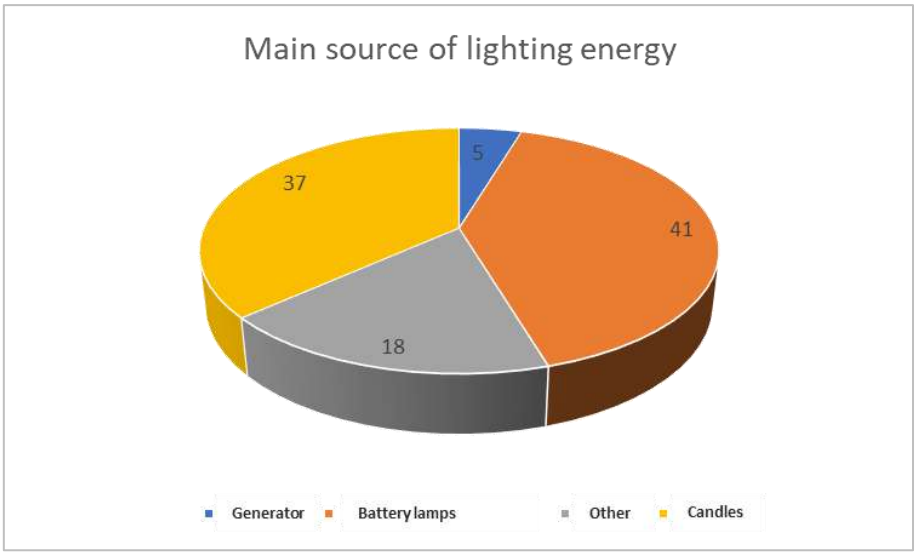


Figure 222 – Graphic treatment of the question "Main source of energy and lighting".

6.11.3.8. Productive Framework and Employment

The economic and social history of Angola has been marked by upheavals, resulting from its own historical evolution. After independence in 1975, more than 25 years of internal struggle followed, which made the country's economic take-off and development unfeasible.

In the 1990s, with the end of the civil war, the Angolan economy had a period of prosperity, very focused on the oil economy. In the late 2000s, Angola was hit hard by the collapse of oil prices, having suffered the biggest negative spike in 2009.

Angola's economy grew by 2.6% year-on-year in the first quarter of 2022, after a 2.4% increase revised upwards in the previous quarter. It was the fourth consecutive quarter of expansion and the fastest pace since the last quarter of 2018. The transport sector was the one that grew the most (31.3%), namely the airline sector, as a result of the increase in flight frequencies, as well as the entry into operation of new companies. Additionally, the oil sector rose 1.9% in the first quarter for the first time since 2016, amid higher oil prices and strengthening demand. On the other hand, the extraction of diamonds and other minerals registered the biggest drop, with a contraction of 28.3%. On a seasonally quarterly basis, Gross Domestic Product (GDP) grew by 4.3%, the highest since the last quarter of 2014.

The following figure (*see* **Figure 123**) shows the evolution of Angola's GDP between 2018 and 2022, using the values of the African Development Bank and the National Institute of Statistics of Angola as a reference.

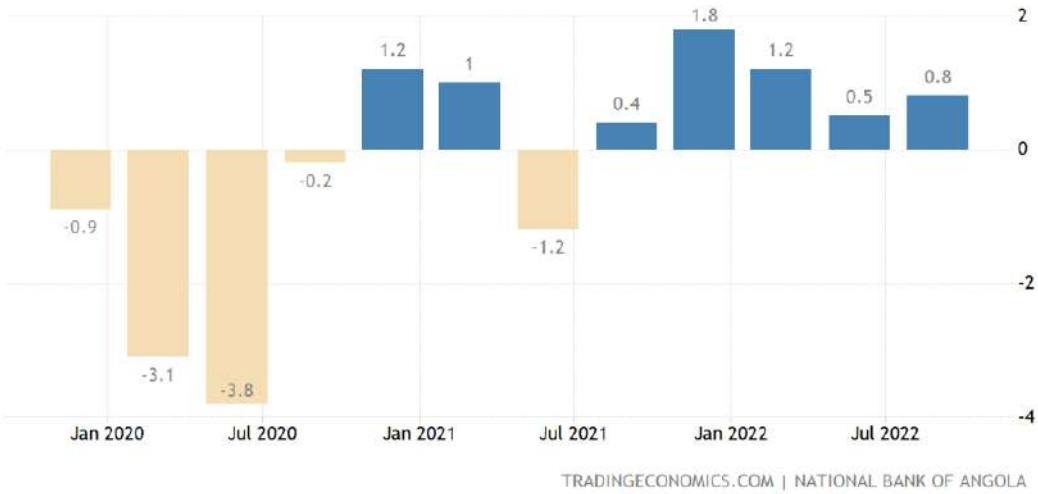


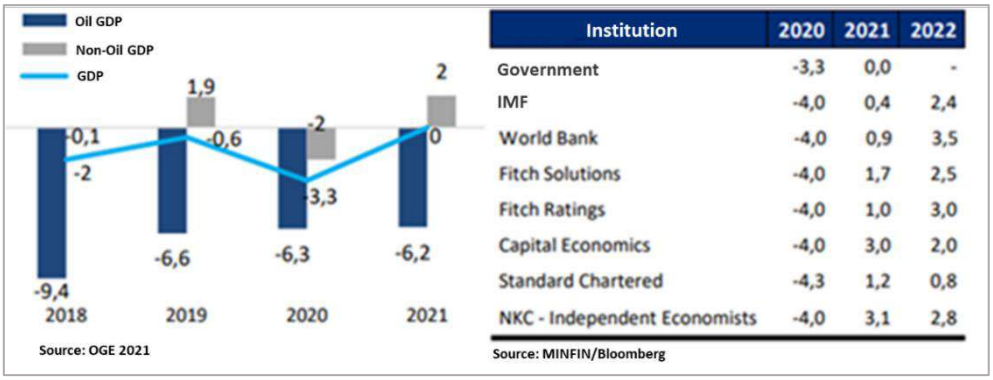
Figure 223 – Angolan GDP Growth Rates, 2020 – 2022 (Source: *Tradingeconomics.com*).

Through the analysis of the previous figure (*see* **Figure 223**) it appears that the Gross Domestic Product (GDP) of Angola grew by around 0.80% in the third quarter of 2022 compared to the previous quarter.

According to the IMF's most recent World Economic Outlook (WEO) published in January 2021, the global economy is estimated to have retreated by 3.5% in 2020 after growing by 2.8% in 2019, a worse global GDP performance than the 2008/2009 financial crisis. For 2021, there is greater optimism regarding the prospects for growth in the world economy. The IMF expects growth of around 5.5%. If confirmed, it should be the highest expansion in the last 14 years, reflecting the implementation of vaccines against Covid-19, as well as the additional budgetary support planned, especially in large economies.

The international oil market was marked by the drop in world consumption, resulting from the emergence of Covid-19. As a result, the Angolan oil sector experienced tensions in production and revenue collection, which exacerbated the Government's challenges in implementing efforts to contain the decline in oil production (in the 2020 Conjuncture Report – BAI).

The following figure (*see* **Figure 224**) presents the Comparative Projections of GDP in Angola by various institutions.



Institution	2020	2021	2022
Government	-3,3	0,0	-
IMF	-4,0	0,4	2,4
World Bank	-4,0	0,9	3,5
Fitch Solutions	-4,0	1,7	2,5
Fitch Ratings	-4,0	1,0	3,0
Capital Economics	-4,0	3,0	2,0
Standard Chartered	-4,3	1,2	0,8
NKC - Independent Economists	-4,0	3,1	2,8

Source: MINFIN/Bloomberg

Figure 224 – Comparative Projections of GDP in Angola (Source: Annual Report 2020 – BAI).

Analyzing the figure above (*see* **Figure 224**) it can be seen that for 2021, although a recovery in GDP was expected, the economy was stagnating, with the risk of not emerging from the prolonged period of economic recession remaining. The outlook is for the non-oil sector to grow supported by the robust growth expected for the minerals, energy and water and agricultural sectors.

The growth of activity sectors not directly related to oil, according to information published on the official pages of the Angolan administration, has been strongly encouraged and supported with a view to improving infrastructure and relaunching economic activity throughout the country.

Nationally, after higher unemployment rates, Angola had an unemployment rate of around 20% in 2017 and 2018. However, the unemployment rate in Angola increased to 31.60% in the second quarter of 2021. The unemployment rate in Angola decreased to 30.20% in the second quarter of 2022, from 30.80% in the first quarter of 2022, based on figures from the African Development Bank and the National Institute of Statistics of Angola, as can be seen in the following figure (*see* **Figure 225**).

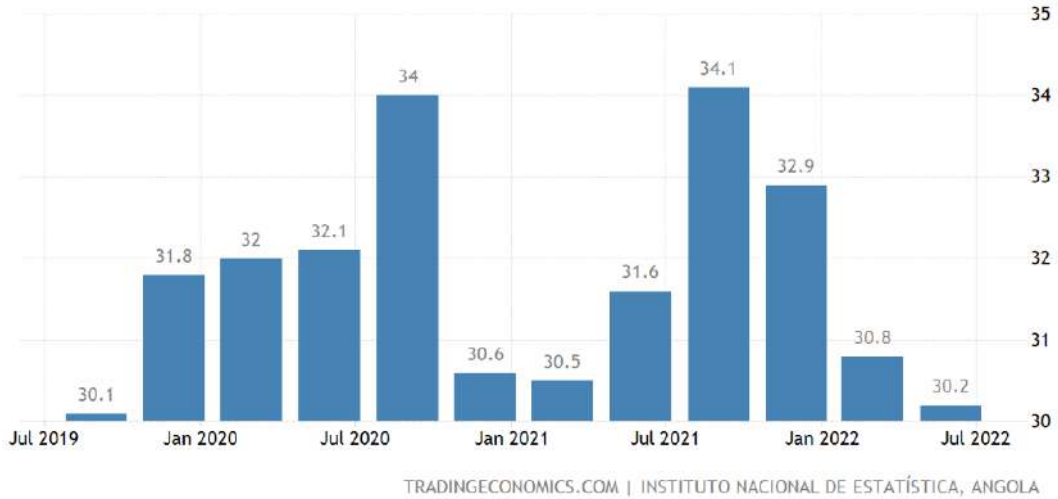


Figure 225 – Unemployment rate in Angola (Source: Adapted from *Tradingeconomics*).

According to the INE Employment Report, until 2016, the unemployment rate in Moxico Province was around 31.2% (27.7% Men and 34.4% Women).

It should be noted that in Moxico Province, the three main sectors of economic activity in which the population was employed were agriculture, animal production, hunting, forestry and fishing; industry, construction, energy and water; services (INE, 2019).

At a local level, when surveys were carried out among the populations surrounding the project, it was found that 39% of respondents were unemployed, 16% did not answer this question and the remaining 44% were employed (*see* **Figure 226**). Of these, 44% worked in the agricultural sector, 1% in the transport sector, 1% in the commercial sector, 2% in the fishing sector, 1% in the public sector and the remaining 53% did not indicate their profession.

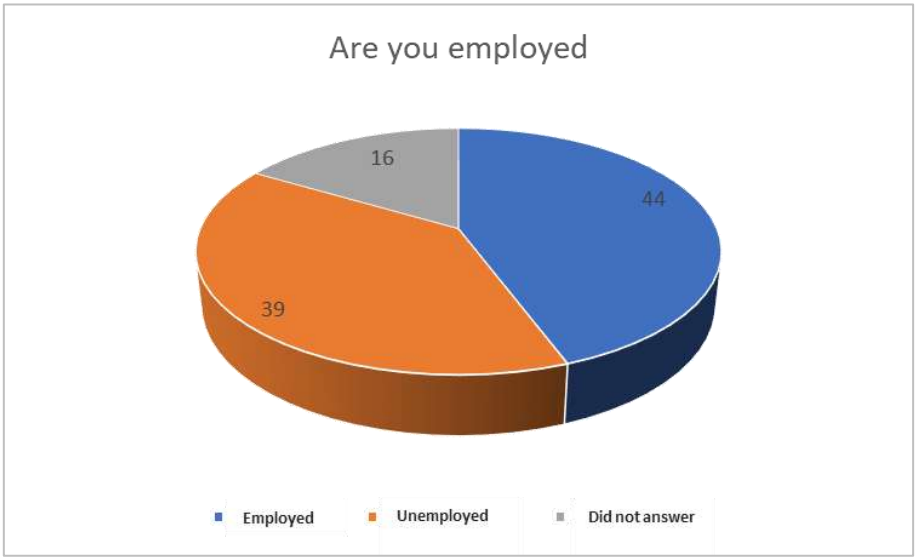


Figure 226 - Graphic treatment of the question: "Are you employed?"

The information obtained during the public consultation reveals a worsening of the information regarding the productive framework and employment compared to the information referred to in the Report on Employment for the Province of Moxico, in 2017.

6.11.3.8.1. Agriculture, Livestock and Fisheries

Primary activities present themselves as fundamental pillars to fight poverty and food insecurity, particularly in a rural population and with the characteristics of a significant part of the Angolan population. Angola's agrarian activity was greatly reduced after independence, as a result of the war. This situation fundamentally affected the peasant sector, which was forced, in many provinces, to abandon their areas of residence to concentrate in areas that offered security conditions, generally on the outskirts of urban centers.

At the moment, the agro-industrial-industrial and agricultural sectors are in full expansion at this stage, as a result of the goals and objectives launched by the Government in order to make the country less dependent on exports.

Regarding the types of farm, Angola has three distinct zones. The zone essentially of rainfed exploration (large part of the territory), where the vegetative cycle of the crops coincides with the rainy annual season, which is very expressive, irrigation becomes necessary only in the dry period and in relation to certain long-lasting crops (orchards) or horticulture. In the transition zone, rainfed farming is restricted to crops that are resistant to drought or that do not require moisture (cotton, cassava, massembala, massango), while irrigated farming is required for many other annual cycle crops. Finally, in the irrigated area, which covers the entire coast, irrigation is the priority for agricultural production, while rainfed is only viable in the case of crops that are quite resistant to drought and provided that specific conditions are provided for soils and topography.

Despite the recent growth of the Province of Moxico, the main activity of the population is subsistence agriculture, with cassava being the most exploited food, which serves as the basis of the diet of the majority of the population. Other foods are produced in smaller quantities, such as beans, corn or honey (VIS, 2012). In addition to agriculture, families raise animals (chickens and goats), allowing them to enrich their diet and do business.

The Province has favorable soils and climate conditions for rice cultivation and defended the use of technologies to increase the quality of the product. The Province of Moxico was the biggest producer of rice in the country, with more than 70 tons per year, which corresponds to a third of what is currently produced in the whole of Angola (www.jornaldeangola.ao).

Currently, agricultural activity is limited to 257 registered small and medium-sized agricultural and livestock companies, with around twelve operating in the Municipality of Moxico. The activity of the traditional sector is carried out in an uncontrolled manner, limited to subsistence production, lacking framework and technical assistance for its development (Government of Angola, 2022).

At a local level, subsistence agriculture was practiced, often carried out by school-age children, as can be seen in the following figure (*see* **Figure 227**).

Figure 227 – Photographic record of the subsistence farming activity on the Cazombo-Cavungo route.

There is some forest exploitation in the Municipality of Moxico, mainly extracted from areas planted with eucalyptus and pine trees. The wood logs are exported for consumption on the coast and outside the country, with a fraction used locally (Government of Angola, 2022).

In the livestock subsector, the Province is one of the national centers specializing in the production of meat and milk, with cattle, sheep, goats and pigs (Portal São Francisco, 2018).

As far as fishing is concerned, this is an artisanal activity, but with great abundance due to the rivers and lakes as well as the flooding of the territory during the rainy season. The numerous rivers, lakes, lagoons and extensive swamps in the rainy season, enhance the practice of river and lagoon fishing, whose exploration through targeted projects, could be a factor of economic development and social promotion of the populations (Government of Angola, 2022).

At local level, there was the practice of river and lagoon fishing in the project's area of influence, as can be seen in the following figure (*see* **Figure 228**).

Figure 228 – Photographic record of fishing activity in Moxico.

6.11.3.8.2. Trade and Industry

In the Province of Moxico, the commercial subsector is based on wholesale centers that distribute processed and semi-processed products to the Province's localities, with a concentration in Luena, Luau and Cazombo (Portal São Francisco, 2018). Trade in other locations works informally (Government of Angola, 2022).

There are also service activities dedicated to logistics, given that the Benguela Railway and numerous roads cross the Province of Moxico (Portal São Francisco, 2018).

The industrial parks of Moxico are specialized in the agroindustry for the transformation of meat, milk and eggs, also registering the production of food, beverages, clothing, transformation of furniture and construction materials. The areas of greatest industrial concentration are in Luena and Luau (Portal São Francisco, 2018).

With regard to mining, the mining potential of the Province is diversified (copper, gold, tungsten, diamonds, manganese and uranium, inert for civil construction) (Government of Angola, 2022).

It should be noted that during the fieldwork, along the main roads, informal trade in produced and/or wholesale products is notorious, as can be seen in the following figure (*see* **Figure 229**).

Figure 229 – Photographic record of informal trade in the neighborhood Chipoya, Cazombo.

6.11.3.8.3. Turism

There are several potentially tourist areas in the Province, namely Cangongo (Luena), Lago Calundo (Leua), Lago Dilolo (Luacano), Cameia National Park and falls of the Luizavo River (Alto Zambeze), however, these are not explored, due to lack of investments (Government of Angola, 2022).

Moxico's hotel sector has registered 8 hotels, 5 pensions and 34 bars and restaurants (Government of Angola, 2022). Of these, only one hotel operates outside Luena (*in* www.dn.pt).

6.11.4. Transport and Communication Infrastructures

The National Development Plan (PDN 2018-2022) aims to promote the socio-economic and territorial development of the Country. The PDN has a prospective and multi-annual nature, with national scope. The execution of the PDN 2018-2022 will allow the structural transformation of the economy in order to increase the weight of the non-oil sector, will enable the creation of jobs and the creation of well-being of the population, assuming development, with the necessary infrastructures.

6.11.4.1. Airport Infrastructures

SGA, Sociedade Gestora de Aeroportos manages 18 airports and air navigation services for all airports, another 7 are under the control of provincial governments, 5 are operated by mining companies and 6 are used by the Angolan Air Force.

This network is complemented by a set of military airports (Lobito, Cabo Ledo, Ngage, Cahama, Changongo and Catumbela) and a set of public dirt runways (Porto Amboim, Waco Kungo, Ambriz, Andulo, Damba, Jamba, Luau, Kangamba, Nzeto) and private (Lucapa, Catoca, Gove, Nzaji). Angola's main international airport is located in Luanda and is served by several international and regional airlines.

The Province of Moxico has two airports, namely Luena Airport (Comandante Dangereux) which receives small and large domestic aircraft, and Luau International Airport (General Sapilinha Sambalanga) which receives routes from neighboring countries such as the Democratic Republic of Congo and Zambia (Welcome to Angola Portal).

6.11.4.2. Railway Infrastructures

The Republic of Angola has three railways managed by public companies with a total length of about 2.700 km (*see* **Figure 230**). These railways run from the coastal zone to the east of the country in colonial times, connecting the country's main Atlantic ports (Luanda, Lobito and Namibe) to the hinterland. The three lines are disconnected from each other and from the railways of neighboring countries, except for the Benguela Railway which connects Angola to the Republic Democratic of Congo.

It should be noted that the rail network is extremely important as a means of reaching the interior of the country, taking into account that cities and inland areas have been left out of the developments that have taken place in coastal areas for many years. Sectors such as agriculture and mining, which are centralized in Angola's inland areas, will certainly benefit from an operational rail system. The transport of imports (such as equipment and goods) to the interior will also be easier.

It should be noted that a large part of the development of Moxico Province (especially the larger towns) was linked to the Benguela Railway (CFB) (*see* **Figure 230**), which left Lobito on the west coast and reached the Katanga region in the Republic Democratic of Congo (Atlas e perfil do Moxico, Angola, 2015).

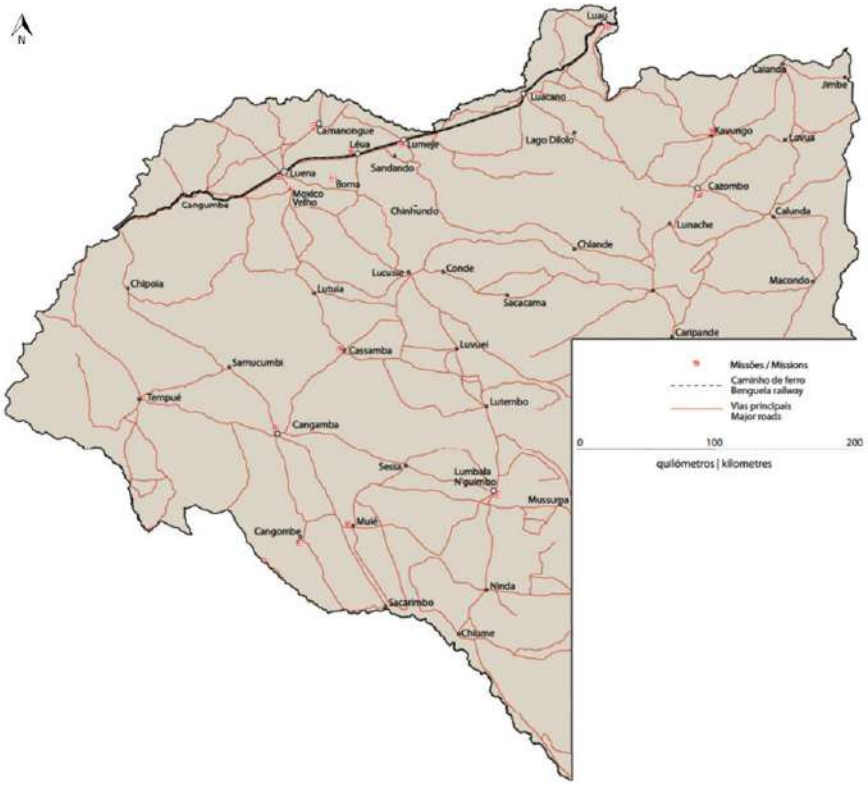


Figure 230 – Illustration of the Benguela Railway in Moxico Province (Source: adapted from Atlas e perfil do Moxico, Angola, 2015).

Construction of the CFB began in Lobito in 1902 (Benguela Province) and ended in Luau (Moxico Province) in 1928. The railway was destroyed during the civil war but has recently been rebuilt. Luau is the border post for the DRC. Other border posts for Zambia exist at Jimbe and Caripande (Atlas e perfil do Moxico, Angola, 2015).

The Province of Moxico has 10 stops and 11 stations, with two cities standing out, namely Luena and Luau.

By analyzing the previous figure (*see* **Figure 230**) it can be seen that the project's implantation area is not served by this infrastructure.

6.11.4.3. Road Infrastructures

The Republic of Angola has invested a significant amount in the reconstruction of its road infrastructure since the end of the Civil War in 2002. Angola currently has a very extensive road network, covering a total distance of around 76.000 km. However, the country's road infrastructure remains in relatively poor condition. Most traffic is concentrated in the area around Luanda, but overall traffic levels are relatively low. The inadequate condition of the roads caused by several years of destruction and lack of maintenance is one of the factors

contributing to the reduced levels of traffic (Source: National Master Plan for the Transport Sector, MINTRANS).

The Province of Moxico has a network of around 4.774 kilometers of roads (Source: www.dn.pt). The following figure (*see* **Figure 231**) shows the road network in the Province of Moxico.

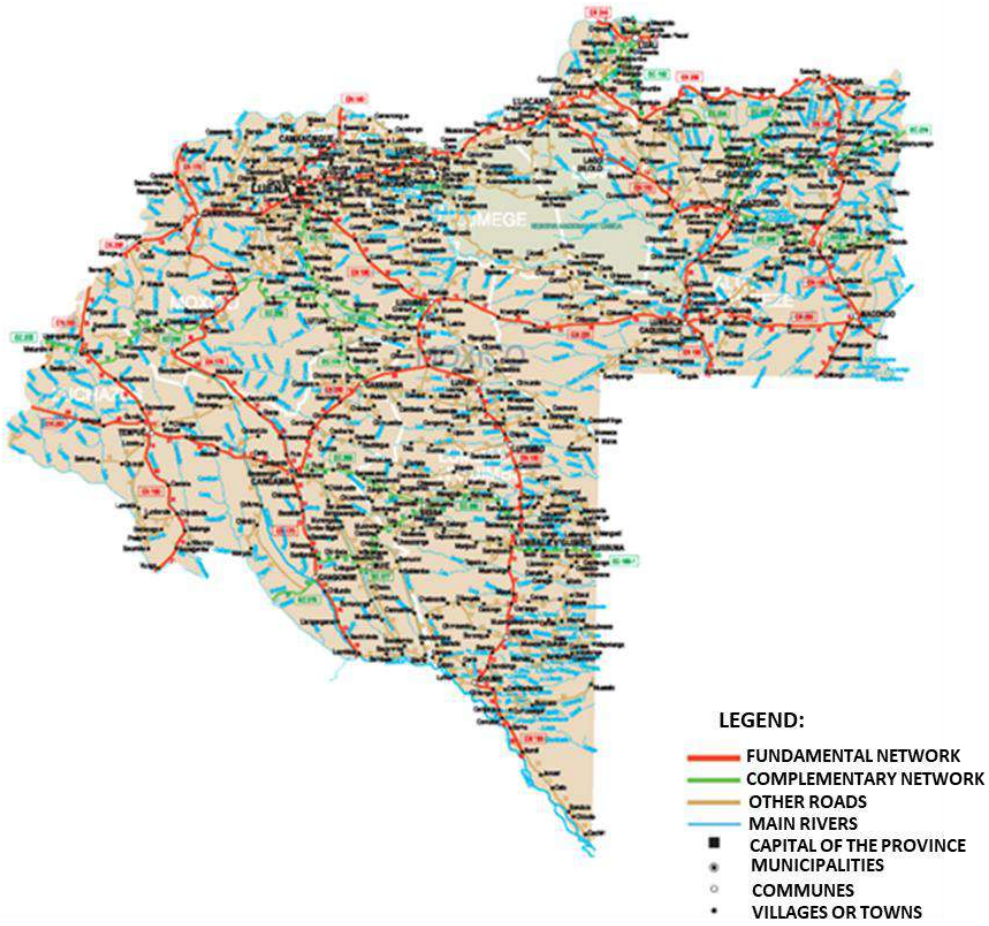


Figure 231 – Illustration of the Moxico Road Network (Source:Fundo Rodoviário de Angola – Ministério das Finanças).

In general, most of the road network has received little or no maintenance, as many of them were located in war zones, having been used by little or no traffic. A large part of the main roads in the Province of Moxico have been rebuilt and paved during the last few years, but many secondary roads date from colonial times (Atlas e perfil do Moxico, 2015).

In Moxico Province, which has less than 800.000 inhabitants, but where some Municipalities are more than 500 kilometers from the capital (the city of Luena), only 5% of the road network is paved roads. Associated with the lack of roads, the demining teams continue to find, in the Province, explosive devices from the period of the civil war, which until 2002 severely hit this region (Source: www.dn.pt).

Most of the population within cities move around using motorcycle taxis (cupapata). However, the city of Luena has urban public transport (mini buses) and also has private taxis (Nosso Táxi). There are no urban and intercity public transport companies in the Province for passengers and/or cargo (Government of Angola, 2022).

During the field work carried out, it was found that some of the access roads were flooded, which made it difficult to circulate between the various Neighborhoods/Communes. The population was obliged to cross these places, often with the presence of crocodiles, on foot or using boats/canoes, as can be seen in the following figure (*see* **Figure 232**).

Figure 232 – Photographic record of flooded land accesses in the project's area of influence.

6.11.5. Forecast in the Absence of the Project

The Project for the Rehabilitation of the Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo is of great importance for the Province and, in itself, is a compensatory measure for the local population. In the absence of the project, the percentage of unemployment in the area will remain the same or even increase, since, as mentioned, the rural exodus is expected to continue in search of better socioeconomic conditions. However, with its implementation, this trend could be reversed as the rehabilitation of road sections will allow the socio-economic dynamism of the region, combined with the creation of roads.

6.12. Cultural Heritage

6.12.1. Introduction

The present descriptor intends to characterize in a synthetic way the cultural richness of the study area, as well as of its insertion region, namely in terms of the aspects:

- Archaeological;
- Architectural;
- Natural;
- Historical.

6.12.2. Metodology

The work outlined included carrying out a heritage and archaeological survey referring to the area of direct and indirect influence of the project, with the aim of recommending impact mitigation measures to be proposed to the Promoter, in order to safeguard and record evidence of historical and archaeological interest, that may be in the vicinity or even in the project area.

To achieve the defined objectives, the following general working methodology was implemented:

- General and specific historical-archaeological research on the evolution of human occupation in the area of intervention, including a general compilation of data available in publications, reports, databases;
- Characterization of the territory in order to verify its scientific potential;
- Definition, based on all previously collected information, of a general reference framework of archaeological potential, including the respective mapping of areas of greater sensitivity and archaeological risk;
- Archaeological prospecting in the project's areas of influence;
- Presentation of a proposal for minimizing measures to be taken in each identified case;
- Photographic record of each area of influence of the project;
- Cartographic location;
- Definition of methodologies for the archaeological record to be applied according to the assessment attributed to the different levels of complexity considered;

- Definition of rules for action by the archeology team and inter-institutional relationships for the correct management of archaeological interventions;
- Registration, in a general file, of sites or structures of archaeological, architectural and ethnographic interest. Preparation of a cultural heritage inventory sheet for each identified occurrence;
- Summary assessment of identified heritage events;
- Proposal of mitigation measures to be implemented in the heritage events that have been identified and that are the target of possible affectation by the execution of the project.

6.12.3. Historical-Cultural Background

The Province of Moxico was marked by relevant historical events, as has been mentioned throughout the various socio-environmental descriptors in this study.

The term Moxico derives from “Mukiko”, which is a basket that was used to practice artisanal fishing. The Province was founded on September 15, 1917. In the 17th century, the Lunda state became the first Lunda Empire (Part of the Democratic Republic of Congo; Zambia; Eastern Part of Angola), under the reign of Queen Lweji Nkonde. In the middle of the 19th century, the second Lunda Empire emerged (with its headquarters in Luena), under the command of the Lunda-cokwe kingdom. The colonial powers, Belgium, Great Britain and Portugal, did not accept the formation of this new imperial unit, making several military incursions in the region, until, as a result of the Berlin Conference, they proceeded to the definitive division of the Lundas, extinguishing the Kingdom Lunda-Chocue (*in* welcometoangola.co.ao).

Initially known as the "Luvale region", the first Portuguese to travel from Benguela to *Moxiquenses* lands was José de Assunção e Melo, on a commercial mission, in 1794 (*in* welcometoangola.co.ao).

The effective Portuguese occupation expedition only took place in March 1895, after the treaty that signed the Lunda-Chocue Protectorate. The mission was headed by Lieutenant Colonel Trigo Teixeira. In this expedition, the military definitely transferred Moxico-Velho to where the capital Luena is based. One of the last kingdoms in the region to be subjugated by Portugal was the Mbunda kingdom, after the defeat of King Mwene Mbandu Kapova I, in 1914. Between the end of the 19th century and the beginning of the 20th century, several expeditions were made to study the area and build the monumental Benguela Railway, which profoundly marked the

region, definitively connecting it with the rest of the Colony of Angola (*in* welcometoangola.co.ao).

Until independence, it was a district of the then overseas Province of Angola, a former colony of Portugal. The history of its founding as a district began to be traced approximately from August 31, 1894, when the Portuguese captain Frederico César Trigo Teixeira left Benguela, in command of an expedition that was destined to set up an Agricultural Military Penal Colony, within the scope of campaigns to occupy the vast lands of Angola, and particularly for the occupation of the extensive lands of Moxico, in favor of Portugal, which disputed some portions of the territory with the British (FTP, 1973).

The occupation was consolidated over a period of 23 to 28 years. At first, with Decree nº 3365 of 1917, which provided the basis for the installation of the first headquarters of the district, in the village of Moxico-Velho. And in a second moment, with the Ordinance of February 25, 1922, the capital of the district of Moxico began to operate in Vila Luso, the current city of Luena, which is 17 km from Moxico Velho (FTP, 1973).

In 1973 UNITA, with the support of the Defense Force of South Africa, began an intense military campaign in the East, with a view to taking over the areas under MPLA control, managing to establish positions in Cangonga, Cangumbe, Chicala, Samafo and Serpa Pinto (Menongue), managing to occupy Luena in 1975, already within Operation Savana, in the Angolan Civil War. The city remained under foreign rule for two months (*in* welcometoangola.co.ao).

On December 10, 1975, one month after the proclamation of National Independence, the Popular Armed Forces for the Liberation of Angola (FAPLA) abandoned the capital of Moxico Province and retreated in two columns, one towards the Luau and the other established in Buíla. Between February 14 and 15, 1976, as part of Operation Carlota, which had the support of the Armed Forces of Cuba, FAPLA reconquered Luena and, by the end of February, the rest of the Province (*in* welcometoangola.co.ao).

6.12.4. Natural, Archaeological and Built Patrimony

Some of the monuments of reference in the Province of Moxico are the tomb of the first Queen Nhakatolo, Lake Kalundo, the sites of Lunhameji, Kassongo, Kassamba, the building of the former Colonial Administration of the then district of Moxico and the ruins of the mission of the Evangelical Church of Brothers in Angola (IEIA). Moxico only has one monument in the national Cultural Heritage, namely the Ruins of Fort Cameia, a sign of the resistance of the

natives against the Portuguese colonial occupation. Currently, 94 monuments and historic sites are registered with the Provincial Directorate for Culture (*in* www.jornaldeangola.ao).

Also noteworthy is the Peace Monument (*see* **Figure 233**), in allusion to the Cease Fire Agreements, signed on April 4, 2002, between the FALA guerrilla army (armed arm of the National Union for the Total Independence of Angola) and the army of the Armed Forces of the Government of Angola (Gino, C., 2017).

Figure 233 – Peace Monument located in Luena (Fonte: *Google*).

The following figures (*see* **Figures 234** and **235**) show some of the previously mentioned sites of national historic interest, as well as other natural, archaeological and built patrimony elements identified in the area of direct and indirect influence of the project.

Figure 234 – Photographic record of some sites of national historical interest existing in the Province of Moxico: Sacalundo Church of Nossa Senhora das Vitórias do Luena.

Figure 235 – Photographic record of the Monument to Agostinho Neto.

It should be noted that in the area directly affected, no heritage occurrences were identified, even though the presence of elements of high cultural and heritage value is admitted, as shown, in the area of direct and indirect influence of the project.

At the same time, it should be noted that the company QG Konstruktion GmbH has a procedure for property occurrences.

6.12.5. Forecast in the Absence of the Project

Cultural heritage and cultural creation are important identity and differentiating factors in the region, so its preservation and enhancement are fundamental, not only to reinforce that identity but also to make the Province of Moxico attractive and to stimulate economic opportunities. In this sense, in the absence of the realization of the project under study, it is foreseen, the maintenance, in general, of the current situation and the non-potentialization of the dynamization of the potential economic and tourist activities inherent to the natural, cultural and architectural/monumental patrimony of the Province.

VII.

RISK ANALYSIS


Resurb
Ambiente, Lda
Jane Goodall
"It's hard to go a single day without having an impact on the world around you. Our actions make a difference and you must decide what kind of difference you want to make."

7. RISK ANALYSIS

The purpose of this Chapter is to identify the potential risks resulting from eventual accidents that may occur during the Construction/Deactivation and Operation Phases of the Project. In the context of this analysis, the causes that could lead to the occurrence of a given event and the potential consequences for the environment and the population will be identified. Based on this information, the available means for minimizing these risks will be described, allowing for effective risk management.

The risk analysis is based on the information available during the preparation phase of this document, which implies that, considering the evolution of the project and the availability of more information, this analysis has a preliminary and indicative character. In the project implementation phase, a more detailed study must be presented, including an Emergency Plan where all the measures to be taken in the event of an accident are indicated.

The following figure (*see* **Figure 236**) shows the risk analysis flowchart.

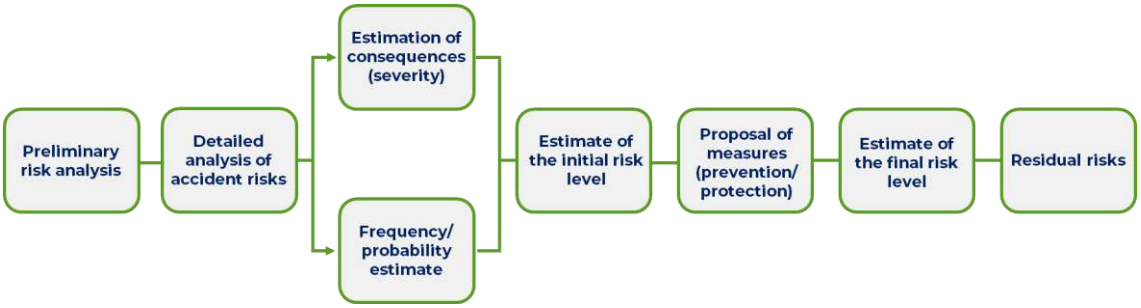


Figure 236 – Risk analysis flowchart.

The following table (*see* **Table 49**) presents the Risk Management Plan with the identification of risks and respective prevention control measures – pre-accident scenario and control measures – post-accident scenario.

Table 49 - Risk identification matrix and respective preventive and control measures

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
1. Risks inherent to existing constraints on site				
Interference "from" and "with" third parties	- Collisions - Running over - Fall of people from heights - Fall of materials	Work Fronts/Road Section	- Inform the local community of the time and start of construction activities - Signaling and fencing of intervention sites, in order to prevent access by unauthorized persons - Define circulation zones - Create alternative routes	- In the event of an accident scenario occurring during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety Technician and Project Manager)
Electricity (overhead and/or underground lines)	- Electrocution/Electrization - Fire - Burns - Contact	Work Fronts/Road Section	- Registration request to the competent authorities - Define and demarcate underground networks (carry out soundings, if necessary) - Request in advance, if necessary, to change the route of the lines - Request power cut if necessary - Place signage and delimit the area - Use individual and collective protective equipment	
Water Lines	- Sinking or collapse - Slip or landslide - Overloads - Floods - Rising water table levels after heavy rain - Overturning of machines - Drowning	Work Fronts/Road Section	- Previous study - Conservation of water lines - Diversion of water lines if necessary - Keep a safe distance from the edge of the river/water lines - Water pumping - Define circulation paths - Information and training	- In the event of an accident scenario occurring during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety Technician and Project Manager)
Technical Networks	- Various Hazards	Work Fronts/Road Section	- Registration request to the competent authorities	
Explosive devices (land	- Burn	Work Fronts/project	- Question, prior to carrying out any	- In case of occurrence of an

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
mines and cluster bombs)	- Death - Fire and/or Explosion - Cut - Exposure to Noise - Exposure to Vibrations - Psychosocial	implementation area	activity, the competent authorities about the need to carry out the detection and removal of explosive devices in the project area; - If the risk is confirmed. Explosive devices must be detected and removed - Construction activities should only be started (when the risk exists) after obtaining the Demining Certificate issued by the Competent National Authority - Provide training to workers on the topic of landmines: - Recognize explosive devices such as land mines and cluster bombs - Behave in a life-threatening situation - Avoid accidents and save life(s)	accident scenario during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety Technician and Owner of Work) - Training for the local population on the topic of landmines: - Recognize explosive devices such as land mines and cluster bombs - Behave in a life-threatening situation - Avoid accidents and save life(s)
2. Materials Applied with Special Risks				
Cement	- Ulcerations - Eczema - Dermatoses	Construction Sites/Jobsites/Concrete Plants	- Use of PVC gloves	- In case of occurrence of an accident scenario during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety Technician and Owner of Work)
Additives for mortar and concrete	- Dermatoses - Pollution	Construction Sites/Jobsites/Concrete Plants	- Keep in proper and properly labeled and signaled containers - Store in cool and ventilated places - In confined places, use exhaust systems - Use of protective gloves	
Paints, resins	- Fire	Construction	- Keep in proper and properly labeled	

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
epoxy and solvents	- Explosion - Intoxications	Sites/Jobsites/Concrete Plants	and signaled containers - Store in cool and ventilated places - In confined places, use exhaust systems - Use of protective gloves and filter mask - Ensure that the atmosphere is inert (there are no gaseous or explosive mixtures in the air)	
Fuels	- Injuries - Crushing - Tetanus	Construction Sites/Jobsites/Concrete Plants	- Keep in proper and properly labeled and signaled containers - Store in cool and ventilated places - In confined places, use exhaust systems - Use of protective gloves and filter mask - Ensure that the atmosphere is inert (there are no gaseous or explosive mixtures in the air) - No smoking or fire on site	
Steels	- Injuries - Crushing - Tetanus	Construction Sites/Jobsites/Concrete Plants	- Use of helmet, protective boots and mechanical protection gloves	
Concrete	- Dermatoses - Eczema	Construction Sites/Jobsites/Concrete Plants	- Use of protective gloves	
Release agent oils	- Skin diseases - Respiratory diseases	Construction Sites/Jobsites/Concrete Plants	- Keep in proper and properly labeled and signaled containers - Store in cool and ventilated places - In confined places, use exhaust systems - Use of protective gloves	

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			- Apply the product in the opposite direction of the wind	
Asphalt bitumen	- Skin diseases - Respiratory diseases - Burns	Construction Sites/Jobsites/Concrete Plants	- Use of protective mask with filter for chemical vapors - Use of protective gloves	
Bituminous emulsion	- Skin diseases - Respiratory diseases - Burns	Construction Sites/Jobsites/Concrete Plants	- Use of protective mask with filter for chemical vapors - Use of protective gloves - Use of overalls type clothing	
3. Installed equipment with risk in use, conservation and maintenance				
Rehabilitation of the road section and bridges	- Construction activities with risk of: ▪ Collision ▪ Crushing ▪ Trapping ▪ Cuts ▪ Shock or impact ▪ Falls from heights ▪ Drowning ▪ People fall from the same level ▪ Fall of materials ▪ Burial ▪ Electrocution ▪ Electrification- Risk of falling materials - Physical risks	Work fronts/project implementation area	- Preparation of a risk identification and assessment matrix - Use of appropriate PPE and EPC - Awareness, Information and Training (AIT) for workers on safety procedures to be adopted during construction activities in view of identified risks and first aid - Delimitation and signaling of work fronts - Monitoring of construction/installation activities by a Safety Technician - Use fall protection systems for work performed at height - Inform the local community of the ongoing construction activities of the project and the prohibition of access to the work fronts - Entivation of ditches with a depth of more than 3 m - Inform other Public Entities of the	- In the event of an accident scenario occurring during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety Technician and Project Manager)

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			construction activities to be carried out so that the "interference register" of other public networks that are buried and that coincide with the project implementation area and that are not properly signaled (eg, electrical networks)	
Fall of equipment/materials that could affect the local community/workers	- Shock or impact - Crushing - Drilling - Trapping - Falling from heights - Drowning - People fall from the same level	Work fronts/project implementation area	- Preparation of a risk identification and assessment matrix - Use of appropriate PPE and EPC - Awareness, Information and Training (AIT) for workers on safety procedures to be adopted during construction activities in view of identified risks and first aid - Delimitation and signaling of work fronts - Monitoring of construction/installation activities by a Safety Technician - Inform the local community of the ongoing construction activities of the project and the prohibition of access to the work fronts	- In the event of an accident scenario occurring during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety Technician and Project Manager)
4. Works whose access and circulation present risks				
Topographical Survey/General Preliminary Preparation	- Electrocution/Electrization - Fire/Explosion - Landslide - Run over - Physical and mechanical hazards	Work fronts	- Get all the information regarding existing infrastructure, terrain consistency and water levels - Keep work areas properly organized - Mandatory use of PPE on work fronts, appropriate to the tasks/activities to be performed	- In the event of an accident scenario occurring during construction activities, workers must activate the emergency communication chain (communication to the supervisor, Senior Safety

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
Placement of Signaling	- Falling of objects - Crushing - Run over - Collision/crash between vehicles - Physical and mechanical hazards	Work fronts	- Keep work areas properly organized - Mandatory use of PPE on work fronts, appropriate to the tasks/activities to be performed - If necessary, place traffic lights to control traffic - Check that the signs are in good condition and in the stipulated order - Temporary signage must be removed immediately after completion of the work in the reverse order of that which had been mounted, leaving only the necessary signage - Temporary Road Signaling Plans	Technician and Project Manager)
Opening of ditches	- Collision - Run over - Burial - Fall from height - Crushing - Falling Objects - Physical Risks	Work fronts	- Implementation of Temporary Road Signaling before the start of works - Delimitation of the perimeter of the work fronts with an orange signaling net and in some cases (depending on the depth of the ditch), delimitation with a “Bekaert” type net - All trench opening equipment must have flashing lights and a reversing sound signal - Prohibit the equipment maneuver area to workers - Guarantee the safety distance of workers in relation to the machines and they cannot walk on foot - Inspect the correct sealing of the excavation during lunch and at the end of the day. If the excavation is close to	

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			public roads, it must be protected with a signaling net or protective grids at an adequate distance - Ditch deeper than 1.20 m, shoring is mandatory, however, if the trench is in rock or shoring is not possible, the ramp must be used according to the angle of the natural slope - Carry out the excavation in phases, avoiding large extensions of open trenches - Equip the excavation with accesses (ladders) and place them in such a way as to ensure sufficient escape routes - The stairs must exceed at least 0.90 m the crest of the excavation slope - Do not allow the placement of materials, or any overloads, at a distance from the crest less than 1/3 of the depth of the trench and never less than 0.60 m	
Trench Closure and Compaction	- Collision - Crushing - Run over - Physical Risks	Work fronts	- At the end of the day, whenever possible, all trenches should be filled in and the work area delimited with a “bekaert” type or with orange net	
Paving execution	- Fall to the same level - Crushing - Trapping - Run over - Blows and cuts - Physical risks - Chemical hazards	Work fronts	- Implementation of Temporary Road Signaling before the start of works - Correct arrangement of materials and equipment - The equipment must have reversing light and sound warning devices - All workers must work in front of the	

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			machines - Use of the necessary PPE (e.g. protective gloves, dust mask)	
Movement and elevation of equipment/accessories	- Run over - Fall from height - Falling objects - Crushing - Wedge - Cut/blows - Muscle and joint injuries - Shock with objects - Falls at the same level	Work fronts	- Implementation of Temporary Road Signaling before the start of works - Manual Handling of Loads: - The access of workers to the Pumping Station must be preceded by checking the cleanliness and state of conservation of the stairs to be used, fixed or mobile - Avoid handling unsuitable loads in terms of volume or weight (over 23 kg) - Try to adapt ergonomic handles to the load handled to facilitate lifting and transport - Use appropriate techniques depending on the type and specificity of the load – avoid using the trunk as a lever, keeping it in a vertical position and try to use the lower limbs as a lever - Whenever possible, place loads on high planes from the ground (before lifting) - Avoid “bending” the spine as much as possible, this should serve as support	

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			- When moving and lifting/lowering loads, the worker must avoid making sudden movements - Torsion movements of the trunk around the body should always be avoided - The transported loads must be supported by the spine and lower limbs, the spine being only a static transmission element and never an articulation - Suspend equal loads in each hand (when possible) - Take into account the weights to be suspended, according to the age, physical constitution and sex of the worker - The movement of loads must be carried out in areas where the floor is properly leveled and free from obstacles, rubble, cables and electrical wires - Whenever technically possible, use lifting and transport aids to move loads - The loads to be transported must be properly packed and symmetrically distributed in	

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			order to avoid oscillations and over-efforts - Arms should be positioned close to the body in a relaxed way - Mechanical Handling of Loads: - Inspect the condition of the lifting accessories and only duly certified accessories should be used - Check that the accessories are suitable for the load to be transported and that the equipment/accessories to be moved are correctly lashed - Check that the load is well secured and the load is only released when it is certain that the equipment/accessories are locked/shod to prevent accidental movement - Ensure coordination between workers who participate in the movement of loads of equipment/accessories - Check that there are no workers under suspended loads	
5. Natural hazards				
Earthquake	Earthquake leading to an incident (eg	Construction Sites/	- Carrying out practical accident	- Implementation of the

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
	fall/damage to infrastructure)	implementation area/ Jobsites/Concrete Plants	exercises (simulacrum)	Emergency Plan - Preparation of an accident report in order to assess the preventive measures adopted and the need for them to be adjusted
Abundant precipitation/storm	- Risk of flooding of the facilities, which may lead to: - People falling from heights - People falling at the same level - Fall of materials - Shock or impact - Crushing - Wedge	Construction Sites/ implementation area/ Jobsites/Concrete Plants	- Take this risk into account during construction activities, particularly in the foundations of the infrastructures and in the definition of construction materials, in order to avoid the weakening and collapse of the infrastructures in case of heavy rains. - Development of a risk identification and assessment matrix - Use of appropriate PPE and CPE - Awareness, Information and Training (AIT) for workers on the safety procedures to be adopted during construction activities in view of the identified risks and first aid - Monitoring of construction/ installation activities by a Safety Technician - Realization of practical exercises of accidents (simulacra) - Monitoring of water quality - Forecasting climate change	- Implementation of the Emergency Plan - Preparation of an accident report in order to assess the preventive measures adopted and the need for them to be adjusted
Strong winds/wind flutter	- Movement of poles and cables causing their weakening and consequent fall	Construction Sites/ implementation area/ Jobsites/Concrete Plants	- Ensure that the foundations made in the infrastructures allow compliance with safety rules in order to mitigate the probability of falling	- Secure infrastructure elements most exposed to wind where possible

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			- Monitoring of construction/installation activities by a Safety Technician	
Existence of trees in the surroundings of the road infrastructure	- Trees can present risks in case of falling branches	Work fronts/project implementation area	- Prepare and implement a checklist for an identification and risk control associated with the surrounding environment - Performing periodic inspections in order to ascertain the existence of dangers - Ensure fixed servitude and highway safety - Monitoring constructive activities by a security technician.	- Elaboration of an accident report in order to evaluate the preventive measures adopted and the need for them to be adjusted
6. Risks of accidents inherent to intentional/malicious acts				
Malevolence/intentional harm	Damage, fire and explosion	Construction Sites/ implementation area/ Jobsites/Concrete Plants	- Carrying out periodic inspections in order to ascertain the existence of hazards - Access control for people and animals - Carrying out periodic rounds - Apply fire and explosion prevention measures in accordance with national and international standards	- Extinguishing the fire, if any - Elaboration of an accident report in order to evaluate the preventive measures adopted and the need for them to be adjusted - Immediate notification to the Authorities
7. Risks of accidents inherent to technical or human failure				
Material defect	- Run over - Fall from height	Frentes de obra/área de implantação do projecto	- Elaboration and implementation of the road infrastructure maintenance	- Elaboration of an accident report in order to evaluate

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
Technical failure/human error	- Falling objects - crushing - Trapping - Cuts/Blows - Muscle and joint injuries - Collision with objects - Falls on the same level		and cleaning plan - Periodic inspection and maintenance - Ensure quality control of materials and equipment during the construction phase - Implementation of the preventive/corrective maintenance plan - Carrying out periodic inspections of facilities/infrastructures	the preventive measures adopted and the need for them to be adjusted
Poor maintenance and/or inadequate maintenance				
Collision by a vehicle and respective loss of stability of structures	- Short circuit - Fire - Run over - Fall from height - Falling objects - Crushing - Collision with objects - Falls on the same level	Work fronts/project implementation area	- Carrying out inspections/preventive maintenance/control of operating parameters	- Implementation of emergency procedures for fire situations - Extinguishing the fire - Elaboration of an accident report in order to evaluate the preventive measures adopted and the need for them to be adjusted
Technical failure	- Leakage of polluting products with consequent contamination of soil/water resources	Work fronts/project implementation area	- Conducting periodic inspections of facilities/infrastructures - Implementation of an Environmental Emergency Plan in the event of a spill/leak accident - Placement of adequate spill containment means - Training for workers on the Environmental Emergency Plan and procedures to be adopted in the event of an accident/incident	- Evaluate the effectiveness of the preventive and corrective measures adopted as well as the implementation of the Environmental Emergency Plan in order to assess the need to adjust existing measures and ensure continuous improvement for these situations
Human error	- Risk of ignition of flammable materials	Work fronts/project implementation area	- Training for workers on the risk of handling chemicals and flammable	- Implementation of emergency procedures for

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
			materials and internal procedures to be adopted for activities to be carried out safely, namely packaging, transport and handling - Sensitize workers to only smoke in authorized areas - Identification and signaling of stored/flammable chemicals and availability of technical sheets and safety data sheets to workers	fire situations - Fire extinguishing
8. Risks of accidents inherent in the transport of materials/equipment				
Human error	- Collision between moved objects and a worker	Work fronts/project implementation area	- Training to workers on good practices to be adopted in the transport of materials and equipment and respective safety rules and procedures - Control/limit the speed of circulation on work fronts and jobsites - Ensure proper packaging of cargo during transport- Use of PPE - Prohibition of consumption of alcoholic beverages during construction activities - Ensure the control of periodic alcohol consumption to workers	- Alert and intervention procedure integrated in the Contract's Emergency Plan
	- Collision between moved objects and a hazardous facility (eg chemical storage)	Work fronts/project implementation area		
9. Risks of accidents inherent to the maintenance of infrastructure and equipment				
Deficit in infrastructure maintenance and consequent degradation of infrastructure	- Risk of malfunctioning road/bridge infrastructure - Risk of collapse of infrastructures	Work fronts/project implementation area	- Inspection and preventive maintenance - Training for workers - Adoption of preventive procedures	- Fire extinguishing - Implementation of emergency procedures for fire situations
10. Risks of poor storage/treatment of domestic and industrial wastewater				
Technical failure	- Crack in the packaging/piping/duct medium	Jobsites/environmental infrastructure	- Ensure the implementation of the maintenance plan for the existing	- Alert and intervention procedure integrated in the

Risks identification	Accident scenario	Workstation/ Location	Prevention control measures - pre-accident scenario	Control measures - post-accident scenario
	- Loss of watertightness of a pipe/duct/packaging medium - Technical malfunction of the equipment		storage and treatment systems - Training for workers in the proper use of treatment and storage equipment - Periodic audit, by a specialized team, in order to assess the proper functioning of the storage and treatment systems	Contract's Emergency Plan
11. Biological hazards				
Exposure to biological agents (viruses, bacteria, parasites)	Coexistence of groups of workers and their contact with biological fluids (eg blood, urine, saliva, vomit) that can come into contact with the skin, mucous membranes, blood of the worker and others	- Work fronts - Social facilities - Recreation areas	- Preparation and Implementation of Contingency Plan - Control of Vaccines Certificates - Control/update of workers' Health Bulletins - Awareness, Information and Training for workers on exposure to biological agents, risk contacts and sexually transmitted diseases and preventive measures to be adopted for the various risk scenarios	- Implementation of the Contingency Plan which is part of the Health and Safety Plan for the project

Analyzing the risks presented in the previous table (*see* **Table 49**), subdivided into several accident scenarios related to the project, it appears that the main risks identified are the mechanical ones that could be related to inadequate modes of operation, ignorance of the risks, deficit formation and material failures. For all identified risks, prevention and protection measures were proposed for pre and post accident scenarios.

In this sense, some general recommendations are presented to be adopted during **the construction/deactivation phase** of the project:

- Raise awareness, inform and train workers on the dangers and risks inherent in work activities, as well as the procedures and safety measures to be adopted;
- Protect facilities and restrict access to them;
- Ensure the grounding of the contract support facilities;
- Ensure soil shoring on the excavation fronts according to the characteristics of the soil, excavation depth, degree of humidity and accidental, static and dynamic overloads, to be supported by the adjacent land surfaces;
- Elaboration of a professional risk identification and assessment matrix and implementation of the respective preventive and risk mitigation measures;
- The area where the work will be carried out must be signposted in accordance with the regulations in force;
- In works of great extension, with reduced lane width and/or with poor visibility, consider the presence of workers equipped with paddles to alternately command the circulation;
- In works which, due to their location or reduced visibility, constitute an increased risk of accidents, the signaling must be complemented with intermittent light equipment, during the night and during the day if visibility is reduced;
- Ensure that the rotating lights installed on the vehicles are functional and that the retro-reflective signs installed on some vehicles are in good condition;
- Ensure the signaling of machines involved in the work with directional or position bays placed at the front and rear;
- Do not allow strangers to approach areas where machines and equipment are involved;

- All employees who intervene in any way in the work area must wear a vest and safety boots with a steel insole and toe cap, as well as other mandatory personal protective equipment depending on the activities to be carried out (e.g. mask, goggles, gloves, hearing protectors, etc.);
- Whenever the work compromises the circulation of pedestrians on the sidewalk, or the safety of pedestrians is not guaranteed, due to insufficient space, an alternative path must be established on the same side of the road, delimited on both sides in order to allow pedestrians to pass safely;
- The opening of a trench must always be duly signposted, whether on the sidewalk or directly on the road. When the sidewalk is partially occupied, a net, tape, fixed to suitable supports, or a metal boundary barrier should be placed around the entire opening;
- Before entering the construction sites, all workers must undergo a small welcome action, that is, these actions must have a general and at the same time specific component, namely, as they include preventive measures aimed at the activity of each one. An Awareness Action Plan must be drawn up;
- The executing entity must ensure insurance against accidents at work and occupational diseases for all workers;
- Ensure proper storage of chemical products, namely in watertight containers and over a retention basin;
- Store chemicals in a safe place protected from the weather. Carry out an inventory of these substances and make technical sheets and safety data sheets available to workers;
- Prohibit smoking in car parks, facilities/plants/sites and work fronts where flammable or explosive materials are present;
- Define speed limits for road traffic on work fronts and jobsites.

For the **exploration phase** of the project, next are presented some general recommendations to adopt:

- Ensure the maintenance of traffic signs;
- Contact the authorities whenever there is improper occupation of the road/bridges or acts of malevolence;

- Carry out actions to raise awareness, inform and educate the surrounding populations on the importance of safeguarding the rehabilitated road infrastructures and complying with traffic rules;
- Preventive maintenance interventions carried out on the road section, during the operating phase, must always be carried out in accordance with the specific safety procedure, in order to guarantee adequate signaling of the carrying out of activities on the road, so as not to interfere with passers-by and guarantee the protection of workers.

7.1. Emergency Response Plan

The purpose of the Internal Emergency Plan (IEP) is to prepare and organize existing human and material resources to protect workers and occupants in the event of an emergency situation. In this way, the primary objective of the IEP is to promote the creation of a guiding document with procedures for action in an emergency situation. The creation of the IEP will increase the level of safety and minimize the possible consequences of an incident/or accident.

At the same time, an Environmental Emergency Plan (EEP) has as its main objective the definition and organization of human and material resources in order to guarantee an effective intervention in an environmental emergency situation, as well as to establish the appropriate action procedures for each situation in order to prevent and/or or minimize potential environmental impacts associated with accidents and environmental emergencies (eg spill, fire, explosion, flood).

To this end, the executing entity must prepare an Internal Emergency Plan and an Environmental Emergency Plan where the various actors involved in the implementation of the Emergency Plan must be presented, as well as describing the responsibilities and operational mode of each one, in an emergency situation. In this sense, the document must include, notwithstanding other relevant elements:

- Top management commitment to the Security and Emergency Policy;
- Competences and responsibilities: Security officer, Security Delegate, Intervention Team and other workers, among others;
- Activation of the Emergency Plan and alert system;
- Procedures for action and evacuation;
- Material means suitable for intervention for first aid;

- Posting (availability) at the work site of a list of telephone numbers and emergency contacts, namely Fire Department, Police, Health Centre, Hospital, Communal/Municipal Administrations, Civil Protection, Project Team, Project Proponent, etc.
- Identification of a person trained in first aid (rescuer) and the respective means made available to him/her for quick communication.

7.2. Information and Training System on the Prevention of Occupational Risks

Under the terms of the Law on Safety, Hygiene and Health at Work, it is the employer's obligation to ensure the training and information of workers, taking into account the functions they perform and the job they occupy.

Given the characteristics of the work to be carried out, the execution period of the Contract, the existing constraints and the construction processes and working methods, it is recommended that the Training and Information Plan for Workers include actions of different types:

- Welcoming actions;
- Awareness actions;
- Specialization actions.

The following subchapters present a brief description of the various types of training that will be administered throughout the project, as well as the Information System that will be used in terms of preventing occupational risks.

7.2.1. Welcoming Actions

Date of realization: Whenever a new team/worker enters the work;

Trainer: Prevention and Safety Technician, General Manager, Team Leader;

Recipients: Workers who start activities on the construction site;

Objective: The objective of the action is to integrate workers, present them to the various people responsible for the work and provide essential information on safety at the workplace, safety signs and preventive measures.

Topics to be addressed:

- Presentation of the Contract;

- Reference to the location and possibility of consulting the Contract's Health and Safety Plan;
- Delivery and brief explanation of the content of the Welcome Manual;
- Information on Personal Protective Equipment to be used;
- Dissemination of the Alcohol Control Regulation;
- Disclosure of the Emergency Plan.

7.2.2. Awareness Actions

Date of completion: Before the start of a new activity for which the workers do not have their own qualifications.

Trainer: On-site Prevention and Safety Technician/Team, General Manager.

Recipients: Workers involved in this activity. Awareness actions can be organized by professional category.

Objective: The action aims to enable trainees with theoretical and practical knowledge of security for the activities.

Topics to be addressed:

- Delivery and dissemination of the Risk Assessment Sheets for each activity that the worker will perform;
- Information on the Individual and Collective Protection Equipment to be used in this activity;
- Warning of Risks and respective Preventive Measures.

7.2.3. Specialization Actions

Date of completion: Before the start of a new activity for which the workers do not have their own qualifications.

Trainer: On-site Prevention and Safety Technician/Team, General Manager.

Recipients: Workers involved in this activity. Awareness actions can be organized by professional category.

Objective: The action aims to enable trainees with theoretical and practical knowledge of security for the activities.

Topics to be addressed:

- Delivery and dissemination of the Risk Assessment Sheets for each activity that the worker will perform;
- Information on the Individual and Collective Protection Equipment to be used in this activity;
- Warning of Risks and respective Preventive Measures.

Specific Training Actions:

- Training on "Work Plans for Activities with Special Risk";
- Date of completion: Before the start of an activity considered to have Special Risks;
- Trainer: Workplace Safety and Prevention Technician/Team, Executing Entity - Consortium.

Recipients: Workers involved in this activity.

Objective: The action aims to equip trainees with theoretical and practical knowledge that will allow them to carry out their tasks related to the activity considered as a Special Risk in Safety.

Topics to be addressed:

- Safety Aspects to be taken into account in the development of activities with Special Risks.

7.2.4. Information System

In addition to training actions, specifically with the information provided to the worker (eg, the welcome manual), other information actions will be carried out for workers, specifically through the display of information in the shop window of the construction site and through periodic meetings by groups of workers.

In this window, the Executing Entity must display at least:

- Prior Communication;
- Nominal organization chart;
- Working hours;
- Board with registration of emergency telephones;
- Accident registration table and labor accident rates;

- Reference to the location and possibility of consulting the Contract's Health and Safety Plan;
- Information on safety and health actions that will take place at the jobsites.
- It is also possible to foresee in this window the placement of figures with references to specific aspects regarding the execution of works in progress and information regarding the training and information actions that will take place at the jobsites on safety and health.

In addition to awareness-raising actions aimed at all the Contractor's workers, the Executing Entity must also organize periodic meetings with groups of workers, preferably in their own workplaces.

Depending on the characteristics of the work and the number of workers at the jobsites, these groups may be constituted by professional categories or types of work they perform, taking into account the possible existence of expatriate workers and their respective languages and/or dialects. In these meetings, the Inspection and Prevention Plans applicable to the work that the workers will perform should be analyzed. The duration of these meetings will depend on the complexity of each type of work, and should, as a rule, be limited to the minimum necessary.

VIII.

IDENTIFICATION AND ASSESSMENT OF IMPACTS

Resurb
Ambiente, Lda

Wangari Maathai

"The environment and the economy are two sides of the same coin. If we don't know how to sustain the environment, we can't sustain ourselves."

8. IDENTIFICATION AND ASSESSMENT OF IMPACTS

This chapter presents the forecast and assessment of the environmental impacts verified in the various phases of the Project for the "Contract for the Rehabilitation of Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo".

The **identification** of impacts constitutes the first moment of the analysis and consists of a preliminary survey of impacts that results from the crossing of project actions in the construction, operation and deactivation phases, with the variables considered within the scope of each environmental factor/strand. This procedure implies the existence of a list of the project's actions and a systematization of the variables to be considered in each environmental factor, as well as a definition of scope and geographic scales of analysis. In this sense, the actions that generate impacts associated with the activities taking place following the project under study will be identified, in the different phases of the project analyzed and considered: Construction Phase, Operation Phase and Deactivation Phase.

The **prediction** begins with the identification of impacts and has the fundamental objective of deepening the knowledge of the cause and effect links between the project's actions and the potential socio-environmental effects resulting from them, configuring possible futures, using, for this purpose, the methods and techniques more adequate and feasible to the requirements and limitations of an ESIA. Most impact forecasts made in the ESIA are based on the following steps:

(1) Analysis of the project's construction, operation and deactivation, using the information provided by the proponent and the professional experience of the technicians involved;

(2) Collection and analysis of information on impacts verified in similar projects, using the bibliography and, once again, the information provided by the proponent and the professional experience of the technicians involved;

(3) Discussion of the forecast carried out with other members of the ESIA team and other specialists with practical experience in the environmental assessment of projects.

The **impact assessment** is the result of previous analyses, with the objective of building and providing an idea of the importance of the analyzed impacts, using, for this purpose, their classification through a set of parameters (impact classification criteria). The impact assessment is carried out after considering the integration of measures to avoid, reduce or eliminate the negative impacts identified, as well as to enhance the positive impacts. The

overall assessment is based on the sectoral analyses, seeking to translate, in an evaluative summary, the most relevant aspects and the most important impacts. In the global assessment, the following aspects were considered:

- Most relevant project actions, depending on the importance of the assessed sectoral impacts;
- Most relevant environmental factors, also depending on the importance of the assessed sectoral impacts;
- Explanation of the criteria for selection of actions and environmental descriptors and the importance of impacts;
- Use of the impact classification categories referred to below (*see* **Table 50**).

The methodology for identifying and assessing the socio-environmental impacts induced by a given project is presented below, taking into account:

- The characteristics of the project, as well as the possible aggressive actions for the environment resulting from its construction, operation and deactivation;
- The characterization of the reference situation and its projection in a scenario without a project.

The classification of potential socio-environmental impacts induced directly or indirectly by the project, during the construction, operation and deactivation phases, is carried out based on consideration of its intrinsic characteristics and those inherent to the respective implantation site, taking into account experience and knowledge of the socio-environmental impacts caused by projects of this type, the previous experience of the technical team in carrying out environmental and social impact studies and, finally, the information and elements collected from the official entities consulted within the scope of the ESIA to be developed.

Below are the criteria, considered by Resurb Ambiente, Lda., to be used in the characterization of impacts:

- **Qualification** – Represents a Positive, Negative or Null impact;
- **Magnitude** – With a High, Moderate or Low magnitude;
- **Incidence** – With direct or indirect incidence on the environment;
- **Probability or degree of certainty** – With a probability of occurrence Certain or Probable;

- **Duration** – An impact with a temporary, permanent or unlikely duration;
- **Spatial dimension** – Impact at the Local, Regional, National or Transboundary level;
- **Occurrence** – Immediate, Medium Term or Long-Term impact;
- **Reversibility** – Reversible or Irreversible Impact.

The following table (*see* **Table 50**) shows the legend of the environmental impact assessment matrix.

Table 50 – Environmental impact assessment matrix

Qualification	**(+) Positive; (-) Negative; (o) Null**		
Magnitude	**High**	**Moderate**	**Reduced**
Incidence	**D –** Direct, **I** – Indirect		
Probability or degree of certain	**C –** Certain**, P –** Probable		
Duration	**T –** Tempory**, Pt –** Permanent, **I** – Improbable		
Spatial dimension	**L –** Local**, R** – Regional **N –** Nacional **CB –** Cross-border		
Occurrence	**Im –** Immediate**, MT –** Medium Term**, LT –** Long Term		
Reversibility	**Rs –** Reversible**; Ir –** Irreversible		

With regard to their nature, impacts are classified as positive or negative. Impacts are classified according to their incidence as direct or indirect impacts. The project's indirect impacts, ie impacts induced by the occurrence of other impacts, must be identified and characterized whenever their occurrence is expected.

It should be noted that the interpretation of the impact does not exclusively result from the type of polluting element or the element that disturbs the established natural balance, but also from the characteristics of the environment in which the project is located, namely its self-purification capacity and the viability of recovery of the receiving environment and knowledge of socio-economic and biogeophysical characteristics.

The probability of occurrence or the degree of certainty of the impacts are determined based on knowledge of the characteristics of each of the actions and of each environmental factor, allowing the classification of each of the impacts as certain or probable.

According to their area of influence (spatial dimension), impacts are classified as local, regional, national or cross-border, taking into account the size of the area in which their effects are felt.

As for duration, impacts are considered temporary if they occur only during a certain period, being permanent otherwise or improbable when they occur in emergency and/or non-routine situations.

As regards reversibility, impacts are considered to be irreversible or reversible depending on whether the corresponding effects remain over time or are canceled out in the medium or long term, namely when the respective cause ceases.

Regarding the time lag (occurrence), impacts are considered immediate as long as they occur during or immediately after the project's occurrence phase. If they only manifest themselves in the long term, they are classified as medium (roughly up to five years) or long term.

With regard to the magnitude of the environmental impacts determined by the project, forecasting techniques are used that make it possible to highlight the intensity of these impacts, taking into account the aggressiveness of each of the proposed actions and the sensitivity of each of the affected environmental factors. Thus, when feasible, the magnitude (absolute meaning) of potential environmental impacts is translated quantitatively or, when this was not possible, qualitatively, but in as objective and detailed a manner as possible and justifiable. The magnitude of impacts is thus classified as high, moderate or low. Subsequently, an attempt will be made to assign significance (global assessment) to the environmental impacts induced by the project, for which an assessment methodology is adopted, predominantly qualitative, which allows for the clear transmission of the global meaning of the environmental impacts determined by the project, in the biophysical and socioeconomic context in which it is inserted, that is, the meaning of the impacts induced in each of the analyzed environmental aspects. The attribution of the degree of significance of each of the impacts will take into account the result of the classification assigned in the various criteria presented, but also the sensitivity of the ESIA team to the consequences of that impact in a global context; in this way, impacts with similar classifications can be verified in the different characterizing parameters, but with different global results in terms of the respective levels of significance. The impacts identified and classified according to the above may also have a simple or cumulative character.

The quantification of Environmental and Social Impacts is made by the difference between the future situation in the absence of the project and the future situation with the project. This comparison is made for each environmental descriptor, analyzing how it evolves over time, in the presence and absence of the project under study.

Cumulative impacts are impacts generated or induced by the project under analysis that will add to disturbances induced by past, present or foreseen projects in a reasonable future, as well as by complementary or subsidiary projects, on any of the environmental aspects considered. This type of impacts can thus result from the accumulation of similar impacts or

from the synergistic interaction of different impacts, whose final importance is greater than the sum of the individual impacts that originate them.

In identifying and assessing these cumulative impacts, the general methodology identified above is followed, associated with some additional steps:

- Identification of resources allocated by the project;
- Spatial and temporal boundaries pertinent to the analysis of the significance of the impact on the resource;
- Identification of other projects or actions, past, present or reasonably foreseeable in the future that have affected, affect or may significantly affect the identified resources;
- Analysis of the interactions between the impacts of the project under study and the impacts of other identified projects or actions and determination of the relative importance in the allocation of resources;
- Identification of mitigation measures or valuation of impacts.

It should be noted that the above-detailed methodology was based on the guidance contained in the IFC guidelines and that for each topic the assessment of significance took into account the sensitivity of the baseline socio-environmental conditions and the magnitude of the impacts or change in the existing baseline that likely to occur as a result of the proposed development. It should also be mentioned that the demining activities have not yet been concluded at the time of writing this report. The census will be carried out as part of the development of the resettlement report in the next phase of project preparation, identifying all those directly affected by the project.

For all descriptors, **Chapter 10 - Environmental and Social Management Plan** will propose, and whenever deemed necessary, mitigation measures for negative impacts and potentiation measures for positive impacts.

Monitoring Plans are intended to:

- Evaluate the effectiveness of the implemented measures;
- Identify any deviations from the forecasts made or the appearance of unforeseen impacts;
- Timely adopt measures to correct these situations.

The Monitoring Plans will be composed of several Monitoring Programs, each one referring to an environmental factor to be monitored.

The impact assessment is carried out after considering the integration of measures to avoid, reduce or eliminate the negative impacts identified, as well as to enhance the positive impacts.

The purpose of assessing a given impact is to determine the relative importance and acceptability of residual impacts. The identification and classification of residual impacts is therefore the ultimate objective of assessing environmental impacts during an ESIA, providing the decision-maker with the final picture of the effects of a given project already contemplating its possible mitigation.

Thus, as an important step in the overall impact assessment process, an analysis should be carried out regarding the possibility of mitigation (*see* **Table 51**), that is, whether the execution of mitigating measures is applicable/feasible (mitigated impacts) or whether their effects will be felt with the same intensity regardless of all the precautions that may be taken (non-mitigable impacts).

Table 51 – Classification of the possibility of mitigating environmental impacts

Characteristic of impact	Evaluation
Possibility of mitigation	Mitigable
	Not mitigated

Subsequent to the identification of the possibility of mitigation and the proposal/design of measures in accordance with the project's objectives, but focused on the prevention, mitigation or elimination of negative environmental impacts, also taking into account their technical and environmental feasibility, the exercise of qualification of residual impacts.

Residual impacts are unmitigated impacts and/or impacts that remain, albeit to a lesser extent, following the implementation of appropriate mitigation measures. These impacts are typically presented within the scope of the overall project assessment, to support the decision on the environmental viability of the project considering the residual environmental assessment after implementation of mitigation measures.

In the following subchapters, in addition to the environmental impacts foreseen for the different phases, the good environmental practices foreseen in the project (for the different phases of the project) are also contemplated, as well as some observations whenever considered relevant.

8.1. Climate and Climate Change

The typology of this project, which consists of the rehabilitation of a road infrastructure, is not conducive to measurable changes (impacts) on climate parameters such as temperature, precipitation, relative humidity or the wind either during the construction phase, exploration and deactivation. However, and since the cumulative effects of human activities on climate variables are now a reality, and it is often not possible to spatially limit their origin and effect, the expected impacts are discriminated.

Actions during the construction phase that can have an impact on the climate and climate change are associated either with the emission of Greenhouse Gases (GHG), resulting from the operation of equipment that consumes fossil fuels, or with the loss of sequestration capacity of carbon in the intervened area, by cutting down trees and bushes. Thus, in the Construction and Deactivation Phases of the project, the occurrence of environmental impacts related to the production and emission of GHG (CO_2, NO_x, SO_x) originating from car circulation/machines and equipment for carrying out construction activities, loading and unloading, earthmoving, transport of materials, among others, which may eventually affect air quality are classified as negative, direct, certain, temporary, immediate, local to cross-border, of small magnitude (taking into account the duration of the construction phase of the project) and reversible since the possibility of rebuilding the descriptor affected by the project is considered, returning to the initial conditions by natural means, when the project action ceases to act on the environment.

The negative impact related to the actions of deforesting and clearing the land, which cause the destruction of the vegetation cover, may eventually lead to an increase, although not very pronounced, in the temperature of the air close to the ground and a slight decrease in the relative humidity of the air, due to a possible loss of thermal regulation capacity. This entire effect will be limited to the perimeter of the project where the deforestation activities will be carried out for the rehabilitation of the road section and the installation of the jobsites and plants. This impact is classified as negative, direct, local, certain, temporary, immediate, of small magnitude and reversible.

During the Exploration Phase, impacts are related to the circulation of vehicles that will use the road infrastructure. This impact is classified as negative, indirect, local, probable, temporary, immediate, of small magnitude and reversible.

8.1.1. Cumulative Impacts

With regard to the environmental descriptor Climate and Climate Change, and although the greenhouse gases that will be emitted, indirectly, during the various phases of the road rehabilitation project, which are dispersed in the atmosphere, have a cumulative impact on the climate change, as will be detailed in **Chapter 8.6. Air Quality**, it is considered that the activities that are expected to be carried out within the scope of the project, do not contribute significantly to the increase in temperature in the area directly affected by the project, therefore, the occurrence of cumulative impacts on the climate is not expected.

8.1.2. Assessment of Environmental and Social Impacts

The following table (*see* **Table 52**) presents the assessment of the environmental impacts of the Climate and Climate Change Descriptor for the three temporary phases of the project considered in the Environmental and Social Impact Assessment.

Table 52 - Table with the assessment of the environmental impacts of the Climate and Climate Change Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Climate and Climate Change	Production and emission of particles and GHG into the atmosphere	- Change in air quality	Mitigable	Yes	-, D, C, T, L to CB, I, Rs
		Land clearing and stripping actions	- Increase in air temperature close to the ground and decrease in relative air humidity, associated with loss of thermal regulation capacity	Mitigable	No	-, D, C, T, L, I, Rs
Exploration	Climate and Climate Change	Usufruct of the road section	- Change in air quality	Mitigable	Yes	-, I, P, T, L, I, Rs

8.2. Geology/Geomorfology

During the Construction Phase, the realization of this project may geologically and geomorphologically affect the area under study since the planned construction activities always imply local geomorphological modification even if it is necessary and insignificant in terms of the surrounding geomorphology. Soil removal, earthworks, excavation, trenching, human action in construction, equipment, truck movement, are all factors to be taken into account. However, the impacts generated by these factors, if mitigated *a priori*, since they are known impacts, will be immensely reduced.

Taking into account the specificities of the Project, it is expected that the activities with the greatest potential impact on geology and geomorphology in the construction phase are related to:

- Excavations and/or embankments associated with trenching. This impact is considered negative, direct, certain, permanent, local, immediate, of moderate magnitude and irreversible;
- The opening of accesses to the road infrastructure that will change the local morphology of the land to a considerable extent, as new accesses will be opened, which is considered to have a negative, direct, permanent, immediate impact, of reduced magnitude (compared to that priority will always be given to the use of existing accesses that allow access to the work fronts), local, irreversible and certain;
- The allocation of rocky outcrops of geological formations due to excavations and constructions for the rehabilitation of the road and implementation of support infrastructures (yards, plants, etc.) will cause a negative, direct, local, permanent, immediate, irreversible, certain and of reduced magnitude, based on the small extension of rocky outcrops, since the project implantation area is constituted by effusive and metamorphic sedimentary rocks;
- Transport of materials, movement of people, machines and vehicles assigned to the works, including the movement of heavy goods, among others, affecting the local morphology of the terrain and affecting rocky outcrops. This impact is classified as negative, certain, permanent, immediate, local and irreversible.

In the exploration phase, the activities with the greatest potential impact on geology and geomorphology are related to:

- The maintenance and repair of the road section, which will generate an impact considered as negative, direct, certain, immediate, of reduced magnitude, reversible, improbable and local;
- In the exploration phase, the impacts resulting from the artificialization of the land will remain, mainly due to the presence of the road infrastructure built. Negative, direct, local, permanent, immediate, of reduced magnitude, reversible and certain impacts will therefore be expected.

With regard to the Deactivation Phase of the project, it is considered that, as in the construction and operation phase, it will always imply local geomorphological modification, even if it is necessary and insignificant in terms of the surrounding geomorphology when carrying out the project landscape recovery activities. This impact is classified as being of a negative nature, of reduced to moderate magnitude, direct, probable, permanent, with a long-term occurrence, local geographical scope and reversible.

8.2.1. Cumulative Impacts

With regard to this project, it is not considered that it generates cumulative negative impacts on the geology/geomorphology of the region.

8.2.2. Assessment of Environmental and Social Impacts

The following table (*see* **Table 53**) presents the evaluation of the environmental impacts of the Descriptor Geology/Geomorphology for the three phases of the project.

Table 53 - Table with the assessment of the environmental impacts of the Geology and Geomorphology Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Geology/ Geomorfology	Excavations and/or embankments associated with the opening of ditches and the implementation of infrastructure to support the contract	- Affectation of rocky outcrops	Mitigable	No	-, D, C, Pt, L, Im, Ir
		Movement of people, machines and vehicles assigned to the works, including the movement of heavy vehicles	- Affecting the local morphology of the terrain	Mitigable	No	-, D, C, L, Pt, Im, Ir
		Carrying out the landscape restoration activities of the project	- Local geomorphological modification	Mitigable	No	-, D, P, Pt, L, LT, Ir
Exploration	Geology/ Geomorfology	Maintenance and repair of road infrastructure	- Affecting the local morphology of the terrain	Mitigable	No	-, D, C, Im, I, L, Rs
		Presence of road infrastructure	- Artificialization of the terrain	Mitigable	No	-, D, L, Pt, Im, C, Rs

8.3. Water Resources

During the construction phase, it is necessary to ensure that the existing water lines in the intervened areas are not obstructed (by opening paths and undue deposition of materials resulting from excavations, or any other material used during the work), otherwise it could generate a significant impact.

Also, the rehabilitation of existing accesses and the opening of new accesses may interfere with some existing water lines in the area where the project will be implemented. Thus, it is considered a negative impact, direct, certain, local, temporary, immediate, reversible and of reduced magnitude.

Cleaning activities in the area where the works will be implemented, which essentially involve clearing operations, removal of the surface layer of soil and earthworks, produce sediments that, in the event of rain, can be washed into the water lines, affecting their quality. It is accepted that a negative, indirect, temporary, immediate impact will be generated, of reduced magnitude, reversible, probable and with a local to regional dimension.

The activities of the jobsites and plants (concrete and bituminous concrete) are responsible for the production of wastewater and possible accidental spills of oils, fuels and similar products, which, when discarded, could contaminate the soil, if the proposed mitigation measures in this document are not properly applied, generating a negative, indirect, probable, immediate, medium-term, temporary, local to regional impact of high magnitude and irreversible.

Excavation operations may have a direct, negative impact on groundwater resources, namely in terms of affecting groundwater levels (lowering of groundwater levels), changes in flow, or infiltration conditions. However, these impacts occur if excavations are carried out below or close to the water table. Eventual alterations in underground circulation and natural infiltration of water as a result of the project represent direct and indirect negative impacts, local, probable, temporary, reversible, immediate in the medium term and of reduced magnitude.

The construction and implantation of the structures of the jobsites, plants and eventual areas of support to the works fronts imply the execution of primary actions of deforestation. These project actions change the infiltration conditions of the land, which occur not only at the installation site of the jobsites and platforms, but also in the surrounding area, inducing soil compaction phenomena, which will lead to greater difficulty in the natural water infiltration process. The movement of vehicles and machinery in the project area under study will also

cause soil compaction, modifying the natural infiltration conditions. In addition, structures will be built that will additionally waterproof the soil, thus reducing the aquifer recharge area, generating direct or indirect negative impacts, local, probable, temporary, reversible, immediate in the medium term and reduced magnitude.

The road section that will be built within the scope of the project, constitutes an impermeable structure that will remain in the operating phase, helping to reduce the area of gradual infiltration of precipitation water, so that its implantation represents a negative, permanent impact (considering the time lifetime of the project), but not very significant given the size of the area to be waterproofed compared to the area of the impacted groundwater body.

The potential negative impacts resulting from the project on water resources are predictably reduced, taking into account that the project's design proceeded to define the sites for support to the work without affecting water lines, and the mitigation measures defined for the construction phase, which are directly dependent on the behavior of the contractor on site, considering that they are easy to implement. The impacts to occur are restricted to the following activities on site: installation and use of the jobsites/park of materials/plants and of machines and equipment assigned to the work due to eventual accidental contamination, resulting from spills of substances (e.g. oils, fuels, among others); and the necessary deforestation to proceed with the eventual opening of access to the work fronts, which, if the correct measures are not adopted, could lead to an increase in occasional erosion phenomena with consequent dragging of sediments into the water lines. Given the short time interval between earth removal and subsequent covering and recovery/modeling of the support and access implantation sites, it is assumed that this impact is of reduced magnitude and unlikely to occur, therefore not significant.

The traffic of vehicles assigned to the work and the operation of machinery and equipment are actions likely to cause accidental spills of oils, fuels or other polluting substances that may lead to punctual contamination of water resources, as well as other planned constructive activities, namely paving, which implies the use of chemical products with special risks and which, in an accidental situation, could also contaminate water resources. Also, site activities, specifically toilets/bathrooms, can lead to the production of wastewater runoff which, in the event of infiltration, will cause changes in the physical-chemical and bacteriological quality of groundwater. A negative, direct, probable, immediate, local, reversible, temporary and low-magnitude impact could be generated, as long as preventive and mitigation measures are applied, these potential impacts will be reduced or even annulled.

With regard to the exploration phase of the project, if the correct application of the mitigation measures proposed in this study is verified, the planned actions will not affect the quality of surface or underground water resources. However, and as in the construction phase, the maintenance and repair operations of the road infrastructures, in the event of accidental spills or inappropriate forwarding of oils and related products to waste management operators, could result in a negative impact on lines of water and on the aquifers in presence. Its quantification will depend on the severity of the various situations that may occur.

The impacts likely to occur at this stage are of an accidental nature and result from infrastructure maintenance and repair operations. The maintenance operations of the project's infrastructures could lead to accidental spills of oil and similar products, which must be contained immediately. In this way, it is not considered that a possible spill could cause a significant impact on the quality of groundwater, however, it is considered the possible occurrence of a negative impact, indirect, probable (in case of an accident), immediate in the medium term, of small to moderate to high magnitude (which will depend on the size of the spill), reversible, of unlikely duration and local.

Regarding the deactivation phase, the removal of support infrastructures may cause, temporarily, an impact on water resources caused by the same activities of the construction phase, with the possibility of leakage of chemical and biological contaminants, in accidental situations resulting from negligent behaviors. Thus, it is accepted that this impact is negative, direct, temporary, immediate, of reduced magnitude, reversible, probable and local to regional.

8.3.1. Cumulative Impacts

The cumulative impacts in terms of quantitative aspects of surface water resources are related to the expected increase in consumption in the Province of Moxico, which maintains a trend of population expansion and occupation of the territory with new residential, commercial and industrial areas.

Cumulative impacts are not expected for the quantitative aspects of groundwater resources.

With regard to water quality, the project will contribute to a situation of cumulative impact, in the event of an accident and/or incident. It is also important to highlight the fact that construction activities can promote the transport and dragging of dust to surface water lines, being one of the factors that will eventually influence water quality. The presence of

suspended solids contributes to increased turbidity and alteration of physical-chemical properties, as well as limiting the passage of light.

8.3.2. Assessment of Environmental and Social Impacts

The following table (*see* **Table 54**) presents the evaluation of the environmental impacts of the Descriptor Water Resources for the three phases of the project.

Table 54 - Table with the assessment of environmental impacts for the Descriptor Water Resources

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction /Deactivation	Water Resources	Rehabilitation of existing accesses and opening of new accesses	- Interference with run-off water lines	Mitigable	No	-, D, C, L, T, Im, Rs
		Deforestation operations, removal of the surface layer of soil and earthworks Movement of people, movement of vehicles and machinery assigned to the works, including movement of heavy vehicles Rehabilitation of existing accesses and opening of new accesses Excavation operations (digging trenches) Transport of various materials	- Potentiation of the risk of erosion and dragging of solids from the intervention areas	Mitigable	No	-, I, T, Im, P, L to R, Rs
		Water use	- Depletion of water resources	Mitigable	Yes	-, D, P, Pt, T, Im, L, Rs
		Movement of people, movement of vehicles and machines assigned to the works, including movement of heavy vehicles Transportation of various materials Assembly and disassembly of jobsites, temporary storage areas for various materials and concrete, bituminous concrete and crushing plants	- Contamination of water lines resulting from accidental spillage of oils, lubricants and/or fuels	Mitigable	Yes	-, I, P, Im to MT, T, L to R, Rs

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
		Installation and use of yards and temporary storage areas for various materials Installation and use of yards and temporary storage areas for various materials	- Soil compaction with modification of natural infiltration conditions	Mitigable	No	-, I, P, Im to MT, T, L a R, Rs
		Rehabilitation of road infrastructure	- Decrease in the infiltration area of precipitation water		No	-, D, L, P, T, Im to MT, Rs
		Removal of support infrastructures	- Contamination of water lines resulting from accidental spillage of chemical and/or biological contaminants	Mitigable	Yes	-, D, L, P, T, Im to MT, Rs
Exploration	Water Resources	Presence and operation of road infrastructure	- Eutrophication of water lines	Mitigable	No	-, I, P, Im, T, L, Rs
		Road infrastructure maintenance activities	- Change in water quality, due to equipment maintenance and repair	Mitigable	Yes	-, I, P, Im to MT, I, L, Rs

8.4. Environmental Noise and Vibrations

With regard to the Construction Phase of the project, the existence of two main sources of noise and vibrations is considered, namely those associated with the construction activities of the project (eg, assembly of jobsites and concrete and bituminous concrete plants, handling land, cleaning, transport of materials, crushing, paving, among others) and associated with the movement of machinery, light vehicles, heavy vehicles, etc. Discomfort related to noise and vibrations will be mainly felt by workers, population and surrounding fauna. It should be noted that in built-up areas, the circulation of heavy machinery could physically affect the existing buildings and in rural areas, noise and vibrations could lead to the escape of fauna, in particular avifauna (birds) and mammals. Therefore, the impact on the closest receptors is considered negative, of moderate magnitude, certain, temporary duration, indirect incidence, immediate occurrence, local dimension and reversible. Consequently, measures must be taken to minimize negative impacts, which may include shifting work fronts/work hours, alternative routes for the circulation of vehicles and heavy machinery, whenever possible, among others.

During the exploration phase of the project, the activities that may eventually affect the environmental noise are those inherent to the normal flow of vehicles, local passers-by and commerce/services existing in the area surrounding the project and along the road, since this phase reflects a scenario of usufruct of the rehabilitated infrastructure. Therefore, it is considered that the impact on the closest receptors, resulting from the exploration phase of the project, is of a negative nature, of moderate magnitude (since it is a highly sought after area), certain, of temporary duration, of occurrence immediate, local dimension and reversible.

Finally, the Deactivation Phase of the project corresponds to a global analysis of the project's life cycle, which is difficult to assess given its temporal distance. The deactivation phase will be characterized by the improvement and rehabilitation of the current project. Analogously to the construction phase, the operations associated with decommissioning are associated with the emission of sound levels due to temporary noisy activities, limited in space and time, in particular the sound emission of heavy machinery and the circulation of heavy vehicles.

Similar to the construction phase, taking into account the intermittent and discontinuous nature of the noise generated during the construction phase, the deactivation phase is expected to have negative impacts, of temporary duration, of moderate magnitude, long-term occurrence, local and reversible.

8.4.1. Cumulative Impacts

The sound level increases introduced by the project, near the nearest receivers, will be considerable compared to the existing values, so it is considered that this project generates cumulative impacts on the environmental noise of the project area.

8.4.2. Assessment of Environmental and Social Impacts

The following table (*see* **Table 55**) presents the assessment of impacts for this descriptor.

Table 55 - Table with the assessment of environmental impacts for the Environmental Noise Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Environmental Noise	Noise produced by construction activities and infrastructure to support the contract	- Increase in sound levels (continuous and punctual) incident on the surrounding sensitive receivers, which may cause annoyance situations	Mitigable	Yes	-, D, C, T, L, Im, Rs
		Noise associated with the movement of vehicles/equipment	- Exclusion effect on fauna	Mitigable	Yes	-, D, C, T, L, Im, Rs
Exploration	Environmental Noise	Noise associated with the circulation of vehicles and passers-by	- Increase in sound levels (continuous and punctual) incident on the surrounding sensitive receivers, which may cause annoyance situations	Mitigable	Yes	-, D, C, T, L, Im, Rs
			- Exclusion effect on fauna	Mitigable	Yes	-, D, C, T, L, Im, Rs

8.5. Waste and Effluents

The production of waste is inseparable from any human activity. Waste means any and all substances or objects that the holder discards or intends or is obliged to discard.

Waste can take different forms (liquids and solids) and types (urban, hospital, industrial, among others), according to its origin. This classification is currently defined in accordance with Presidential Decree n.º 190/12, of August 24, in which, in addition to the subdivision of waste by categories (article 5) there is also its classification in the Angolan Waste List (AWL), defined in Annex X of the aforementioned Decree, where the separation of waste generated by the activities from which it comes and the respective typologies is carried out.

In order to enable adequate management of waste inherent to the different phases of the project and a correct assessment of the impacts produced on the environment, it is imperative to clearly identify the different waste streams, which include information regarding their typology, of which the danger, and possible final destinations more suitable. Thus, depending on the phases of the project, it is expected that there will be different types of waste depending on the activities to be carried out, as well as all the activities that will be intrinsic to it, with a schematic presentation of the type of waste expected to be produced, its origin and estimated production quantities (if available) (*see* **Table 18**).

During the Construction Phase of the project, it is expected that the waste generated will be mostly non-hazardous. Due to the type of activities to be carried out (eg, civil construction activities, execution of reinforced concrete structures, paving, etc.), it is expected that a mixture of construction and demolition waste will be produced, possibly some excess soil and green waste, and to a lesser extent, plastic, paper, cardboard and metal waste associated with the conditioning/packaging of construction materials, as well as remains of concrete and wood (formwork *in situ*) and steel (formwork and staking). The production of non-hazardous waste is classified as an impact of a negative nature, low magnitude, direct, temporary, immediate and reversible.

However, the production of some hazardous waste related to the maintenance and supply of machinery and equipment is also considered, namely empty packaging of chemical products and absorbent materials contaminated with these types of products, as well as asphalt bitumen/emulsion residues bituminous associated with paving activities on the rehabilitated road. This waste involves specific packaging, transport and final destination, given its composition and risk of spillage and/or soil and water contamination. It is expected, however, that its production will be residual and very occasional. The impact in terms of the production

of hazardous waste is classified as negative, of moderate magnitude (taking into account its dangerousness and not quantity), direct, probable, of temporary duration and of immediate occurrence in the medium term.

In the area of administrative and social support (support yards/jobsites) urban waste and office consumables (eg paper, cardboard, plastic, ink cartridges and light bulbs) will also be produced.

The implementation of an adequate integrated waste management system will provide not only a reduction in waste production, as reuse and internal recycling will be favored, but also a reduction in the environmental impacts that may be caused by its incorrect handling, packaging and final destination. In this context, we highlight the good practice of reusing leftover materials and soil in the ditch bed, and/or in landscape recovery activities and/or restoring the initial conditions of the support areas to the contract. The impact in terms of adopting the Principle of Prevention and Reduction of Waste is classified as positive, of moderate magnitude, local scope, temporary duration, with immediate and reversible occurrence.

In the Exploration Phase of the project, the amount of waste produced will be much lower than that produced during the construction phase, since it is expected that the waste produced will be inherent to the activities of maintenance and/or intervention of the infrastructures. However, it is expected that most of the waste produced in this phase will be classified as hazardous, which is why the impact is classified as negative, of reduced magnitude (in view of the low volume of waste that will be produced), and permanent duration, with effect from local level, occurrence in the medium and long term and reversible.

The Deactivation Phase corresponds to a global analysis of the project's life cycle, which is difficult to assess given its temporal distance. However, it is expected that, in the future, it will be associated with an improvement/rehabilitation phase of the current project. Therefore, it is considered that the impact will be negative, of temporary duration, reduced magnitude, long-term occurrence, local and reversible.

8.5.1. Cumulative Impacts

Based on the Principle of Waste Prevention and Reduction that will be adopted during the course of the project, and in view of the fact that, whenever technically feasible, it is foreseen the re-incorporation of the leftover material in the ditch bed and/or landscape recovery of the support areas for the contract, it is considered that the production of inert waste, given that they will be fully recovered, will not have a cumulative effect on the amount of waste

produced for this typology, whose volume is the most relevant in the construction phase. With regard to the remaining types and amounts of waste expected to be produced, their cumulative effect is considered negligible.

8.5.2. Assessment of Environmental and Social Impacts

The assessment of expected impacts for this environmental descriptor is shown in the following table (*see* **Table 56**).

Table 56 - Table with the assessment of the environmental impacts of the Waste and Effluents Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction / Exploration / Deactivation	Waste	Principle of Waste Prevention and Reduction	- Reduction of waste production	Mitigable	Yes	+, C, T, L, Im, Rs
Construction / Deactivation	Waste	Production of non-hazardous waste	- Contamination of soils and water resources	Mitigable	Yes	-, D, C, T, L, Im, Rs
	Waste	Production of hazardous waste		Mitigable	Yes	-, D, C, T, L, Im, Rs
Exploration	Waste	Production of non-hazardous waste	- Contamination of soils and water resources	Mitigable	Yes	-, D, C, T, L, Im, Rs
	Waste	Production of hazardous waste		Mitigable	Yes	-, D, C, T, L, Im, Rs

8.6. Air Quality

During the Construction Phase of the project, it is expected that the air quality will be affected, essentially, due to the emissions of combustion gases, originating from the circulation of vehicles/machinery and equipment. These sources are of a diffuse nature and, as such, contribute to the degradation of air quality in a generalized way and not just in the area of intervention of the project. Also noteworthy is the operation of equipment used in construction activities, loading and unloading, earth moving, transport of materials, among others, which will also affect air quality through the emission of suspended particles and greenhouse gases (CO_2, NO_x, SO_x).

In assessing the impacts, qualitative methods were used to estimate the magnitude of the impact associated with the project, since emissions and the respective effect on air quality will generally depend on a series of variables, of which the meteorological conditions of the location, the topography of the area, the nature and duration of the various operations, type and composition of fuel used (gasoline or diesel), type of vehicle and speed of circulation, as well as the type and characteristics of the equipment used. It is therefore quite difficult to quantify the impacts resulting from this phase, taking into account the numerous factors and variables that may influence the magnitude of the identified impacts. In short, it is assumed that there will be an increase in the concentration of particulate matter in the air; however, although it has a somewhat uncomfortable and disturbing effect, this does not pose a risk to the health of individuals who come into direct contact with this dust, in addition to the fact that workers use the necessary PPE to carry out construction activities safely.

The environmental impacts generated will be negative, direct, certain, temporary, immediate, local, of moderate magnitude and reversible.

During the Exploration Phase, it is considered that the impacts will be those essentially related to the circulation of motor vehicles that promote the emission of atmospheric pollutants arising from the combustion process that release GHG, as mentioned above. It should also be mentioned that asbestos particles (a highly toxic substance) are released from the wear of tires and brakes, albeit in small quantities, most of which are deposited on the pavement of the road. In view of the ongoing national road infrastructure rehabilitation strategy, it is expected that the use of the rehabilitated road infrastructure will be permanent and progressive (as traffic increases). Therefore, it is considered that the impact on the closest receptors, resulting from the exploration phase, is of a negative nature, of low to moderate magnitude, temporary duration, immediate occurrence, local dimension and reversible.

The Deactivation Phase corresponds to a global analysis of the project's life cycle, which is difficult to assess given its temporal distance. However, it is expected that, in the future, it will be associated with a phase of improvement and rehabilitation of the current project. Therefore, it is considered that the impact will be negative, of temporary duration, moderate magnitude, long-term occurrence, local and reversible. The Deactivation Phase also includes all activities inherent to the decommissioning and dismantling of infrastructure supporting the contract (jobsites, crushing plant, concrete and bituminous concrete plants and temporary deposits). In view of the results obtained in characterizing the air quality of the concentration reference situation, it is expected that the activities to be carried out, particularly in the construction/deactivation phase of the project will lead to a localized increase in the concentrations of PM_{10} and $PM_{2.5}$ in the atmosphere, resulting the circulation of equipment and all types of vehicles on unpaved access roads, as well as the movement of earth and soil, and the stripping/clearing of surfaces carried out according to the needs of the areas to be excavated or the installation of equipment and infrastructure of support.

8.6.1. Cumulative Impacts

The activities foreseen to be carried out within the scope of the project will have cumulative impacts in relation to the socioeconomic activities, identified when characterizing the reference situation (prior to the construction phase) and some bad practices identified, namely, the burning of waste by the local population with consequent resuspension of particles. These effects will be verified at the level of public health, as the increase in atmospheric emissions and particles will particularly affect the most vulnerable groups such as asthmatics, the elderly and children, in particular those living close to traffic routes.

The dispersion of dust will have a cumulative effect in terms of climate change, as it contributes to the degradation of air quality, contributing to the occurrence of phenomena such as smog and the greenhouse effect.

8.6.2. Assessment of Environmental and Social Impacts

The assessment of expected impacts for this environmental descriptor is shown in the following table (*see* **Table 57**).

Table 57 - Table with the assessment of the environmental impacts of the Air Quality Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Project Phase
Construction/ Deactivation	Air Quality	Emission of dust resulting from the movement of vehicles and other equipment Emission of dust/particles resulting from construction activities/deactivation and dismantling of infrastructure supporting the contract	- Change and degradation of air quality - Climate change	Mitigable	Yes	-, D, C, Pt, L, Im, Rs
		Emission of particles and GHG into the atmosphere resulting from the movement of vehicles and other equipment (combustion process of motor vehicles)		Mitigable	Yes	-, D, C, Pt, R, MT, Rs
Exploration	Air Quality	Emission of particles and GHG into the atmosphere resulting from the movement of vehicles - use of road infrastructure (combustion process of motor vehicles)	- Change and degradation of air quality	Mitigable	Yes	-, D, C, Pt, R, MT, Rs

8.7. Soils, Land Use and Spatial Planning

In view of the typology of the project under analysis in this document, it should be noted that the activities of cleaning, deforestation, earth moving, soil transport, necessary for the preparation of the land, are responsible for the loss of large volumes of arable soil in the area. Soils must be stored and protected during the construction phase, so that they can be reused in rehabilitation actions. However, this is not common practice. Often, stripped soil ends up being deposited in landfills, together with waste, losing its quality.

Other operations, such as compacting the land to create accesses (inside and outside the perimeter of the project and supporting infrastructure) and building support infrastructure (e.g., life bases/jobsites/temporary deposits/concrete and bituminous plants/crushing plant) also contribute to the loss of arable land.

The destruction of soils and the respective vegetation cover also favors the occurrence of erosion and sedimentation phenomena. Unprotected soils, in the presence of precipitation (more or less intense), become vulnerable to ravine phenomena and mass movements. However, laminar erosion phenomena are the most aggressive, causing the successive removal of layers of soil, which are directed to the water lines.

In this sense, it should be noted that the main impacts of the project on the soil will be related to the activities of deforestation, earthworks, excavation and circulation of light and heavy vehicles, machinery and equipment necessary for the implantation/rehabilitation of the infrastructures roads in the construction phase of the project, which will contribute to the inevitable weakening/disruption of the soil structure, which will contribute to the acceleration of the process of erosion, disruption, weakening, waterproofing and/or compaction of the surface layers of the soil. The destruction of the soil texture and the modification of slopes are two important parameters to be taken into account when carrying out construction activities.

The circulation of vehicles, machines and people, in the Construction Phase of the project, will cause soil compaction and its waterproofing, which will be felt in a particular way in view of the characteristics of the soils themselves. This impact is classified as negative, of moderate magnitude, direct, certain, permanent, immediate, local geographical scope and reversible.

The installation of equipment, plants, transport of materials, movement of machinery, are potential sources of soil contamination by oils, hydrocarbons, solvents, or any other dangerous liquid in case of accidental spillage. This impact on soils will be classified as negative, of moderate magnitude, direct, certain, permanent, immediate, local geographical scope and reversible. Although the affected area is often small, the impact on soil quality will be

permanent if mitigation or prevention measures are not applied. These impacts can be mitigated by implementing mitigation measures.

During the Exploration Phase of the project, soil compaction will be mainly related to road traffic and maintenance equipment for the built/rehabilitated road infrastructures. This impact is classified as negative, of reduced magnitude, direct, certain, permanent, immediate, local geographic and reversible.

As regards the Deactivation Phase of the project, it is expected that it will be, in the future, associated with a phase of improvement and rehabilitation of the current project. Therefore, it is considered that the impact will be negative, of temporary duration, moderate magnitude, long-term occurrence, local and reversible.

With regard to the land use descriptor and given that the project under analysis is for the rehabilitation of existing roads and that the project is part of the National Strategic Plan, it is not expected that conflicts will occur in this area.

8.7.1. Cumulative Impacts

The occurrence of cumulative impacts related to the project under analysis is only foreseen in the event of an environmental accident, with imminent or potential soil contamination.

8.7.2. Assessment of Environmental and Social Impacts

The following table (*see* **Table 58**) presents the assessment of impacts for this descriptor.

Table 58 - Table with the assessment of environmental impacts for the Descriptor Soils, Land Use and Spatial Planning

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Soils, Land Use and Spatial Planning	Circulation of vehicles, machines and people	- Compaction and greater waterproofing of soils	Mitigable	No	-, D, C, Pt, L, Im, Rs
		Deforestation activities, land clearing and earthworks Occupation of the area reserved for jobsites and support areas for the contract	- Degradation of the natural layers of the soil and its quality - Soil erosion	Mitigable	No	-, D, C, Pt, L, Im, Rs
		Spill of products containing hazardous substances (with hydrocarbons and other polluting materials)	- Soil contamination	Mitigable	Yes	-, I, P, T, L, Im, Rs
		Rehabilitation of road infrastructure	- Compaction and greater waterproofing of soils - Soil contamination	Mitigable	No	-, D, T, LP, L, Im, Rs
Exploration	Soils, Land Use and Spatial Planning	Circulation of vehicles, machines and people – use of the road infrastructure Maintenance activities for the rehabilitated infrastructure	- Soil compaction and waterproofing	Mitigable	No	-, D, C, Pt, L, Im, Rs
		Occurrence of spills of products containing hazardous substances Uncontrolled disposal of urban waste generated in the operation and maintenance of the road	- Soil contamination	Mitigable	Yes	-, D, C, Pt, L, Im, Rs

8.8. Biodiversity and Ecological Factors

The degree of importance of the impacts was estimated from the degree of affectation of the faunistic and floristic communities, taking into account their conservation relevance. Thus, the value and functionality of the different biotopes were considered, as well as the importance of the area for species of fauna and flora with special biogeographic status or with unfavorable conservation status.

Impacts on fauna were also predicted based on the potential occurrence of species in the area, given the typology of their preferred habitat, their mobility, dispersal capacity and their conservation status according to the International Union for Conservation of Nature (IUCN).

During the construction phase of the project, negative impacts are expected on the vascular flora and plant communities, which fundamentally result from the physical destruction of individuals or populations of vascular plant species; and disturbance of natural biotopes/habitats.

It should be noted that in the elaboration of this Project, particular attention was paid to the occupation of the existing land, namely to the presence of species and habitats that reveal conservation value (*see* **Chapter 6.9**).

The movement of heavy machinery and personnel assigned to the work outside the areas to be intervened can lead to the local destruction of the vegetation, through soil compaction, which increases its mechanical resistance to the root development of the plants and, consequently, hinders their survival and regeneration capacity. As it is anticipated that the area will subsequently be subject to landscape recovery, through the placement of topsoil, vegetation regeneration will be facilitated.

In addition to being affected by mechanical causes, there may be a chemical effect on plant species, in case of spillage of oils, fuels and similar products resulting from the use of machines and vehicles assigned to the works. These punctual pollution situations are impacts that are easy to control and directly depend on the behavior of the contractor and the respective workers on site. In order to lessen this type of impact, several mitigation measures were defined in this ESIA. In this way, the impact is considered to be negative, indirect, probable (in an accident scenario), immediate, of reduced magnitude, reversible and local.

The different infrastructures that make up the project will affect natural habitats, however priority habitats are not expected to be affected. Thus, regarding the allocation of natural habitats in the area under analysis, it is considered that the impact generated in the

construction phase is negative, direct, local, permanent, immediate, of reduced magnitude, reversible and certain.

With regard to fauna, during the construction phase, in addition to the disturbance resulting from the circulation of vehicles and machines essential for carrying out the work, and the inevitable human disturbance, also responsible for the increase in noise, the movement of vehicles and machines may cause crushing or concussion of small animals (reptiles, amphibians, small mammals and invertebrates), especially during general earthmoving, generating a negative impact, direct, probable, immediate, of reduced magnitude, irreversible and temporary.

Specifically with regard to disturbance, the following indirect impacts are mentioned:

- Actions related to the cutting of existing vegetation will cause negative impacts on fauna, resulting in a faunistic impoverishment of the site, particularly for species that depend on and are closely associated with shrub habitat (compared to herbaceous habitat). This action is expected to remove the species that feed on the plant species present, or that use these habitats for their circadian or seasonal activities of feeding, shelter, nesting or reproduction;
- Regarding the faunal groups that will be most affected in this phase, it is expected that they will be the mammal and bird fauna. Since no particular nesting sites have been identified in the project's implantation area, it is expected that a reduced number of individuals and fauna species will be negatively affected in this specific period.

The same activities will disturb the resting, feeding and reproduction sites of various faunal species that are present (eg birds, mammals, reptiles), which will result in a temporary removal of these individuals. Taking into account the size of the intervention area, elevation and abundance, a negative, indirect, temporary, immediate, moderate, reversible, probable and local impact will be generated.

The exploration phase of the project refers to the use of the road infrastructure rehabilitated by the contract, and the impact will be related to the anthropogenic pressure of the local population and the use of the road. This impact is classified as negative, of moderate magnitude, direct impact, certain and immediate impact, with a temporary and reversible effect.

Reference should also be made to the possible impact on animals caused by being run over (mainly goats), it is expected that the human presence itself (movement of people and vehicles allocated to infrastructure maintenance work) will cause disturbance in the community

faunistic, generating a negative impact, direct, local, immediate, of reduced magnitude, reversible, probable and temporary.

For the deactivation phase, in terms of the potential negative impacts that may occur at this stage, it refers to the disturbance caused by the improvement/rehabilitation works of the current project, which will be similar to some of the impacts that occur during the construction phase of the road project. Thus, it is predicted that the human presence (machinery and men) will cause a disturbance on the biological communities, synthesizing the impact as negative, direct, temporary, immediate, of reduced magnitude, local, reversible and certain. Animal mortality may also occur due to being run over or crushed, considering the impact as negative, direct, probable (in the event of an accident), immediate, of reduced magnitude, irreversible, temporary and local.

8.8.1. Cumulative Impacts

The available data on the study area, as well as the data obtained *in situ*, reveal that the activities that generate impacts are related to human occupation, namely the frequent burning, uncontrolled deposition of urban waste in the open and runoff of effluents water lines, which constitute actions that end up causing ecological degradation, interrupting the normal ecological succession, so it is considered that this project generates cumulative impacts on the existing biodiversity.

8.8.2. Assessment of Environmental and Social Impacts

The following table (*see* **Table 59**) presents the assessment of impacts for this descriptor.

Table 59 - Table with the assessment of environmental impacts for the Descriptor Biodiversity and Ecological Factors

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Biodiversity and Ecological Factors	Vegetation removal actions, stripping, soil compaction	- Affectation of natural habitats - Mortality by crushing/being run over by vehicles and machines - Exclusion effect on fauna - Loss of vigor and/or mortality of flora due to soil contamination - Physical destruction of individuals or populations of floristic species - Disturbance of natural biotopes/habitats - Disturbance of resting, feeding and breeding places	Mitigable	Yes	-, D, L, C, Pt to T, Im, Rs/Ir
		Installation and implementation of jobsites, temporary storage area for various materials, concrete, bituminous concrete and crushing plants		Mitigable	Yes	
		Movement of people, vehicles and machines assigned to the work, including the movement of heavy vehicles		Mitigable	Yes	
		Rehabilitation of existing accesses		Mitigable	Yes	
		Opening access paths		Mitigable	Yes	
		Transportation of various materials used in construction activities		Mitigable	Yes	
		Road infrastructure rehabilitation activities		Mitigable	Yes	
		Deactivation and dismantling of support infrastructures		Mitigable	Yes	
Exploration	Biodiversity and Ecological Factors	Increase in the circulation of people and vehicles to once underused locations	- Loss of vigor and affectation of plant communities by contamination - Mortality of animals due to being run over by the circulation of vehicles - Disturbance due to increased movement of people and vehicles involved in the maintenance and repair of infrastructure - Direct collision mortality	Mitigable	Yes	-, D, C, Pt, L, MT to LT, Rs/Ir
		Road Infrastructure Maintenance Activities		Mitigable		

8.9. Landscape

The identification and assessment of landscape impacts are carried out taking into account the changes that the project phase causes in the characteristics of the landscape, in its visual quality and scenic value.

For the evaluation of the units, the dimension of the action, the sensitivity, vulnerability, fragility, visual absorption capacity of the present landscape unit and the existence of potential observers of the intervention in question will be taken into account.

The impacts on the landscape are characterized, essentially, by the contrast of shapes, textures and color, as well as by the modification of the relationships between the elements of the landscape that, by the introduction of elements discordant with the environment, lead to the alteration of the visual structure and, consequently, to a decrease in the landscape quality of the area (Favas, 1999).

The implantation of the project will cause changes in the landscape, directly or indirectly, which will translate into more or less negative impacts, since there will be the appearance of new infrastructures with great vertical development.

The impacts essentially translate into the disorganization of the landscape during the construction phase, an impact that is temporary and reversible; in the introduction of new elements in the landscape, even if these are not completely foreign elements; and, finally, in the operation/exploitation of the project.

Thus, it is expected that in the Construction Phase of the project the main impacts will be associated with the modification of the initial conditions for the rehabilitation of road infrastructures. These modifications are related to occasional changes in soil occupation and changes in the vegetation cover. Changes to the landscape resulting from this phase consist of:

- Removal of vegetation cover and surface soil layer, inducing changes in land use with immediate visual impact;
- Implementation of jobsites, support areas and concrete and crushing plants, inducing changes in land use with immediate visual impact;
- Earthmoving and earthworks that modify the original terrain morphology and lead to the appearance of visual discontinuity zones;
- The allocation of heavy equipment promotes the inclusion of strange elements in the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area.

The impacts associated with this phase are considered to be negative, of reduced magnitude, direct, certain, permanent (during the construction phase), of local dimension, immediate and reversible (at the time of deactivation).

In the Exploration Phase of the project, the impacts on the landscape associated with the use of the road section are evaluated. These impacts are classified as negative, of reduced magnitude, of direct incidence, certain, temporary, local, immediate and reversible. In this classification, it was considered that the study area has, to date, no particular interest in the landscape and is not valued for an important tourist activity.

In the Deactivation Phase, the impacts on the landscape associated with the implementation of the Environmental and Landscape Recovery Plan (ELRP), deactivation and dismantling of the support infrastructures for the contract are evaluated. These impacts are classified as positive, of high magnitude, of direct incidence, certain, permanent, local, immediate and reversible.

8.9.1. Cumulative Impacts

In characterizing the reference situation, the project intervention area was described as being a natural landscape with some anthropic influence. Thus, with the execution of the project, it is not foreseen the introduction of extraneous elements to the local landscape, since it is, in general, a rehabilitation of an existing road. Consequently, cumulative impacts are not expected.

8.9.2. Assessment of Environmental and Social Impacts

The assessment of expected impacts for the different phases of the project is presented in the following table (*see* **Table 60**).

Table 60 - Table with the assessment of environmental impacts for the Landscape Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Landscape	Removal of vegetation cover and topsoil layer, inducing changes in land use	- Destruction of natural elements of the landscape	Mitigable	No	-, D, C, Pt, L, Im, Rs
		Earth moving and earthmoving Rehabilitation of road infrastructure Implementation of jobsites, support areas and centers Assignment of heavy equipment	- Modification of the original terrain morphology leading to the appearance of visual discontinuity zones - Change of orography - Introduction of foreign elements into the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area	Mitigable	No	-, D, C, Pt, L, Im, Rs
		Landscape recovery activities in degraded areas, decommissioning and dismantling of infrastructure to support the contract	- Reset of initial conditions	Mitigable	No	+, D, C, Pt, L, Im, Rs
Exploration	Landscape	Road infrastructure	- Creation of a visual discontinuity and promoting a degradation of the scenic value of the area	Mitigable	No	-, D, C, T, L, Im, Rs

8.10. Socio-economy

The project object of this study will determine impacts on the population and economic activities, some considered positive and others negative. The degree of importance of impacts was estimated from the degree of negative or positive impact on local populations and activities in general.

During the Construction Phase of the project, some positive impacts will be created at a socio-economic level. They relate to:

- Job creation for new employees to be assigned to the project;
- Acquisition of human and material resources for the execution of the contract;
- Social inclusion and community participation;
- Demand for goods and services by workers in the project implementation area;
- Improved accessibility at local and regional level, and increased internal cohesion, particularly in the Moxico region;
- Improvement in the level of service and, consequently, a reduction in travel times and average costs, benefiting the economic context of families and bringing people together, as well as economic activities;
- Increased convenience, speed and safety in circulation, promoting accessibility and consequent attractiveness of the surrounding area for the settlement of population and industrial/commercial units;
- Promotion of trade, associated with various areas, from the sale of foodstuffs, to the purchase of subsidiary materials on the national market, to the hiring of waste management operators to collect the waste to be produced at this stage;
- The value of the project's investment, which is one of the main positive impacts as it benefits the economy as a whole with repercussions at the local/regional level;
- Increased tax revenues for the state.

These impacts are evaluated as positive, high magnitude, direct, certain, local, immediate and reversible.

With regard to the negative impacts at a socioeconomic level during the construction phase of the project, they are related to:

- Emission of particles and greenhouse gases;

- Interference of the project in local communities;
- Increased traffic of heavy vehicles and equipment at local level;
- Inadequate planning of activities;
- Degradation of roads and streets with disruption to the normal use of roads by the local population;
- Noise from construction activities that could disturb the population residing in the project implementation area, as well as its surroundings.

These impacts are evaluated as negative, of reduced magnitude, of direct incidence, probable, temporary, local, immediate and reversible.

During the Exploration Phase of the project, the positive impacts will be related to the use of road infrastructure (including bridges) rehabilitated/built, namely:

- Increased employment opportunities;
- Improved mobility and better access to social services;
- Reduction of transport costs;
- Decrease in road accidents;
- The investment value of the project;
- Attracting investment.

These impacts are evaluated as positive, high magnitude, direct, certain, local, immediate and reversible.

With regard to the negative impacts at a socio-economic level in the exploration phase of the project, they are related to:

- Visual presence of road infrastructure and bridges, when visually exposed, as well as the possible reduction in the aesthetic quality of spaces resulting from their presence.

These impacts are assessed as negative, of reduced magnitude, direct, certain, temporary, local, immediate and reversible.

The Deactivation Phase of the project refers to the end of its life cycle, being its occurrence in the long term. However, it is estimated that at that time the infrastructures could be replaced or improved to better fulfill their function, therefore, the associated positive impact, as conditions are expected to improve.

It is therefore important to refer, and in common to the three phases of the project, the value of the investment in the project, which is one of the main positive impacts, as it benefits the economy as a whole with repercussions at all levels. This impact is considered positive of reduced magnitude, direct, certain, temporary, immediate and irreversible.

8.10.1. Cumulative Impacts

For this descriptor, negative cumulative impacts resulting from the implementation of the project are not considered, and it should be noted that, by itself, the project is a compensatory measure for the local population.

8.10.2. Assessment of Environmental and Social Impacts

The assessment of expected impacts for the different phases of the project is presented in the following table (*see* **Table 61**).

Table 61 - Table with the assessment of environmental impacts for the Socio-economy Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Socio-economy	Investment value	- Benefit from the economy as a whole with reflexes at all levels - Increase in tax revenue for the state - Social inclusion and community participation	Mitigable	No	+, D, C, T, R, Im, Ir/Rs
		Road infrastructure construction activities	- Uncertain-term job creation for new employees and maintenance of jobs for existing employees - Demand for goods and services by workers in the project implementation area	Mitigable	No	+, D, C, Pt, R, Im, Rs
			- Promotion of trade associated with various areas, from production of materials and equipment, rental of machinery, hiring of waste operators, among others	Mitigable	No	+, D, C, Pt, L, Im, Rs
		Circulation of equipment and heavy vehicles used in construction activities	- Degradation of roads and streets, with disruption of the normal use of roads by the local population - Emission of particles and greenhouse gases - Interference of the project in local communities - Direct allocation of natural and legal people - Increased traffic of heavy vehicles and equipment at the local level - Inadequate planning of activities - Noise from construction activities that may disturb the population residing in the project implementation area, as well as in its surroundings	Mitigable	No	-, D, P, T, L, Im, Rs

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Exploration	Socio-economy	Circulation of vehicles, machines and people Road maintenance activities	- Improvement of the living conditions of the population - Increase in jobs due to new road users - Increased employment opportunities due to the attractiveness of investments and reduction of transport costs - Better access to social services (education, health and security) - Decrease in road accidents- Melhoria da qualidade de vida		No	+, D, P, T, L, Im, Rs
		Investment value	- Benefit from the economy as a whole with reflexes at all levels	Mitigable	No	+, D, C, T, R, Im, Ir/Rs
		Presence of road infrastructure	- Reduction in the aesthetic quality of spaces	Mitigable	No	-, D, C, L, T, Im, Rs

8.11. Cultural Heritage

In general, during the course of the project, negative impacts (direct or indirect) on occurrences of cultural interest, all intrusive actions on the ground, related to the execution of the Project, namely deforestation, revolving and excavation of soil and underground, the creation of functional areas (jobsites social areas, plants, inert/material deposits) and the creation, regularization and use of accesses.

The main parameters for altering the status of a cultural occurrence are: partial or total destruction (negative effect), degradation due to intrusion into the spatial environment (negative effect), identification of unknown values and their physical safeguard or registration (positive effect).

The characterization of impacts took into account:

- The physical nature of occurrences of cultural interest, namely, structures highlighted above ground and traces at ground level;
- The degree of incidence or proximity of the impacting action on the occurrence of cultural interest;
- The intrinsic cultural value of the occurrence subject to the impact.

This assessment was carried out based on the degree of proximity or overlapping of the project's exploration areas in relation to occurrences of cultural interest, and the field work carried out to characterize the reference situation was essential for the environmental impact assessment of this descriptor. It is important to note that the location of the project does not affect the archaeological, historical and cultural heritage as mentioned in the characterization of the reference situation.

It is expected that in the Construction Phase of the project, the impacts are inherent to the construction activities, recommending, when moving earth resulting from the excavation, the implementation of an archaeological follow-up, as a way of minimizing impacts, on the archaeological remains that may be underground and which are not visible on the ground surface. The eventual allocation of archaeological heritage underground is classified as being a negative impact, of moderate magnitude, direct, probable, local, immediate and irreversible.

In the Exploration Phase of the project, impacts associated with the use of road infrastructures on the Cultural Heritage are not expected.

The Deactivation Phase of the project also refers to the end of its life cycle, being its occurrence in the long term. However, it is estimated that at that time the road infrastructure

could be replaced or improved to better fulfill its function. The need to excavate new areas in order to carry out repairs or improve the built infrastructures could, eventually, affect the archaeological cultural heritage in the subsoil. This impact is classified as negative, direct, of moderate magnitude, probable, local, immediate and irreversible.

8.11.1. Cumulative Impacts

Regarding cumulative impacts, they were not identified for the present descriptor.

8.11.2. Assessment of Environmental and Social Impacts

Below (*see* **Table 62**) the assessment of expected impacts for this environmental descriptor is presented.

Table 62 - Table with the assessment of environmental impacts for the Cultural Heritage Descriptor

Project Phase	Environmental Descriptor	Description	Impacts	Possibility of mitigation (Mitigable/ Not Mitigable)	Cumulativity (Yes/No)	Evaluation
Construction/ Deactivation	Cultural Heritage	Moving and operating machinery and equipment Earthworks and excavation Soil removal Ditching and excavation Demolition, dismantling and removal of existing/support infrastructure activities Landscape restoration activities	- Possible use of the Built Heritage and/or Archaeological Heritage in subsoil	Mitigable	No	-, D, P, I, L, Im, Ir
Exploration	Cultural Heritage	Movement of people and vehicles Road infrastructure maintenance activities	- Possible use of the Built Heritage and/or Archaeological Heritage in subsoil	Mitigable	No	-, D, P, T, L, Im, Ir

IX.

COMPILATION OF IMPACTS

Resurb
Ambiente, Lda

Chinese proverb

We reap what we sow. Choose what you nourish carefully.

9. COMPILATION OF IMPACTS

The compilation of impacts identified for each of the descriptors and their classification is shown in the following tables (*see* **Tables 63** and **64**).

Annex XIII presents the Environmental and Social Impact Assessment Matrix used to support the information contained in the following tables.

Table 63 – Compilation table of environmental impacts for the Construction/Deactivation phase of the project

Activity		Environmental Descriptor	Description	Impacts	Evaluation
CONSTRUCTION/DEACTIVATION PHASE	CONSTRUCTION OF THE ROAD SECTION BETWEEN LUAU-CAZOMBO-LUMBALA CAQUENGUE (AROUND 246KM), IN THE PROVINCE OF MOXICO	Climate and Climate Change	Production and emission of particles and GHG into the atmosphere	- Change in air quality	-, D, C, T, L to CB, I, Rs
			Land clearing and stripping actions	- Increase in air temperature close to the ground and decrease in relative air humidity, associated with loss of thermal regulation capacity	-, D, C, T, L, I, Rs
		Geology/ Geomorfology	Excavations and/or embankments associated with the opening of ditches and the implementation of infrastructure to support the contract	- Affectation of rocky outcrops - Affecting the local morphology of the terrain	-, D, C, Pt, L, Im, Ir
			Movement of people, machines and vehicles assigned to the works, including the movement of heavy vehicles		-, D, C, L, Pt, Im, Ir
			Carrying out the landscape restoration activities of the project	- Local geomorphological modification	-, D, P, Pt, L, LT, Ir
		Water Resources	Rehabilitation of existing accesses and opening of new accesses	- Interference with run-off water lines	-, D, C, L, T, Im, Rs
			Deforestation operations, removal of the surface layer of soil and earthworks Movement of people, movement of vehicles and machinery assigned to the works, including movement of heavy vehicles Rehabilitation of existing accesses and opening of new accesses Excavation operations (digging trenches) Transport of various materials	- Potentiation of the risk of erosion and dragging of solids from the intervention areas	-, I, T, Im, P, L to R, Rs
			Water use	- Depletion of water resources	-, D, P, Pt, T, Im, L, Rs
			Movement of people, movement of vehicles and machines assigned to the works, including movement of heavy vehicles Transportation of various materials Assembly and disassembly of jobsites, temporary storage areas for various materials and concrete, bituminous concrete and crushing plants	- Contamination of water lines resulting from accidental spillage of oils, lubricants and/or fuels	-, I, P, Im to MT, T, L to R, Rs
			Installation and use of yards and temporary storage areas for various materials Installation and use of yards and temporary storage areas for various materials	- Soil compaction with modification of natural infiltration conditions	-, I, P, Im to MT, T, L a R, Rs
			Rehabilitation of road infrastructure	- Decrease in the infiltration area of precipitation water	-, D, L, P, T, Im to MT, Rs
			Removal of support infrastructures	- Contamination of water lines resulting from accidental spillage of chemical and/or biological contaminants	-, D, L, P, T, Im to MT, Rs
		Environmental Noise	Noise produced by construction activities and infrastructure to support the contract	- Increase in sound levels (continuous and punctual) incident on the surrounding sensitive receivers, which may cause annoyance situations	-, D, C, T, L, Im, Rs
			Noise associated with the movement of vehicles/equipment	- Exclusion effect on fauna	-, D, C, T, L, Im, Rs
		Waste and Effluents	Principle of Waste Prevention and Reduction	- Reduction of waste production	+, C, T, L, Im, Rs
			Production of non-hazardous waste	- Contamination of soils and water resources	-, D, C, T, L, Im, Rs
			Production of hazardous waste		-, D, C, T, L, Im, Rs
		Air Quality	Emission of dust resulting from the movement of vehicles and other equipment Emission of dust/particles resulting from construction activities/deactivation and dismantling of infrastructure supporting the contract	- Change and degradation of air quality - Climate change	-, D, C, Pt, L, Im, Rs
			Emission of particles and GHG into the atmosphere resulting from the movement of vehicles and other equipment (combustion process of motor vehicles)		-, D, C, Pt, R, MT, Rs
		Soils, Land Use and Spatial Planning	Circulation of vehicles, machines and people	- Compaction and greater waterproofing of soils	-, D, C, Pt, L, Im, Rs
			Deforestation activities, land clearing and earthworks Occupation of the area reserved for jobsites and support areas for the contract	- Degradation of the natural layers of the soil and its quality - Soil erosion	-, D, C, Pt, L, Im, Rs
			Spill of products containing hazardous substances (with hydrocarbons and other polluting materials)	- Soil contamination	-, I, P, T, L, Im, Rs
			Rehabilitation of road infrastructure	- Compaction and greater waterproofing of soils - Soil contamination	-, D, T, LP, L, Im, Rs
		Biodiversity and Ecological Factors Biodiversity and Ecological Factors	Vegetation removal actions, stripping, soil compaction	- Affectation of natural habitats - Mortality by crushing/being run over by vehicles and machines - Exclusion effect on fauna - Loss of vigor and/or mortality of flora due to soil contamination - Physical destruction of individuals or populations of floristic species - Disturbance of natural biotopes/habitats - Disturbance of resting, feeding and breeding places	-, D, L, C, Pt to T, Im, Rs/Ir
			Installation and implementation of jobsites, temporary storage area for various materials, concrete, bituminous concrete and crushing plants		
			Movement of people, vehicles and machines assigned to the work, including the movement of heavy vehicles		
			Rehabilitation of existing accesses		
			Opening access paths		

Activity	Environmental Descriptor	Description	Impacts	Evaluation
		Transportation of various materials used in construction activities		
		Road infrastructure rehabilitation activities		
		Deactivation and dismantling of support infrastructures		
		Vegetation removal actions, stripping, soil compaction		
	Landscape	Removal of vegetation cover and topsoil layer, inducing changes in land use	- Destruction of natural elements of the landscape	-, D, C, Pt, L, Im, Rs
		Earth moving and earthmoving Rehabilitation of road infrastructure Implementation of jobsites, support areas and centers Assignment of heavy equipment	- Modification of the original terrain morphology leading to the appearance of visual discontinuity zones - Change of orography - Introduction of foreign elements into the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area	-, D, C, Pt, L, Im, Rs
		Landscape recovery activities in degraded areas, decommissioning and dismantling of infrastructure to support the contract	- Reset of initial conditions	+, D, C, Pt, L, Im, Rs
	Socio-economy	Investment value	- Benefit from the economy as a whole with reflexes at all levels - Increase in tax revenue for the state - Social inclusion and community participation	+, D, C, T, R, Im, Ir/Rs
		Road infrastructure construction activities	- Uncertain-term job creation for new employees and maintenance of jobs for existing employees - Demand for goods and services by workers in the project implementation area	+, D, C, Pt, R, Im, Rs
			- Promotion of trade associated with various areas, from production of materials and equipment, rental of machinery, hiring of waste operators, among others	+, D, C, Pt, L, Im, Rs
		Circulation of equipment and heavy vehicles used in construction activities	- Degradation of roads and streets, with disruption of the normal use of roads by the local population - Emission of particles and greenhouse gases - Interference of the project in local communities - Direct allocation of natural and legal people - Increased traffic of heavy vehicles and equipment at the local level - Inadequate planning of activities - Noise from construction activities that may disturb the population residing in the project implementation area, as well as in its surroundings	-, D, P, T, L, Im, Rs
	Cultural Heritage	Moving and operating machinery and equipment Earthworks and excavation Soil removal Ditching and excavation Demolition, dismantling and removal of existing/support infrastructure activities Landscape restoration activities	- Possible use of the Built Heritage and/or Archaeological Heritage in subsoil	-, D, P, I, L, Im, Ir

Impact Assessment Legend:			
Qualification	**(+)** Positive; **(-)** Negative; **(o)** Null		
Magnitude	**High**	Magnitude	**High**
Incidence	**D –** Direct, **I** – Indirect		
Probability or degree of certain	**C –** Certain**, P –** Probable		
Duration	**T –** Tempory**, Pt –** Permanent, **I** – Improbable		
Spatial dimension	**L –** Local**, R** – Regional **N –** Nacional **CB –** Cross-border		
Occurrence	**Im –** Immediate**, MT –** Medium Term**, LT –** Long Term		
Reversibility	**Rs –** Reversible**; Ir –** Irreversible		

Table 64 – Compilation table of environmental impacts for the Exploration phase of the project

Activity		Environmental Descriptor	Description	Impacts	Evaluation
EXPLORATION PHASE	CONSTRUCTION OF THE ROAD SECTION BETWEEN LUAU-CAZOMBO-LUMBALA CAQUENGUE (AROUND 246KM), IN THE PROVINCE OF MOXICO	Climate and Climate Change	Usufruct of the road section	- Change in air quality	-, I, P, T, L, I, Rs
		Geology/ Geomorfology	Maintenance and repair of road infrastructure	- Affecting the local morphology of the terrain	-, D, C, Im, I, L, Rs
			Presence of road infrastructure	- Artificialization of the terrain	-, D, L, Pt, Im, C, Rs
		Water Resources	Presence and operation of road infrastructure	- Eutrophication of water lines	-, I, P, Im, T, L, Rs
			Road infrastructure maintenance activities	- Change in water quality, due to equipment maintenance and repair	-, I, P, Im to MT, I, L, Rs
		Environmental Noise	Noise associated with the circulation of vehicles and passers-by	- Increase in sound levels (continuous and punctual) incident on the surrounding sensitive receivers, which may cause annoyance situations	-, D, C, T, L, Im, Rs
				- Exclusion effect on fauna	-, D, C, T, L, Im, Rs
		Waste and Effluents	Principle of Waste Prevention and Reduction	- Reduction of waste production	+, C, T, L, Im, Rs
			Production of non-hazardous waste	- Contamination of soils and water resources	-, D, C, T, L, Im, Rs
			Production of hazardous waste		-, D, C, T, L, Im, Rs
		Air Quality	Emission of particles and GHG into the atmosphere resulting from the movement of vehicles - use of road infrastructure (combustion process of motor vehicles)	- Change and degradation of air quality	-, D, C, Pt, R, MT, Rs
		Soils, Land Use and Spatial Planning	Circulation of vehicles, machines and people – use of the road infrastructure Maintenance activities for the rehabilitated infrastructure	- Soil compaction and waterproofing	-, D, C, Pt, L, Im, Rs
			Occurrence of spills of products containing hazardous substances Uncontrolled disposal of urban waste generated in the operation and maintenance of the road	- Soil contamination	-, D, C, Pt, L, Im, Rs
		Biodiversity and Ecological Factors	Increase in the circulation of people and vehicles to once underused locations	- Loss of vigor and affectation of plant communities by contamination - Mortality of animals due to being run over by the circulation of vehicles - Disturbance due to increased movement of people and vehicles involved in the maintenance and repair of infrastructure - Direct collision mortality	-, D, C, Pt, L, MT to LT, Rs/Ir
			Road Infrastructure Maintenance Activities		
		Landscape	Road infrastructure	- Creation of a visual discontinuity and promoting a degradation of the scenic value of the area	-, D, C, T, L, Im, Rs
		Socio-economy	Circulation of vehicles, machines and people Road maintenance activities	- Improvement of the living conditions of the population - Increase in jobs due to new road users - Increased employment opportunities due to the attractiveness of investments and reduction of transport costs - Better access to social services (education, health and security) - Decrease in road accidents- Melhoria da qualidade de vida	+, D, P, T, L, Im, Rs
			Investment value	- Benefit from the economy as a whole with reflexes at all levels	+, D, C, T, R, Im, Ir/Rs
			Presence of road infrastructure	- Reduction in the aesthetic quality of spaces	-, D, C, L, T, Im, Rs
		Cultural Heritage	Movement of people and vehicles Road infrastructure maintenance activities	- Possible use of the Built Heritage and/or Archaeological Heritage in subsoil	-, D, P, T, L, Im, Ir

Impact Assessment Legend:			
Qualification	**(+)** Positive; **(-)** Negative; **(o)** Null		
Magnitude	**High**	Magnitude	**High**
Incidence	**D –** Direct, **I** – Indirect		
Probability or degree of certain	**C –** Certain**, P –** Probable		
Duration	**T –** Tempory**, Pt –** Permanent, **I** – Improbable		
Spatial dimension	**L –** Local**, R** – Regional **N –** Nacional **CB –** Cross-border		
Occurrence	**Im –** Immediate**, MT –** Medium Term**, LT –** Long Term		
Reversibility	**Rs –** Reversible**; Ir –** Irreversible		

X.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

Resurb
Ambiente, Lda

Victor Hugo

”It is sad to think that nature speaks and
that the human being does not listen.”

10. SOCIAL ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

This chapter presents the Environmental and Social Management Plan (ESMP) to be implemented within the scope of the Environmental and Social Impact Assessment.

The ESMP gathers information on the activities associated with the implementation of the Project in its various phases, the socio-environmental components likely to be affected by the Project, and the set of environmental and social management procedures to be adopted based on the measures to mitigate impacts and the programs of monitoring proposed in this ESIA. For the operationalization of the ESMP, the actors and/or entities in each phase of the Project and their responsibilities in the implementation, verification or inspection of the foreseen environmental management procedures are defined. The ESMP presents the monitoring programs that include measures to mitigate and compensate for impacts and other complementary initiatives, organized by project phase and the entity responsible for its implementation. The ESMP thus aims to make available, in a systematic way, the set of socio-environmental management activities to be implemented and the ways to control their implementation, ensuring compliance with applicable legal, regulatory or normative requirements, and with the commitments assumed by the Project Management Policies, with the main emphasis on environmental and social matters.

The project promoter must guarantee, through contractual or other mechanisms, the fulfillment of all the specifications defined in the ESMP, by the various stakeholders.

10.1. Implementation Structure and Responsabilities

From the identification made of the entities directly involved, it is important to establish the distribution of direct responsibility for the environmental and social management of the implementation of the project, according to their attributions.

Consequently, the following distribution of responsibilities is considered, which may eventually be adjusted during the course of the project, by agreement between the parties:

- ✓ **Owner of Work**

The Owner of Work must ensure the supervision and implementation of the project, in accordance with the strategy and objectives defined and expressed in the Project Management Policies. Thus, they will have the following obligations and responsibilities in terms of Social and Environmental Monitoring of the Work, namely:

- Comply with all national environmental legislation in force and international requirements from the IFC and the Equator Principles;

- Ensure compliance with the objectives defined in the Project Management Policies;
- Carry out the formal environmental impact assessment (EIA) procedure, in accordance with current legislation and applicable requirements and subsequent interpretation and compliance with the imposed measures;
- Develop, provide and monitor the implementation of the Social and Environmental Monitoring Plan at Work (SEMPW) and Health and Safety Plan (HSP) to the other entities involved in the Environmental Monitoring of the Work - Contractor, Environmental and Safety Monitoring Team, Authority EIA (if applicable);
- Hire the Environmental and Social Monitoring Team;
- To be present, whenever necessary, in the periodic meetings of Environmental and Social Monitoring and Safety of the Work;
- Request an opinion from the EIA Authority on the adoption of unforeseen mitigation measures or the alteration of those initially foreseen and that may eventually be considered necessary during the course of the contract, as well as any changes to the project that may be considered and refer to the EIA Authority the Social and Environmental Monitoring Reports of the Work (SEMRW) with the periodicity pre-defined in the SEMPW;
- Ensuring compliance with sending mandatory communications to the Ministry of Public Administration, Labor and Social Security (MAPTSS)/General Labor Inspectorate (IGT) (eg Monthly Report on the Activities of the Occupational Safety, Hygiene and Health Services, Periodic communications, etc.).

✓ **Contractor/Executing Entity**

The Contractor/Executing Entity's obligations and responsibilities are:

- Prepare socio-environmental and health and safety management documents;
- Disclosure of the contract's Management Policies;
- Select the location of jobsites and other locations (eg life base, material deposition site, surplus land, etc.);
- Ensuring the necessary resources for an adequate environmental and social management of the work;

- Keep the Project Owner and the Environmental and Work Safety Monitoring Team informed about the timing and progress of the work;
- Ensuring compliance with all legislation in force, in terms of the environment and safety and other requirements, applicable to the contract;
- Implement the mitigation measures foreseen in the Social and Environmental Monitoring Reports of the Work (SEMPW) and Health and Safety Plan (HSP), and/or others that may eventually be recommended during the course of the work and inform the Environmental and Safety Monitoring Team of the Work of all difficulties that, eventually, may arise to be felt in the implementation of mitigation measures;
- Implement corrective measures that may be recommended by the Environmental and Safety Monitoring Team and approved by the Project Owner/Project Committee and EIA authority (if applicable);
- Report any complaints and/or grievances that may be addressed to the Project's Environmental and Safety Monitoring Team and to the Project Owner/Committee;
- Ensuring that the information regarding the socio-environmental and safety monitoring is known to all workers on the construction site, including any subcontractors;
- Be present at all relevant meetings for environmental, social and safety monitoring;
- Allocate all the human and material resources necessary for the implementation of the planned actions to guarantee safety and health at work, taking into account the state of evolution of the technique;
- Promote the necessary actions by giving adequate instructions to workers, so that the actions are understood by everyone and thus ensure safety at work.

✓ **Socio-environmental and Safety Monitoring Team**

The responsibilities of the Socio-environmental and Safety Monitoring Team of the Work are:

- Disclosure of the contract's Management Policies;
- Ensure and verify the implementation, by the Contractor/Subcontractors, of the provisions of the SEMPW and HSP;
- Enforce all mitigation measures;
- Update the database of applicable legislation, regulations and requirements;

- Accompany the executing entities of the project during the construction period, so that the environment and safety obligations are fulfilled;
- Prepare socio-environmental and safety monitoring reports throughout the work;
- Inspect the work and request appropriate corrective action, if necessary;
- Ensure the existence of an updated copy of the SEMPW and HSP in the work, accessible to all those involved or interested;
- Be present at all relevant work meetings for the social-environmental and safety monitoring at work;
- Creation of the Preventive Commission for Accidents at Work (CPAT);
- Carrying out internal audits and periodic inspections of the work;
- Carry out environmental, safety and health awareness actions for the contractor/subcontractors (the actions must extend to all workers involved in the work);
- Encourage workers to identify and report all dangerous situations they detect, even if these do not directly interfere with their safety;
- Encourage workers to ensure their own safety and that of colleagues who may be affected by their actions;
- Identify and submit the need to review the mitigation measures recommended in the SEMPW and HSP for approval by the Project Owner/Committee;
- Develop and keep an identification sheet for those involved in the work up-to-date;
- Develop and keep up to date the list of environmental and safety legislation applicable to the project;
- Organize and keep the Work Environment and Safety Dossier updated;
- Identify the risks and plan the necessary preventive measures for all activities with associated risks;
- Carry out periodic visits to the work – the frequency of visits by the environmental monitoring team must be adjusted to the needs of the work, which may increase or decrease depending on the frequency and importance of the activities carried out during the work; as a reference, biweekly visits should be considered during the course of the contract; at the beginning of the work, when defining the areas to be intervened, visits should be carried out more frequently (eg, weekly);

- Proceed, on each visit carried out, and whenever applicable, to record environmental/safety findings, that is:
    - Identification of situations that constitute Non-conformities with the environmental/safety legislation in force, with the SEMPW and HSP, or;
    - Situations that, even if they do not constitute Non-Conformities, but which require additional mitigation measures to be taken with a view to their correction/improvement.
- Develop and keep up-to-date a map for recording and monitoring environmental and safety findings;
- Prepare the socio-environmental monitoring report of the work (SEMRW) and the monthly and final safety report (MFSR) of the work;
- Communicate to the contractor any changes to the SEMPW and HSP, namely with regard to the mitigation measures recommended therein.

✓ **Inspection Company**

- Check compliance with the ESIA;
- Verify compliance with the SEMPW;
- Verify compliance with the HSP;
- Check the execution of the project;
- Approval of the materials to be applied;
- Periodic meetings to monitor the project with the Environmental and Safety Monitoring Team, the Executing Entity – Consortium and/or Owner of the Work/Project Committee;
- Verification of compliance with established deadlines.

10.2. Environmental and Social Management Plan Programs

10.2.1. Mitigation, Compensation and Socio-environmental Improvement Program

The socio-environmental mitigation and improvement program aims to improve the environmental and social balance of the project. It consists of identifying a set of measures aimed at reducing negative impacts and enhancing positive impacts, particularly the environmental and social impacts of the project.

The measures proposed by the socio-environmental mitigation and improvement program aim, on the one hand, to anticipate potential impacts, and on the other hand, to reduce the scale and, if possible, the magnitude of negative impacts identified and analysed.

The precautionary measures proposed involve rules that must be observed and recommendations that must be followed during the construction, operation and deactivation phases of the project, considered in the environmental and social impact assessment of the ESIA.

With regard to mitigating and/or compensatory measures, the approach will be carried out for each phase of the project, according to the socio-environmental descriptor, where a series of mitigation measures of a general and specific nature are also proposed. Generalist measures are applicable to a comprehensive set of descriptors and should therefore be applied generically to the different descriptors (*see* **Table 65**).

Table 65 – Matrix for the identification of socio-environmental impacts, mitigation and compensation measures and responsibilities

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
Climate and Climate Change	Construction/ Deactivation	- Operation of machines and heavy vehicles; - Circulation of vehicles; - Constructive activities.	- Production and emission of particles and GHG into the atmosphere.	- Change in air quality.	[1] - Execution of regular maintenance and checks on generators and other GHG producing equipment, ensuring their proper functioning and thus minimizing the production of these gases; [2] - Elaboration of a Preventive Maintenance Plan containing all the equipment and vehicles that contribute to the emission of GHG and that may have a dangerous interference with the climatic system; [3] - Respect for speed limits and all traffic rules; [4] - It is suggested to create a form that compiles all the equipment that use gases and refrigerant/fluorinated fluids in order to control the regulated gases that deplete the ozone layer, listed in Annex I of Presidential Decree n.º 153/ 11, of 15 June; [5] - It is recommended to adopt other refrigerant gases, if possible, or purchase new refrigeration equipment that use non-regulated gases, given that regulated HCFC (Hydrochlorofluorocarbon) gases, including the R-22 used, must be disposed of by 2030, in accordance with the Elimination Schedule stipulated by the Montreal Protocol and HFCs (hydrofluorocarbons) by 2050.	- Owner of Work; - Performing Entity; - Inspection.	- Daily – construction phase.	- Equipment and vehicle maintenance records; - Verification records of the implementation of mitigation measures.
	Exploration	- Circulation of vehicles – increase in local road traffic.	- Production and emission of particles and GHG into the atmosphere.	- Change in air quality.	[3].	- Proponent of the project.	- Two half-yearly campaigns (dry and wet season) in the first year of the road exploration phase	- Average daily traffic by type of vehicle
Geology/ Geomorphology	Construction /Deactivation	- Earthmoving and excavation; - Soil removal; - Ditch opening; - Landscape recovery activities; - Decommissioning and removal of permanent project equipment and installations; - Circulation of vehicles.	- Interaction with the geomorphological heritage.	- Interaction of rocky outcrops; - Interaction of geological heritage	[6] – Ensure that soil removal, opening ditches and excavations alter the morphology of the existing terrain as little as possible; [7] - The execution of excavations and embankments must be interrupted in periods of high rainfall and the necessary precautions must be taken to ensure the stability of the slopes and prevent their sliding.	- Owner of Work; - Executing entity; - Inspection.	- Daily – construction phase.	- Records of training/awareness actions for workers.
	Exploration	- Circulation of vehicles.			---	---	---	---
Water resources	Construction /Deactivation	- Earthmoving, excavation and embankment; - Deforestation and earthmoving operations; - Circulation of vehicles and machines;	- Release of a high quantity of particles into the atmosphere that end up depositing later on vegetation,	- Increase of suspended solids in the surrounding water lines; - Increased runoff and deposition of	[8] – Implement erosion mitigation measures such as, for example, avoiding the rejection of water in areas vulnerable to erosion and/or through a greater distribution of discharge in order to reduce its speed and consequent erosive action;	- Owner of Work; - Executing entity; - Inspection.	- Daily – construction phase; - Period defined in the Water Quality	- Verification records of the implementation of mitigation measures; - Records of training/awareness actions for workers;

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
		- Spills of fuel or dangerous products when using machinery and construction vehicles; - Concreting operations; - Spillage of domestic wastewater in jobsites, concrete plants, bituminous concrete and crushing; - Road rehabilitation and/or paving activities; - Production of solid waste; - Production of contaminated wastewater; - Landscape recovery activities.	roads, houses and, finally, on water lines; - Increase in urban waste in the surrounding water resources; - Accidents or incidents with potentially contaminating materials.	sediments/particles in the surrounding water resources; - Eutrophication of water lines; - Contamination of underground water resources with hydrocarbons and other polluting materials; - Change in water table levels; reduction in the quality of surface and groundwater (turbidity and TSS); - Bacterial contamination of groundwater; - Decrease in the infiltration area of rainwater, altering the surface runoff; - Depletion of the natural resource.	[9] - In the intervened areas, it must be ensured that after the intervention, the soils are clean and free of contamination by hydrocarbons, oils and/or other chemical products so as not to contaminate underground water resources; [10] - Provide for the construction of impermeable areas for fuel supply operations, as well as for the storage of chemical products that may prove necessary; [11] – Accidental spills of hydrocarbons, oils and/or other chemical products must be minimized either through correct and safe storage of these substances, or through handling by qualified personnel who are aware of environmental issues; [12] – Ensure the implementation of measures to rationalize water consumption, as well as measures to allow its reuse and guarantee the licensing of water withdrawals, in accordance with the legislation in force, if necessary; [13] – It is not admissible to deposit waste, even if temporarily, on the banks of water lines and areas of maximum infiltration; [14] – When intervening on land, correct surface drainage must be ensured in order to avoid situations where solid materials are dragged into water lines; [15] – Elaboration of an Environmental Emergency Plan, able to provide the bases for action in an emergency and thus respond to these emergency situations, such as spills, in soil or water, floods or even fire; [16] – WCs must be made available for employees to use; [17] - During concreting work, ensure that cleaning water from equipment and concrete grout is not discharged into water lines; [18] - Regular maintenance of machines and vehicles to prevent oil and fuel leaks from their systems; [19] - Appropriate treatment of wastewater in jobsites, power plants, quarries, deposits and sand pits; [20] - Fuel storage areas must be protected from the weather and containers must be placed in retention basins. The area must be away from water courses; [21] - All containers containing fuels or oils must be identified, avoiding accidental contamination;		Monitoring Plan.	- Records of maintenance of machines and equipment; - Monitoring of water quality; - Water reused in the construction phase (%); - Water consumed in the construction phase (%).

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					[22] - The Contractor shall construct, maintain, remove and reinstall, as necessary, the temporary drainage works and take all other necessary precautions to avoid damage to property and land by flooding and sediment from the works; [23] – Whenever there is an intervention in the hydraulic passages (which includes the provisional diversion of flows) it must be carried out, whenever possible, in the period in which the occurrence of precipitation is lower, spending as little time as possible and, trying to change as little as possible the natural course of water lines. The aim is thus to avoid the diversion of flows and the emergence of situations of difficulty and obstruction to normal flow, and consequent flooding of adjacent land. After the cessation of work, the initial situation must be promptly restored; [24] - After completion of work in a given location, all water lines and drainage organs that may have residues resulting from the work must be cleaned, avoiding problems in terms of obstruction and flooding.			
	Exploration	- Circulation of vehicles; - Circulation of passers-by; - Cleaning and maintenance of the road section.	- Increase in urban waste in the surrounding water resources; - Accidents or incidents with potentially contaminating materials.	- Eutrophication of water courses; - Alteration of water quality; - Contamination of underground water resources with hydrocarbons and other polluting materials.	[11]; [25] - The cleaning and clearing of all transverse and longitudinal drainage organs along the track must be ensured at least once a year, in order to guarantee good functional conditions; [26] – Maintain in good condition all vegetation coverings on the slopes and coatings that may be executed as a form of erosion protection; [27] – Ensure a waste collection service in order to prevent them from being deposited in drainage lines; [28] - Accidental spills of hydrocarbons, oils and/or other lubricants must be minimized through the application of containment material and subsequent washing of the affected area.	- Work Owner; - Performing entity responsible for maintenance.	- Anual	- Record of maintenance activities according to the maintenance plan of the road infrastructure; - Records of incidents/complaints.
Environmental Noise and Vibrations	Construction /Deactivation	- Assembly of jobsites and power plants; - Crushing activity; - Constructive activities; - Transport of materials; - Earth moving; - Execution of cleaning, treatment and stabilization of slopes; - Paving activities;	- Noise produced by construction activities; - Noise associated with the circulation of vehicles/equipment.	- Increased sound levels (continuous and punctual) incident on the surrounding sensitive receptors; - Effect of exclusion on the fauna.	[29] – Ensure that in the selection of equipment, those with CE marking or other international regulation attesting to its proper functioning and compliance in terms of noise emissions are chosen; [30] – When defining the Work Plan, the noisiest activities should be carried out in less critical periods (daytime); [31] – Ensure regular maintenance of all vehicles and equipment, in order to reduce	- Owner of Work; - Executing entity; - Inspection.	- Diary - construction phase; - Period defined in the Noise Monitoring Plan.	- Machinery and equipment maintenance records; - Verification records of the implementation of mitigation measures; - Noise monitoring; - Elaboration of a work plan to minimize the impact of noise in

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
		- Circulation of machines and heavy vehicles; - Road infrastructure maintenance activities.			noise and vibration levels and thus minimize exposure risks; [32] – Ensuring the use of personal protective equipment, namely ear protectors, whenever particularly noisy activities take place; [33] – Plan communication and information actions for the nearest resident population regarding the possibility of activities that generate higher levels of noise; [34] - Encapsulate the generators on site, as well as ensure that the noisiest equipment, if it is not possible to guarantee the satisfaction of regulatory noise levels, are placed within suitable compartments and/or properly insulated; [35] – When carrying out construction activities, pay attention to the presence of animals in an extensive regime (mainly goats) so as not to cause them discomfort; [36] – Determine the time of exposure to noise and vibrations in order to assess the risks of workers' exposure; [37] – Remove sources of noise (eg generators and compressors); [38] – Install noise barriers in infrastructure supporting the contract and work fronts that are closer to housing and/or other sensitive receivers, whenever deemed necessary.			sensitive areas; - Records of training/awareness actions for workers; - Records of delivery of personal protective equipment to workers.
	Exploration	- Road traffic circulation; - Circulation of passers-by; - Attractiveness and implementation of economic activities along the intervened road.	- Noise associated with the circulation of vehicles and passers-by and economic activities; - Noise inherent to road infrastructure maintenance activities.	- Increased sound levels incident on the surrounding sensitive receptors; - Effect of exclusion on the fauna.	[3]; [39] – Monitor Ambient Noise in order to assess the degree of discomfort and the need to place acoustic barriers, considering the values defined by the WHO as a reference; [40] - Ensuring the periodic maintenance and good condition of equipment likely to produce noise emissions (when repairing/maintaining the built infrastructure); [41] - Consultation of stakeholders and implementation of measures in agreement with local communities.	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- Periodically – exploration phase.	- Records and number of occurrences/complaints of noise inherent to road traffic by the population.
Waste	Construction /Deactivation	- Construction activities and execution of reinforced concrete structures, slope stabilization and paving; - Supply of materials and equipment.	- Production of non-hazardous waste; - Production of hazardous waste.	- Contamination of soils and water resources.	[42] – Develop and implement a Waste Management Plan/Plans for the Prevention and Management of Construction and Demolition Waste (PPMCDW) for the project. The PPMCDW must be available at the work site, for the purposes of inspection by the competent authorities and must be known to all those involved in the execution of the work; [43] – Ensure that appropriate waste	- Work Owner; - Performing entity; - Inspection; - Waste Management Operator.	- Diary - construction phase.	- Waste Management Plan; - Records of verification of the implementation of the Waste Management Plan; - Records of training/awareness actions for workers; - Waste transport

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					containerization means are implemented for the types of waste envisaged; [44] – Ensure that the waste produced is properly segregated and sent to an appropriate final destination; [45] – Valuing actions that ensure less waste production, or that allow ensuring its reuse or recovery; [46] – Ensuring the training and awareness of employees on issues related to the correct management of waste; [47] – Workers must receive adequate training in hygiene, Health and Safety at Work and procedures related to products chemical and physical and biological hazards; [48] – The area allocated to the waste park must be waterproofed and covered, at least for hazardous waste (when applicable), in order to avoid the accumulation of rainwater and consequent accidental contamination of soil and water resources; [49] – In the event of a spill, due precautions must be taken to remove the affected soils, as well as all waste produced, and transport to a licensed operator must be ensured; [50] – The washing of concrete mixers/autoconcrete mixers must take place in specific places and duly prepared for the purpose, with geotextile and gravel. Once dry, the concrete waste can be reused in the recovery of rural roads or private accesses or even reused in the contract; [51] - It is expressly forbidden to burn hazardous and non-hazardous waste on site; [52] - The existence of septic tanks for the treatment of domestic wastewater generated in the yards must be ensured, avoiding direct discharge into the natural water environment. This infrastructure must be subject to periodical and appropriate maintenance for the water treatment system, in order to guarantee its cleanliness and avoid obstructions; [53] - Upon completion of the work, the Contractor shall be responsible for deactivating/dismantling the jobsites, power plants and other infrastructure supporting the contract, such as circulation areas and areas for the temporary deposition of materials and waste; C1 – Ensure the training and awareness of the community surrounding the project, on			documents (waste manifests).

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					issues related to the correct management of waste, with special emphasis on the non-disposal of waste and the rejection of wastewater in surface water lines; C2 – Make available to the local population the reuse of some used construction materials.			
	Exploration	- Usufruct of the road infrastructure.	- Production of non-hazardous waste; - Production of hazardous waste.	- Contamination of soils and water resources.	[27]; [44]; [C1]; [54] – Efficient urban waste management with the placement of differentiated and undifferentiated collection containers along the road, especially in towns.	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- Periodically – exploration phase.	--
Air Quality	Construction /Deactivation	- Loading and unloading, vehicle movement and earth moving; - Operation of machines and vehicles (light and heavy); - Landscape recovery activities.	- Emission of dust/particles resulting from construction activities and resulting from the movement of vehicles and other equipment; - Emission of particles and GHG into the atmosphere resulting from the movement of vehicles and other equipment.	- Alteration and degradation of air quality; - Climate change.	[1]; [2]; [4]; [5]; [55] – Ensure, if necessary, regular watering of access routes to and around the work fronts, in order to reduce the production of dust; [56] - All employees must use the appropriate PPE for their role, in accordance with the Hazard Identification and Risk Assessment, which must be carried out (eg, mask); [57] – All vehicles must circulate in the area surrounding the project, including the adjacent lane, at moderate speeds, minimizing the production of dust; [58] – Comply with the discharge regulations for raw materials in bulk, potentially powdery, to avoid the dispersion of particles. Discharges should be carried out from the lowest possible height, thus reducing the production of dust; [59] - Ensure that the transport associated with the movement of earth/aggregates is covered with a gate, minimizing the amount of particles/dust emitted in the circulation of heavy vehicles. Truck wheelsets must be regularly cleaned, so as not to degrade the access roads to the work and road safety; [60] - Areas for the deposition and storage of aggregates and powdery materials must be covered and/or properly packed in order to prevent the dragging of particles by the wind. The machinery circulation area must be regularly moistened or covered with a rigid covering (paved) in order to prevent the suspension of particles by the action of the wind;	- Work Owner; - Performing entity; - Inspection.	- Diary – construction phase.	- Equipment and vehicle maintenance records; - Monitoring of air quality; - Records verifying the implementation of mitigation measures.

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					[61] – Leveling, paving and/or maintenance of access roads to minimize the emission of particles into the air; [62] – Awareness, information and training (AIT) for workers on the impacts arising from the diffusion/emission of particles and dust during construction activities.			
	Exploration	- Emission of particles and GHG into the atmosphere resulting from road infrastructure maintenance activities; - Circulation of vehicles.	- Emission of particles and GHG into the atmosphere resulting from the movement of vehicles.	- Alteration and degradation of air quality.	[51]; [63] - Create/reinforce green corridors along the rehabilitated road section, whenever possible.	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- According to the Environmental Operation Licence of the Project (MINAMB) – exploration phase.	- Environmental Performance Report.
Soils, Land Use and Spatial Planning	Construction /Deactivation	- Cleaning and deforestation activities; - Earthmoving and earthworks; - Circulation of light and heavy vehicles, machinery and equipment; - Spills of fuel or dangerous products when using machinery and construction vehicles; - Occupancy of the area reserved for jobsites, plants and support areas for the contract; - Disassembly/dismantling and complete removal of infrastructure, equipment and installations; - Landscape recovery activities.	- Changes in soil characteristics.	- Compaction and better soil sealing; - Degradation of natural soil layers and disturbance of soil structure; - Soil contamination; - Soil erosion; - Change in land use.	[6]; [9]; [26]; [28]; [49]; [64] – Plan construction activities so that the soil is exposed for as little time as possible; [65] – Excavations and embankments must be started as soon as the soils are clean, avoiding repetition of actions on the same areas and whenever possible, ensure the minimum base vegetation in the most sensitive sectors; [66] – The storage area for chemical products and fuel supply must have a retention basin, waterproofed and isolated from the natural drainage network, in order to prevent accidental spills of oils, fuels or other hazardous products from contaminating the soil and the waters; [67] – Ensure that at the end of the activities, the intervened areas are clean and free of contamination by chemical products and hazardous waste; [68] - Store soils with better suitability in pargas for later use in landscape restoration of degraded areas; [69] – Accidental spills of hydrocarbons, oils and/or other chemical products, potentially causing damage to the soil, must be promptly controlled, using adequate means of containment and removal of the contaminating source; [70] – Erosion control in order to avoid the dragging of sediments into the water lines; [71] – Temporary stoppage of construction activities in case of exceptional weather	- Work Owner; - Performing entity; - Surveillance.	- Diary – construction phase; - Period defined in the soil monitoring plan.	- Verification records of the implementation of mitigation measures; - Elaboration of a work plan to reduce the associated impacts; - Soil monitoring.

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					conditions that could aggravate soil erosion; [72] – If it becomes necessary, during the construction/deactivation phase of the project, to acquire land, a Land Acquisition Procedure must be developed for this purpose, in order to guarantee that the land is being acquired in accordance with the requirements applicable legal and international regulations; [73] – Sensitization of shunting drivers; [74] – Ecological management of effluents produced in jobsites and plants; [75] – Delimit and previously identify intervention areas, as well as access to work fronts and jobsites/support areas; [76] – Restrict the intervention area to the essential minimum, safeguarding the surrounding area; [77] – The selection of areas to be allocated to the installation of jobsites, power stations and other support areas for the work should give preference to areas that have already been intervened and paved; [78] – All areas intervened within the scope of the project, to support the work, such as jobsites, power stations, temporary warehouses and social facilities, must be recovered at the end of the construction activities and, whenever possible and appropriate, restore the initial conditions; [79] – Respect defense zones and strip the area in stages, in order to avoid too much exposed surface, when necessary; [80] – If it is necessary to open new accesses, the route must adapt to the natural terrain, avoiding the tearing of pronounced slopes and with steep inclinations. Removal of vegetation cover must be kept to an essential minimum. Trails must be marked, and circulation outside these areas must be prohibited; [81] – Define and signal the routes to be used by vehicles, mobile equipment and machinery, in order to restrict their movement to areas strictly necessary for construction activities.			
	Exploration	- Circulation of vehicles, machines and people.	- Occurrence of spills of products containing hazardous substances; - Soil compaction and waterproofing.	- Soil compaction and waterproofing; - Soil contamination; - Change in land use.	[26]; [28]; [49]; [69]; [82] – In a situation of repair or maintenance of infrastructure, ensure that the storage of dangerous products with potential for	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- Periodically – exploration phase.	--

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					contamination are stored in confined and impermeable areas; [83] – Make the population aware of the non-occupation of infrastructures built for other purposes (eg, informal market).			
Biodiversity and Ecological Factors	Construction /Deactivation	- Movement of machines, vehicles, equipment and people; - Felling of trees and/or destruction of vegetation; - Construction of jobsites and concrete plants, bituminous concrete and crushing and other support areas; - Road rehabilitation, including bridges; - Paving activities; - Dismantling/ disassembly and complete removal of support infrastructures, equipment and installations; - Extraction of aggregates and temporary deposits; - Crushing activity; - Landscape recovery activities.	- Fuel and/or chemical spills; - Disturbance of fauna and flora; - Interference with animal migration; - Increased environmental noise.	- Generation of an exclusion effect on the fauna and degradation of the surrounding flora; - Mortality of animal species by running over; - Loss of natural habitat; - Elimination of the fertile soil layer, increased erosion and elimination of the soil seed bank; - Difficulty in natural regeneration of plant species.	[3]; [35]; [72]; [84] – When planning activities, avoid the most disturbing actions taking place during the nesting period of the species; [85] – The cutting and felling of existing trees in the area allocated to the project should be reduced to the absolute minimum. Whenever the presence of vulnerable and/or endangered species is identified during the construction phase, these should be marked and delimited whenever possible in order to safeguard them [86] – If it becomes necessary, within the scope of the construction/deactivation phase, to carry out activities that imply the loss of biodiversity, the Executing Entity, within the scope of the environmental monitoring of the contract, must define strategies for compensation of residual impacts (compensations for loss of biodiversity) through the development and implementation of a Biodiversity Action Plan (BAP); [87] – Promote an awareness-raising action among workers for the non-harvesting or damage/slaughter of plant and animal species, and address the theme of the ecological value of flora, vegetation, habitats and fauna in the area where construction activities are inserted; [88] - Avoid leaving roots uncovered and unprotected in excavation areas; [89] - Vegetal biomass and other residues resulting from these activities must be removed and duly sent to their final destination, favoring reuse whenever possible; [90] - Stripping the vegetable land to the depth at which its characteristics are verified, in areas where it is necessary to move earth, with the aim of reusing it in landscape recovery actions.	- Work Owner; - Performing entity; - Inspection.	- Diary – construction phase.	- Verification records of the implementation of mitigation measures; - Noise monitoring program; - Records of training/awareness actions for workers; - Environmental awareness programs for surrounding populations.
	Exploration	- Circulation of vehicles, machines and people.	- Disturbance of fauna and flora; - Fuel and/or chemical spills;	- Loss of vigor and affectation of plant communities due to contamination;	[3]; [63]; [91] - Enable the existence of environmental corridors for animals;	- Work Owner; - Performing entity responsible for maintenance;	- According to the Environmental Operation	- Environmental Performance Report.

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
			- Increased environmental noise;	- Effect of exclusion on the fauna; - Mortality of animal species by running over; - Loss of natural habitat.	[C3] - Develop awareness campaigns on environmental preservation among communities.	- Competent National Entities.	Licence of the Project (MINAMB) – exploration phase.	
Landscape	Construction /Deactivation	- Implementation of jobsites, centers and support areas; - Earthmoving and earthworks; - Deforestation, cleaning and felling of trees; - Rehabilitation of road infrastructure; - Assignment of equipment, machines and heavy vehicles; - Landscape restoration activities in degraded areas.	- Removal of vegetation cover and superficial soil layer, inducing changes in land use; - Alteration of orography; - Changing the landscape; - Restoration of initial conditions.	- Destruction of natural elements of the landscape; - Modification of the original terrain morphology leading to the appearance of zones of visual discontinuity; - Introduction of strange elements in the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area; - Landscape recovery of the landscape after implementation of the recovery of degraded areas.	[92] - All waste must be packed in proper containers, and subsequently sent to authorized companies, in order to reduce the visual exposure of the same; [93] – Develop and implement a landscaping plan suited to the project and its surroundings, in line with guidelines from local administrations; [94] – Request prior authorization from the competent authorities for the use of areas assigned for the implementation of jobsites; [95] – Recomposition of relief, when possible; [96] – Replacement of soil and replacement of vegetation cover; [97] – The quarries, reservoirs and sandpits should be subject to more in-depth studies in order to assess, in greater detail, the quality of the aggregates and compliance with the intended requirements so that they can be used in the contract. In a favorable situation, these should be duly licensed with the competent authorities and the Mining and Landscape Rehabilitation Plan implemented and monitored throughout the project.	- Work Owner; - Performing entity; - Inspection.	- Diary – construction phase.	- Verification records of the implementation of mitigation measures.
	Exploration	- Circulation of vehicles, machines and people.	- Usufruct of the road section.	- Creation of a visual discontinuity and promoting a degradation of the scenic value of the area.	[98] - Prohibit and supervise the undue occupation of adjacent areas and/or road infrastructure.	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- Periodically – exploration phase.	--
Socioeconomy	Construction /Deactivation	- Project interference in local communities; - Direct allocation of natural and legal persons; - Acquisition of human and material resources for the execution of the contract; - Demand for goods and services by workers in the project intervention area; - Improvement of mobility conditions; - Increased traffic of heavy vehicles and equipment at local level;	- Short-term solution to access road problems and lack of employment; - Creation of jobs for communities and local entities (direct and indirect); - Increased influx in the catering, commerce and accommodation sector; - Conflicts between workers and	- Benefit of the economy as a whole with reflections at all levels; - Increased tax revenues for the state; - Creation of indefinite term employment for new employees and maintenance of jobs for existing employees; - Promotion of trade	[16]; [32]; [33]; [36]; [38]; [46]; [47]; [C1]; [C2]; [56]; [62]; [73]; [C3]; [99] – Ensure medical assistance to all employees assigned to the construction	- Work Owner; - Performing entity; - Surveillance.	- Diary – construction phase.	- Verification records of the implementation of mitigation measures; - Records of training/awareness actions for workers; - Environmental awareness programs for surrounding populations.

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
		- Inadequate planning of activities.	population; - Attracting Investments; - Disturbance of traffic of people and vehicles.	associated with various areas, from the production of materials and equipment, rental of machinery, hiring of waste management operators, among others; - Degradation of roads and streets, disturbing the normal use of roads by the local population; - Emission of particles and greenhouse gases; - Restriction of land use and/or temporary or prolonged loss of land use; - Increased noise in the area surrounding the project; - Social inclusion and community participation.	phase of the project; [100] – Promoting training/awareness actions for the different stakeholders in the project, focused on good environmental practices and defined mitigation measures; [101] – Plan communication and information actions to the local population about the scope of the project, the start of work and the areas to be intervened; [102] - Ensuring the sealing and identification of work areas; [103] - In accesses and surroundings where there are schools, safety measures should be redoubled in the circulation of vehicles that may affect the safety of children in particular and of the population in general; [104] – Placing adequate signage for work in progress next to support facilities and work fronts; [105] - Prohibition of access by third parties to areas of jobsites, plants and work fronts to reduce the risk of accidents, by sealing them off, in accordance with the applicable legislation. On the fence, warning signs should be placed that include the safety rules to be observed, as well as the schedule and calendar of activities; [106] – Ensure landlords' access to private properties; [107] - Dissemination by local communities of the scope of the measures that will be taken in the short term, to prevent false expectations and ensure the credibility of the project among the communities; [108] - In situations where the Contractor accidentally interferes with the structures and assets of the populations, he must proceed with the due compensation in coordination with the local authorities and the project proponent and/or carry out the replacement and/or replacement of any infrastructure. existing structures, equipment and/or services in the areas under construction and adjacent areas that are affected during the course of the work; [109] - The location of jobsites and warehouses in the vicinity of towns must be selected with care and, whenever possible, in fields that are already open to avoid increased needs for moving people and goods, compensation and destruction of the natural environment; [110] - Ensure the involvement of the local			

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					structure and the communities that live along the project's route so that it directly benefits from the employment opportunities necessary for the execution of the works; [111] - Employment opportunities must be explained in a clear and realistic way so as not to give rise to false or overly high expectations; [112] - The positive impact on women's living conditions can be further encouraged if the Contractor has specific guidance to give women opportunities when hiring labor; [113] - Create an opportunity for small traders and suppliers of local goods and services to serve the Contractor during the execution of the works; [114] - Reinforce the importance of maintaining a good relationship with local communities in dialogues about health and safety with workers; [115] - Among local workers there should be a community liaison group responsible for establishing communication between project staff and the community, which will be particularly important in cases of conflict. This group should be familiar with the project in general and be able to properly eliminate any difficulties or pass on any grievances/complaints; [116] - A set of rules (or a Code of Conduct) must be established and implemented in the workplace. Standards should include, among others, the prohibition of outsiders or unauthorized persons entering the service and the prohibition of prostitution in jobsites and similar areas (eg storage areas); [117] - Through its own internal policies, establish a minimum quota for women's direct participation in the implementation of the project; [118] - Inform about traffic restrictions, whenever they are foreseen; [119] - Install adequate signage in work areas, indicating alternative routes, speed restrictions and road detours while works are taking place; [120] - Build a safe passage over the ditches that will be opened, in order to minimize inconvenience to the local population; [121] – Use of Individual and/or Collective Protection Equipment according to the work activities to be carried out; [122] - Require the use of a personal			

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					flotation device (PFD) when work is carried out in close proximity to waterways (bridges); [123] - Implement fire and explosion prevention measures in accordance with internationally accepted standards; [C4] – Support research projects, universities, for the development of agricultural production adjusted to the soil and climate conditions of the Province of Moxico; [C5] – Provide didactic material to schools/teaching institutions in the project's intervention area; [C6] – Establish an environmental education program, aimed at local schools in order to sensitize children to the importance of preserving the environment, sustainable management of resources and climate change.			
	Exploration	- Circulation of vehicles, machines and people; - Track maintenance activities.	- Increased road safety; - Increased road traffic in view of the rehabilitation carried out; - Attraction of investments; - Reduction of transport costs; - Improved mobility.	- Increase in employment opportunities due to the attractiveness of investments and reduction in transport costs; - Increase in jobs due to new road users; - Better access to social services (education, health and security); - Decrease in road accidents; - Improved quality of life.	[100]; [C7] – Train people from local communities to carry out cleaning and maintenance activities for the rehabilitated/built road infrastructure; [C8] – Reinforcement of public, private and NGO initiatives in the areas of training, social services, awareness of education and health, etc., mainly for the most disadvantaged (women, children and young people, the elderly, the disabled, associations fighting poverty, etc); [C9] – Support in providing basic services and food to the local community.	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- According to the Environmental Operation Licence of the Project (MINAMB) – exploration phase.	- Environmental Performance Report.
Cultural Heritage	Construction /Deactivation	- Movement and operation of machinery and equipment; - Earthmoving and excavation; - Soil removal; - Landscape recovery activities.	- Possible allocation of Built Cultural Heritage and/or Archaeological Heritage underground.	- Allocation of built heritage and/or archaeological heritage underground.	[124] – Even though the existence of relevant archaeological sites was not identified at a previous stage, it is considered important to provide for closer and careful monitoring during the deforestation phase and remaining earthworks for the implementation of the project's support infrastructures; [125] – The identified heritage occurrences must be preserved in situ in their entirety, during the deforestation process. Mobile finds recorded during archaeological monitoring must be placed in a deposit accredited by the cultural heritage guardianship body; [126] – It is recommended to monitor the	- Work Owner; - Performing entity; - Inspection.	- Diary – construction phase.	- Verification records of the implementation of mitigation measures.

Social and environmental descriptors	Phases	Actions that Induce Impacts	Effect	Impact	Impact Mitigation and Compensation Measures	Responsibilities	Implementation Period	Social and Environmental Indicators/Documented information
					sound and vibration levels of equipment and machines; [127] – Monitoring of sound levels and vibration speeds near sensitive receivers in the project intervention area.			
	Exploration	- Circulation of vehicles, machines and people; - Highway maintenance activities.	- Possible asset allocation.	- Allocation of assets in the course of road infrastructure maintenance activities.	[C7].	- Work Owner; - Performing entity responsible for maintenance; - Competent National Entities.	- Periodically – exploration phase.	--

10.2.2. Social and Environmental Monitoring and Accompaniment Program

The integration and analysis of the information collected in the monitoring of the various socio-environmental parameters will allow, in the future, to achieve objectives that fall within the scope of a policy of prevention and reduction of the negative impacts caused by the development of the different activities of the project.

The implementation of an Environmental and Social Monitoring Plan for the project makes it possible to ensure the implementation of the mitigation measures proposed in **Chapter 10.2.1.** of this document, which focuses on the three phases of the project considered in the environmental impact assessment (construction, operation and deactivation). The socio-environmental monitoring aims to comply with legal and regulatory requirements, good practices and objectives defined in the Project Management Policies.

With regard to the analysis of Human Rights and Gender Equality issues, in addition to the principles referred to in **Chapter 2.6.2**., some published reference bibliography should also be considered for the monitoring of these objectives throughout the life cycle of the project for this purpose, namely Guiding Principles on Business and Human Rights, Manual on Monitoring (Chapter 15 Integrating gender into human rights monitoring) and Human Rights Indicators - A Guide to Measurement and Implementation (The Office of the United Nations High Commissioner for Human Rights (OHCHR)).

In this sense, the objectives underlying the realization of a Monitoring Program (MP) and Socio-environmental Monitoring are, in order of priority and importance, as follows:

- Monitor the socio-environmental objectives defined in the Project Management Policies;
- Evaluate and confirm the project's impact on the monitored parameters, both in terms of the forecasts made in the ESIA and in compliance with the legislation in force and applicable requirements;
- Monitor project stakeholders and their needs and expectations, as well as their opinions, doubts, complaints and/or grievances;
- Check the efficiency of the measures adopted to minimize socio-environmental impacts;
- Assess the possible need to apply new mitigation measures in relation to some environmental and social aspects (if those initially recommended are not sufficient).

With the implementation of the MP in the field, it is intended, in a systematic way, to continue to guarantee the collection of information on the evolution of certain socio-environmental variables, namely the variables that assume the greatest importance in terms of incidence of impacts on the project in question.

The MP results must be computerized, in a database, which makes it possible to monitor the evolution of parameters over time.

Thus, the socio-environmental monitoring and monitoring program aims to monitor the adequate implementation of mitigation measures (environmental and social) during the various phases of the project and good environmental practices, in accordance with the normative reference referring to environmental management ISO 14001. On the other hand, allows checking the effectiveness of the measures implemented and detecting residual impacts that may still persist after the implementation of corrective measures or to treat new unwanted effects.

The monitoring and follow-up program must include at least three levels:

- Monitoring the implementation of planned measures and short, medium and long term results;
- Monitoring of impacts that depend on maintaining the established parameters;
- Monitoring of unexpected effects.

10.2.2.1. Social and Environmental Accompaniment and Implementation of a Social and Environmental Management System

Each month, a report must be produced with the aim of evaluating the socio-environmental situation and the implementation of the preventive and/or corrective measures proposed in this ESIA. This document should present the development of the main environmental and social monitoring actions that have taken place, including activities related to the Stakeholder Involvement Plan (SEP) in order to monitor their degree of implementation.

Likewise, the implementation of an Environmental and Social Management System has several advantages for the environment, society and the project, reducing the potential risks of environmental and social impact, leading to the introduction of socio-environmental practices appropriate to the operations resulting from the activity, reducing thus the socio-environmental risks that may arise from it. Its application can even bring economic benefits to the project, contributing to a better management in the use of resources.

Given the typology of the project, the suggested socio-environmental monitoring and monitoring indicators are:

- Monitoring of objectives, control of documents and records, monitoring of implemented improvement actions and analysis of stakeholder satisfaction;
- Identification and assessment of Risks and Opportunities and monitoring of the effectiveness of actions implemented to deal with risks and opportunities (Quality, Environment, Safety, Social Responsibility and Human Rights and Gender Issues);
- Quantity of waste produced and forwarded;
- Quantification of estimated greenhouse gases;
- Percentage of compliance with the project's environmental provisions and respective assessment of effectiveness and analysis and control of non-conformities/complaints/occurrences;
- Evaluation of suppliers/service providers;
- Number of jobs created locally (local labor used in the execution of the project);
- Number of information and awareness sessions/campaigns;
- Number and nature of social conflicts related to the project;
- Number and nature of recorded work accidents;
- Number of public/community/group meetings (consultations) held;
- Number of complaints received during the project;
- Number of women hired under the project;
- Number of Non-Conformities related to non-compliance with the objectives of the Project Management Policies;
- Proportion of land/plots occupied by the project acquired or leased;
- Existence of landscape recovery;
- Monitoring of suppliers and service providers in relation to the requirements expressed through the Project Management Policies.

10.2.2.2. Security Accompaniment

Safety monitoring must make it possible to identify and monitor the hazards, risks and preventive measures of the work to be carried out on site, as well as the maintenance procedures for equipment on site, intervention procedures, namely, signage, protective equipment and safety rules. to be fulfilled by all those involved in the work. Thus, the Health and Safety Plan (HSP) must define the general rules of planning, organization and coordination to promote safety, hygiene and health at work on construction jobsites.

10.2.2.2.1. Health and Safety Plan

During the execution of the project, a Health and Safety Plan (HSP) should be implemented with the main objective of:

- Carry out all work in order to provide all workers on the construction site with adequate safety and health conditions;
- Ensure the awareness, information and training of workers with regard to safety issues (eg work procedures, PPE, hazards and risks of the activity, etc.) and health (eg medical assistance, hygiene and cleanliness habits, sexually transmitted diseases, etc.);
- Carry out the work within the appropriate deadlines, taking into account good health and safety conditions and the productivity levels considered in the approved planning that must be complied with;
- Minimize labor accident rates and the social and economic costs resulting from work accidents or occupational diseases;
- Carry out all work with the specified quality, in a properly organized and environmentally correct space.

The HSP, which must be prepared by the project monitoring team, must meet the Project Management Policies referred to in **Chapter 5.7.**, and measures defined in the Mitigation, Compensation and Socio-environmental Improvement Program applicable to the health and safety scope.

In this sense, every month, a report should be produced with the aim of monitoring the project's safety issues and the adopted prevention/mitigation measures and evaluating their effectiveness.

10.2.2.3. Water Monitoring Plan for Human Consumption

During the work, the supply of potable water to all workers must be ensured. As mentioned in the general description of the project, mineral water will be provided to the workers. For the construction phase, the executing entity must ensure that the water needs of the site do not harm the water sources used by the local communities. Whenever possible, priority should be given to the potable water resource of public supply systems. If, during the construction phase of the project, the executing entity chooses to use surface water "purchased" at the site for human consumption, it must assess its quality (potability), as defined in Presidential Decree 261/ 11 of the 6th of October. If the water does not fully meet the drinking water criteria, the executing entity must take alternative measures, such as, for example, implementing a pre-treatment system to disinfect the water quality, for example, with the addition of chlorine or another treatment system, depending on non-conforming parameters (microbiological or physicochemical) to ensure the quality of water stored in reservoirs at jobsites destined for human consumption.

All existing water sources on construction sites and work fronts that are not monitored must present the identification of "uncontrolled water/non-potable water".

In the following subchapters, the methodology and parameters to be monitored in the need to acquire uncontrolled water destined for human consumption are presented.

10.2.2.3.1. Sampling Methodology

The sampling methodology to be adopted must guarantee the representativeness of the sample and avoid errors in the collection of samples, such as contamination, sample instability, incorrect preservation or incorrect collection, which may lead to errors in the results obtained. In this sense, and in summary, the steps to be carried out when sampling are presented:

- Scheduling of collections and sampling sites;
- Preparation of material and collection equipment (eg sterilized glass jars, thermal bags, on-site measuring equipment, personal protective equipment, etc.);
- Preparation of material for sampling quality control (eg, monitoring sheets);
- Harvesting/monitoring. At each monitoring site, record the following data: the date, time, geo-referenced location of the point, the meteorological conditions verified, the physical-chemical parameters in situ, flow, as well as an immediate organoleptic analysis and identification of relevant aspects existing in the sampling site. This information must be recorded in a typified form (Environmental Monitoring Form);

- Correct packaging and forwarding of collected samples for analysis and laboratory treatment;
- Preparation and analysis of the monitoring report.

10.2.2.3.2. Parameters to Monitor, Frequency and Sampling Location

The following table (*see* **Table 66**) presents the parameters defined by Presidential Decree no. 261/11, of 6 October should be monitored according to the types of treatment regimen recommended (categories A1, A2 or A3). At the same time, the minimum sampling frequency is presented, as well as a comparison with the maximum admissible values (MVA) and maximum recommended values (MRV).

According to Annex II of Presidential Decree No. 261/11, of 6 October, surface waters must comply with the type of treatment schemes referring to the classes:

- Class A1 – Physical treatment and disinfection;
- Class A2 – Physical, chemical and disinfection treatment;
- Class A3 – Physical treatment, chemical tuning and disinfection.

Table 66 – Water Quality - Human Consumption

Parameters	Expression of results	A1		A2		A3		Classification in group	Minimum sampling frequency (n.º)/ year
		MVA	MRV	MVA	MRV	MVA	MRV		
pH (25.ºC)	Sorensen scale	6,5–8,5	---	5,5-9,0	---	5,5-9,0	---	G1	
Color (after simple filtration)	mg/l, Pt-Co scale	10	(O) 20	50	(O)100	50	(O)200	G1	
Total Suspended Solids	mg/l	25	---	---	---	---	---	G1	
Temperature	ºC	22	(O) 25	22	(O)25	22	(O)25	G1	4
Electrical conductivity	µS/cm, 20ºC	1000	---	1000	---	1000	---	G1	
Smell	Dilution factor at 25ºC	3	---	10	---	20	---	G1	
Nitrates (*)	mg/l NO_3	25	(O) 50	---	(O)50	---	(O)50	G1	
Fluorides (1)	mg/l F	0,7–1,7	1,5	0,7-1,7	---	0,7-1,7	---	G3	1
Dissolved Iron (*)	mg/l Fe	0,1	0,3	1	2	1	---	G2	
Manganese (*)	mg/l Mn	0,05	---	0,01	---	1,00	---	G2	2
Copper	mg/l Cu	0,02	(O) 0,05	0,05	---	1,00	----	G2	
Zinc	mg/l Zn	0,5	3,0	1	5	1	5	G2	
Boron	mg/l B	1,0	---	1	---	1	---	G3	1

Parameters	Expression of results	A1		A2		A3		Classification in group	Minimum sampling frequency (n.º)/ year
		MVA	MRV	MVA	MRV	MVA	MRV		
Arsenic	mg/l As	0,01	0,05	---	0,05	0,05	0,10	G3	
Cadmium	mg/l Cd	0,001	0,005	0,001	0,005	0,001	0,005	G3	
Total Chromium	mg/l Cr	---	0,05	---	0,05	---	0,05	G3	
Lead	mg/l Pb	---	0,05	---	0,05	---	0,05	G3	
Selenium	mg/l Se	---	0,01	---	0,05	---	0,01	G3	
Mercury	mg/l Hg	0,0005	0,0010	0,0005	0,0010	0,0005	0,0010	G3	
Barium	mg/Ba	---	0,1	---	1	---	1	G3	
Cyanides	mg/l CN	---	0,05	---	0,05	---	0,05	G3	
Sulfates	mg/l SO_4	150	250	150	(O)250	150	(O)250	G2	2
Clorides	mg/l Cl	200	---	200	---	200	---	G1	4
Surfactants (which react with methylene blue)	mg/l sodium lauryl sulfate	0,2	---	0,2	---	0,5	---	G2	2
Phosphates (*) (2)	mg/l P_2O_3	0,4	---	0,7	---	0,7	---	G1	4
Phenols	mg/l C6H5 OH	---	0,001	0,001	0,005	0,010	0,100	G2	2
Dissolved or emulsified hydrocarbons	mg/l	---	0,05	---	0,20	---	1	G3	1
Polynuclear Aromatic Hydrocarbons	µg/l	---	0,2	---	0,2	---	1	G3	1
Total pesticiedes (Paradise, hexaclorocyclo-hexane, dieldrin and others)	µg/l	---	1,0	---	2,5	---	5	G3	1
Chemical Oxygen Demand	mg/l O_2	---	---	---	---	30	---	G1	4
Dissolved oxygen (*)	% O_2 saturation	70	---	50	---	30	---	G1	4
CBO_5, 20ºC	mg/l O_2	3	---	5	---	7	---	G1	
Kjedahl Nitrogen (excluding NO_2 and NO_3 nitrogen)	mg/l N	1	---	2	---	3	---	G2	2
Ammoniacal Nitrogen	mg/l NH_4	0,05	---	1	1,5	2	(O)4	G1	4
Extractable substances with chloroform	mg/l	0,1	---	0,2	---	0,5	---	G3	1
Total Coliforms	cfu/100 ml	50	---	5000	---	50.000,00	---	G1	4
Fecal Coliforms	cfu/100 ml	20	---	2000	---	20.000,00	---	G1	
Fecal streptococci	cfu/100 ml	20	---	1000	---	10.000,00	---	G2	2
Salmonella	---	absence	---	absence	---	---	---	G3	1

Parameters	Expression of results	A1		A2		A3		Classification in group	Minimum sampling frequency (n.º)/ year
		MVA	MRV	MVA	MRV	MVA	MRV		
		in 5000 ml		in 1000 ml					
Total Germs a 22ºC/72h	cfu/1ml	100	---	---	---	---	---	G3	1
Total Germs a 37ºC/48h	cfu /1ml	10	---	---	---	---	---	G2	2
Sulfite reducing clostridia	cfu/20ml	---	---	<1	---	---	---	---	---

(O) – The limits can be exceeded in case of geographic and/or meteorological conditions.
(*) – Limits may be exceeded for parameters marked with* in shallow lakes and low renewal rate.
(1) – The values indicated constitute the lower and upper limits of concentrations, determined as a function of the annual average of maximum daily temperatures.
(2) – This parameter is included to satisfy the ecological requirements of certain environments.

This Monitoring Plan must be implemented during the entire duration of the Construction Phase, whenever resorting to the collection and/or purchase of surface water intended for human consumption, whose potability is not guaranteed and/or monitored, as mentioned above.

10.2.2.4. Waste Water Monitoring plan

During the contract, the production of domestic and industrial wastewater is expected, as mentioned in **Chapter 5.3.2. Liquid effluents**. In this sense, whenever it is not possible to carry out the authorized connection to the municipal collector network, connected to a wastewater treatment plant, prior monitoring of the discharge of the treated effluent into the receiving medium (soil or water) must be ensured, in as defined in Presidential Decree 261/11 of 6 October.

10.2.2.4.1. Sampling Methodology

The sampling methodology to be adopted for the collection of wastewater samples is that referred to in **Subchapter 10.2.2.3.1.** concerning water for human consumption.

10.2.2.4.2. Parameters to Monitor, Frequency and Sampling Location

The selection of parameters to be analyzed will comply with what is defined in Annex VI – Emission Limit Values (ELV) for the discharge of waste water in Presidential Decree No. 261/11, of 6 October. According to the aforementioned legal diploma, wastewater discharged into the receiving medium must comply with the Emission Limit Values (ELV) presented in the following table (*see* **Table 67**).

Table 67 - Emission Limit Values (ELV) in the discharge of wastewater

Parameters	Expression of results	ELV
pH (25ºC)	Sorensen Scale	6,0 – 0,0 (2)

Parameters	Expression of results	ELV
Temperature	ºC	Increase of 3ºC(3)
CBO_5, 20ºC (0)	mg/l O_2	40
CQO (0)	mg/l O_2	150
TDS (0)	mg/l	60
Aluminium	mg/l Al	10
Total Iron	mg/Fe	2,0
Total Manganese	mg/l Mn	2,0
Smell	---	Not detectable on dilution 1:20
Color	---	Not visible on dilution 1:20
Residual chlorine available:		
Free	mg/l Cl_2	0,5
Total	mg/l Cl_2	1,0
Phenols	mg/l C_6H_5OH	0,5
Oil and Fat	mg/l	15
Sulphides	mg/l S	1,0
Sulphites	mg/l SO_3	1,0
Sulfates	mg/l SO_4	2000
Total Phosphorus	mg/l P	3 (in waters that feed ponds or reservoirs) 0,5 (in ponds or reservoirs)
Ammoniacal Nitrogen	mg/l NH_4	10
Total Nitrogen	mg/l N	15
Nitrates	mg/l NO_3	50
Aldehydes	mg/l	1,0
Total Arsenic	mg/l A	1,0
Total Lead	mg/l P	1,0
Total Cadmium	mg/l cd	2,0
Total Chromium	mg/l Cr	2,0
Hexavalent Chromium	mg/l Cr (VI)	0,1
Total Copper	mg/l Cu	1,0
Total Nickel	mg/l Ni	2,0
Total Mercury	mg/l Hg	0,05
Total Cyanides	mg/l CN	0,5
Mineral Oils	mg/l	15
Detergent (sodium and laurel sulfate)	mg/l	2,0 (4) (5)

(3) Temperature of the receiving medium after the discharge of residual water, average of 30 m downstream of the discharge point, with the average value exceeding the monthly average value of the 2nd.
(4) The average daily value cannot exceed twice the average monthly value.
(5) Value related to the discharge of the industrial unit for the production of HCH extraction from lindane or simultaneously, the production of HCH and extraction of lindane.

It should be noted that the legislation currently in force in Angola does not indicate a sampling frequency for wastewater. In the first year, a quarterly analysis is suggested, and the frequency may eventually be reduced taking into account the values obtained in the analyzes carried out. If there is an indication of the periodicity of effluent sampling imposed by the competent entity in the authorization for discharge to the municipal collector, this must be complied with.

10.2.2.5. Soil Monitoring Plan

Soil, the upper layer of the earth's crust located between the rocky substrate and the surface, is composed of mineral particles, organic matter, water, air and living organisms, characterized by enormous variability. The physical and chemical characteristics of the soil, as well as the presence of living organisms, influence the transformation, retention or mobility of possible contaminants, being decisive in the form of expansion of a contamination plume, and must be taken into account when preparing either a Plan of Sampling or a Monitoring Plan.

Soil quality assessment consists of determining the presence of contaminants in the soil and their concentration, at a given moment, namely, in an environmental emergency situation.

During the construction activities of the project, periodic monitoring must be carried out by a Technician responsible for the work of clearing, blasting, conditioning the vegetable land, landfill, among others. During these activities, the Technician appointed by the executing entity must verify that the cover lands are properly stored, thus defining their packaging in heaps, with the proper dimensions and respective care.

The technician responsible for monitoring must travel to the work every six months and subsequently a seasonal monitoring must be carried out.

10.2.2.5.1. Sampling Locations and Frequency

The Soil Monitoring Plan aims to obtain information that allows assessing the temporal and spatial evolution of soil contamination and the environments affected by it. In particular, the Monitoring Plan of a soil remediation project or the Post-remediation Monitoring Plan for a soil aim to assess the effectiveness of the remediation carried out, so the locations and sampling frequency should be defined after the occurrence of an environmental accident and the sampling frequency adjusted to the dimension of the environmental accident.

With regard to monitoring the activities of clearing, stripping and conditioning the land, the sampling sites correspond to the implantation area of the project for the rehabilitation of the road section between Luau-Cazombo-Lumbala Caquengue (area directly affected).

10.2.2.5.2. Parameters to Monitor

The parameters must be defined according to the dimension and type of environmental accident and respective soil contamination.

10.2.2.5.3. Acceptability Criteria

Acceptability criteria should be defined according to the type and dimension of the environmental accident as well as the analysis of the risk to human health and the environment.

10.2.2.6. Air Quality Monitoring Plan

The Air Quality Monitoring aims to characterize the air quality in the project area and verify that the values obtained are in accordance with the Reference Limit Values defined in the EHS Guidelines, considered merely indicative, taking into account that at the date of this report there is no legislation in Angola for this purpose.

The atmospheric pollutant resulting from the activities carried out, which is more relevant in influencing the quality of the air being evaluated, is related to the emission of suspended particles originated by resuspension from unpaved accesses, having been concluded by the need to limit their emissions.

In this sense, the air quality monitoring program will include the measurement of the concentration, in ambient air, of the following parameters:

- PM_{10};
- $PM_{2,5}$.

In addition to monitoring atmospheric pollutants, measurements of local meteorological parameters will be carried out, namely:

- Wind speed;
- Wind direction;
- Amount of Precipitation;
- Air Temperature;
- Relative Humidity.

The following table (*see* **Table 68**) presents the Reference Limit Values defined in the EHS Guidelines, which will be considered, as an indication, in view of the absence of Angolan legislation for this purpose.

Table 68 - Air Quality Monitoring Plan - Parameters monitored

Parameter	Reference Value (EHS Guidelines)*
PM10 (µg/m³)	150 µg/m³*
PM 2.5 (µg/m³)	75 µg/m³*

(*) Reference Limit Values defined in the EHS Guidelines (Table 1.1.1: WHO Environment Air Guidelines).

10.2.2.6.1. Sampling Locations and Frequency

The sampling sites for monitoring Air Quality (*in situ* measurements) should correspond to the work points where excavation and earthmoving activities are more significant and where a greater dispersion of dust and particles is expected, namely between Luau, Cazombo and Lumbala Caquengue.

The Monitoring Plan must be implemented throughout the duration of the Construction Phase of the Project. The frequency of the Monitoring Plan must be biannual (before the rainy season and before the dry season).

10.2.2.7. Environmental Noise Monitoring Plan

The Environmental Noise Monitoring aims to characterize the noise levels Outside Environment, in the defined places, with a view to preserving an adequate environmental noise and verifying that the values obtained are in accordance with the Reference Limit Values defined in the EHS Guidelines, considered merely indicative, taking into account that at the date of this report there is no legislation in Angola for this purpose.

The following table (*see* **Table 69**) shows the Reference Limit Values defined in the EHS Guidelines.

Table 69 - Reference Limit Values defined in the EHS Guidelines - Ambient Noise

Type of receivers	Period	Recommended value, LAeq dB (A)	Negative effect if be surpassed the recommended value
Housing (Outside)	Daytime and evening	55	Serious annoyance
Housing, bedroom (Interior)	Nocturne	30	Sleep disorder
School (Outside)	Daytime and evening	55	Annoyance

(*) Reference Threshold Values defined in the EHS Guidelines (Table 1.7.1: Noise Level Guidlines).

10.2.2.7.1. Sampling Locations and Frequency

For the construction phase of the project, given the forecast of working only in the daytime period, it is recommended that measurements be defined in the daytime period, in a first phase, every six months, with the Sensitive Receivers closest to the project. If necessary, the frequency of monitoring can be increased.

In order to carry out the Environmental Noise monitoring campaigns, the sampling sites shown in **Table 70** are suggested, which were defined during the technical visit to the project site.

Table 70 – Location of sampling points – Environmental Noise

Monitoring Point	Description	Coordinates
Ramb1	Houses near the beginning of the road section between River	11°12'41.24"S

Monitoring Point	Description	Coordinates
	Sapo and Cazombo (Pk 0+000)	22°14'30.30"E
Ramb2	Houses near the end of the road section between River Sapo and Cazombo (Pk 196+000)	11°53'47.26"S 22°54'49.64"E
Ramb3	Houses near the beginning of the road section between Cazombo and Lumbala Caquengue (Pk 0+000)	11°53'56.91"S 22°53'12.17"E
Ramb4	Houses near the end of the road section between Cazombo and Lumbala Caquengue (Pk 196+000)	12°22'59.72"S 22°34'56.01"E

10.2.2.8. Occupational Noise Monitoring Plan

Monitoring Occupational Noise aims to assess the noise levels of workers during the noisiest construction activities, with a view to preserving an adequate sound environment.

As there is currently no specific national legislation for this purpose, this plan should consider as an indication the reference values of Directive No. 2003/10/EC on the minimum safety and health requirements in terms of workers to the risks due to physical agents (noise).

During the construction phase, the safety monitoring technician must ensure that the construction activities are carried out safely and systematically assess whether the personal protective equipment, namely hearing protectors, are adequate, based on the results obtained during occupational monitoring.

The following table (*see* **Table 71**) presents the Reference Limit Values for Occupational Noise defined in Directive no. 2003/10/EC, which will be used to compare the values obtained *in situ*, as an indication, against the lack of Angolan legislation.

Table 71 – Reference Values (dB) of Occupational Noise defined in Directive No. 2003/10/EC

Parameter	Reference Value (dB) defined in Directive no. 2003/10/EC
Occupational Noise $L_{EX,8h}$	87
Occupational Noise L_{Cpico}	140

10.2.2.8.1. Sampling Locations and Frequency

The sampling points and frequency must be defined based on the schedule of construction activities, the risk identification and assessment matrix and safety monitoring carried out by the safety technician of the contract. Notwithstanding the foregoing, the following construction activities and jobs must be monitored:

- Deforestation, cleaning and pickling activities;
- Excavation, landfill and earthworks activities;
- Aggregate extraction activity (sand pits, deposits and quarries);

- Crushing activity in jobsites and work fronts (mobile crusher);
- Concrete and bituminous concrete plants;
- Noisier technical areas of the jobsites (eg, where the generators are installed, etc.).

10.2.2.9. Waste Management Plan

During the project, the Waste Management Plan must be implemented in accordance with the provisions of Presidential Decree no. 22 January referring to the Construction and Demolition Waste Management Legal Regime.

It is proposed to monitor the amount of waste produced on a monthly basis and forward it to its final destination. This control should be carried out in order to provide for the implementation of reduction measures and selection of alternative treatments to deposition, namely internal reuse, or even the recovery of the waste produced.

It is important to mention that according to Point 5 of Article 19 of Presidential Decree no. 190/12 of 24 August, waste manifests must be stored for a period of five years.

10.2.2.10. Decommissioning Plan for Jobsites, Support Centers and Biophysical Recovery of Areas Affected by the Contract

The deactivation plan for the jobsites and infrastructure supporting the contract (crushing plant, concrete and bituminous concrete, etc.) is designed to outline the deactivation process of existing temporary construction structures in the areas allocated to the project's worksites, as well as referring to the compensatory measures provided for in the execution project, both for land exploited and for accesses affected within the scope of the current construction model. For this, it is essential to define which structures will be decommissioned, describe the dismantling operations, as well as identify the waste resulting from these activities and their final destination. At the same time, the Biophysical Recovery Plan, applicable to the entire area of intervention of the Contract, where direct or indirect effects on the environment may have occurred, aims to guarantee the restoration of the initial conditions of the land, whenever they have been affected by construction activities, namely, sand pits, deposits, quarries, temporary deposits of materials, among others. Thus, the measures related to the demobilization and/or improvement activities will be part of the plan, as well as the respective mode of execution as a result of the end of the contract, and with the aim of adding value to the road infrastructure, enhancing the purposes for the which it was carried out, and minimizing the environmental impacts that result from its installation, seeking integration in the surroundings and in the local socio-economic framework.

The interventions to be carried out for the biophysical and landscape integration of the project, aim to:

- Promote the landscape recovery of all affected areas as a result of the implementation of the contract, namely the construction site and accesses with the aim of restoring, as far as possible, their topography, productive capacity and vegetation cover;
- Guarantee the storage of soil from pickling in areas previously defined for this purpose, in order to maintain its structure and balance. These lands will later be used in the recovery and biophysical integration of the affected areas;
- Limit the circulation areas around the Project as much as possible in order to avoid the compaction of the neighboring lands;
- Promote the restoration of a balanced and sustainable landscape, integrated into its surroundings;
- Promote the cleaning and recovery of the work area after the construction phase;
- Promote the dismantling of all support structures, with the removal of all leftover materials and replacement of the original situation, prior to its execution.

10.3. Estimative of Cost and Indicative Budget of Implementation of the ESIA

The implementation of the ESIA involves the mobilization of human and material resources for the implementation of the proposed measures to minimize the identified environmental impacts, as well as the environmental and social monitoring of the work in the various phases of the project.

The cost of mitigation or compensation measures depends on the impact generated. Benefit-cost analysis is a new tool in environmental economics, designed to assess relatively realistic environmental costs. These costs of environmental protection measures are estimated at between 1 to 5% of investment costs (Hydro Quebec, 1990).

XI.

PARTICIPATION AND PUBLIC CONSULTATION

Resurb
Ambiente, Lda

Augusto Cury

Everyone wants the scent of flowers, but few dirty their hands to cultivate them.

11. PARTICIPATION AND PUBLIC CONSULTATION

Stakeholder consultation and engagement is based on an inclusive and participatory approach carried out throughout the project cycle, with the aim of building around stakeholders effective and efficient buy-in and engagement for risk assessment and management and environmental and social impacts of the project.

As part of the preparation of the project's public consultations with stakeholders, they should be informed on the one hand of the project's activities, objective and expected results, potential impacts and expected mitigation measures and, on the other, collect concerns, needs and expectations stakeholders before it in order to define additional mitigating and/or compensatory measures for the various phases of the project, if necessary.

The relevant consultation process is also intended to provide the opportunity for stakeholders to express their views on risks, impacts and mitigation measures, enabling them to respond to them.

Relevant consultation is a two-way process that begins at the early stage of the planning process, during project preparation, to receive initial input on the project proposal and inform project design and continues uninterruptedly during project implementation and external dissemination.

It should be noted that according to Presidential Decree No. 117/20 of 22 April, Article 16, projects subject to Environmental Impact Assessment are obligatorily subject to public consultations promoted by the Ministerial Department responsible for the environment sector (Ministry of Culture, Tourism and Environment). After scheduling the Public Consultation activities by the competent entity, the Owner/Project Promoter must disclose the Non-Technical Summary of the Environmental and Social Impact Assessment and assess the exposures and complaints that are presented and relate to the project, if exist.

The public participation process is an intrinsic component of the process and has the following main objectives:

- Inform people about the project;
- Collection of concerns and interests expressed by the population;
- Obtain stakeholder input/opinion in terms of avoiding/minimizing possible negative impacts and maximizing the project's positive impacts;
- Finally, support social dialogue and identify, from the beginning, perceptions and expectations of stakeholders, which can contribute to the planning of actions and

effective communication in order to minimize the project's impacts. The process also allows you to rethink the technical aspects of the project.

In this regard, a Stakeholder Engagement Plan for the Project was prepared in order to ensure an open and transparent stakeholder engagement process.

The Stakeholder Engagement Plan applies to all projects financed by the IFC. The project proponent will consult with stakeholders as a key part of the environmental and social assessment and project implementation process.

The main objectives of the Stakeholder Engagement Plan are:

- Establish a systematic stakeholder engagement strategy that will help the Proponent/Project Team to create and maintain a constructive relationship with stakeholders and, in particular, those affected by the project;
- Assess the level of stakeholder interest and support for the project and allow their views to be considered in project design and environmental and social performance;
- Promote and provide means for effective and inclusive engagement of project affected parties throughout the project lifecycle on issues that could affect them;
- Ensure that appropriate information on the project's environmental and social risks and impacts is disseminated to stakeholders in a timely, accessible, understandable and appropriate manner;
- Ensure that project affected communities have accessible and inclusive means to raise issues and grievances and allow the Proponent/Project Team to respond and manage such issues and grievances.

11.1. Relevant Consultations – Project Preparation Phase

During the project preparation phase and based on the strategies defined in the Stakeholder Engagement Plan for the three defined groups (potential stakeholders, likely to be affected by the project and disadvantaged or vulnerable individuals or groups) several visits were made to the areas of influence of the project in order to present and collect contacts and authorization requests from Municipal Administrations, *Sobas* and/or neighborhood representatives to carry out surveys to the local community, within the scope of the public consultation process.

The following table (*see* **Table 72**) shows the number of surveys carried out by Commune in order to obtain a representative sample of the population and to carry out a comprehensive and participatory approach.

Table 72 – Number of inquiries carried out within the scope of the Public Consultation, distributed by Commune

MUNICIPALITY	COMMUNE	NO. OF INQUIRIES
Alto Zambeze	Cazombo	28
	Lumbala Caquengue	16
	Nana Candungo	150
	REPRESENTATIVE SAMPLE	**194**

The following figure (*see* **Figure 237**) shows the location of the places where the group and individual consultation sessions were carried out.

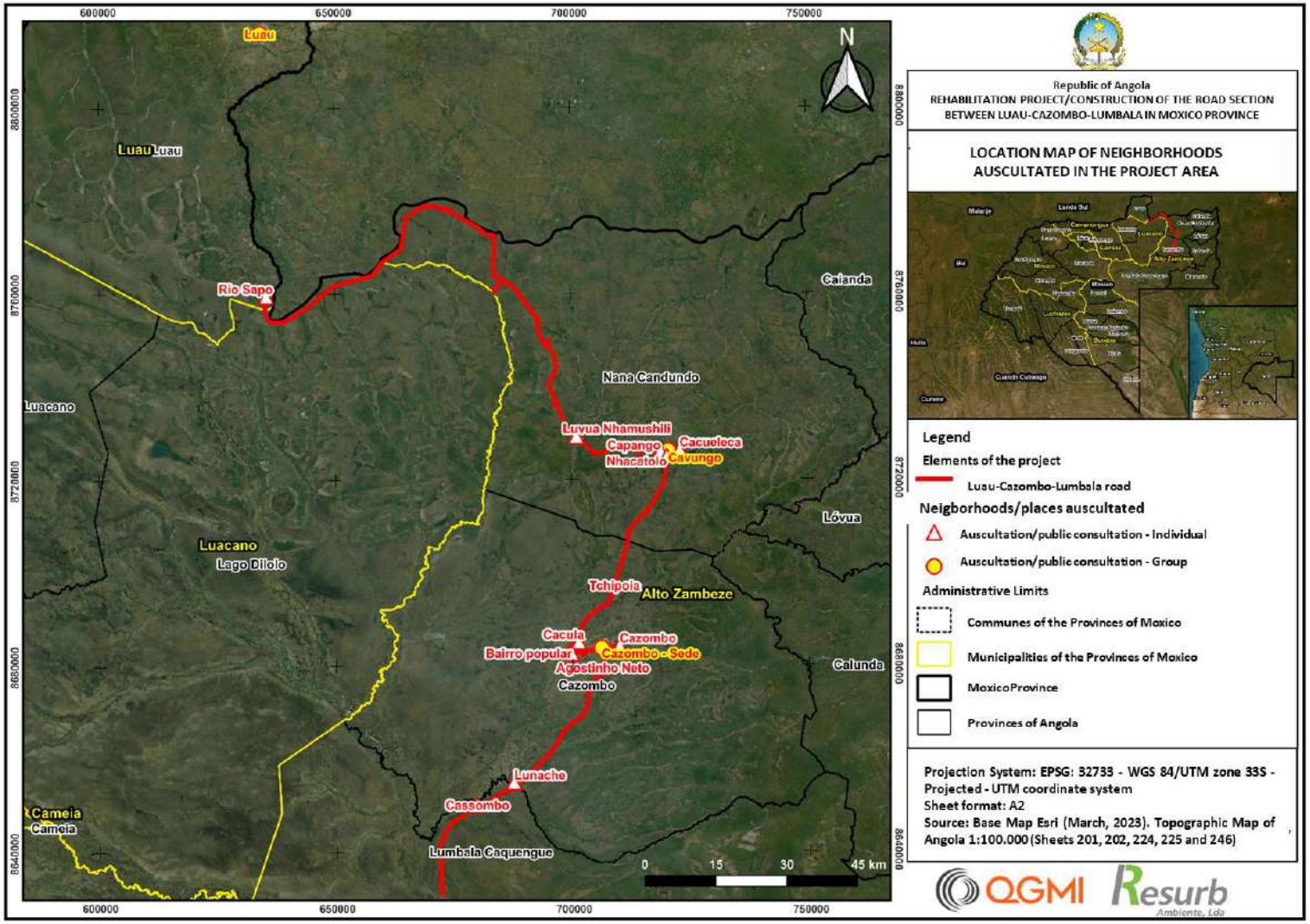


Figure 237 - Location of the places where the group and individual consultation sessions were carried out.

The relevant consultation process carried out in the project preparation phase made it possible to verify that many of the activities planned under the project met the needs and expectations of the stakeholders that were present in the public consultation sessions. Below is a summary of the requirements (needs and expectations) referred to by the stakeholders during the consultation and consultation process:

- have access to water in homes and collective water points (community fountains and tanks);
- have access to the electricity grid;
- rehabilitation of the telecommunications network;
- job creation;
- improvements/rehabilitation of access roads, with emphasis on those that are unpaved;
- the rehabilitation of health, education and service infrastructures;
- the provision of food;
- proper waste management in municipalities.

It should be noted that all the information obtained during the public consultation process was also taken into account for the definition of mitigation and compensation measures presented in the Project's Environmental and Social Management Plan.

With regard to the benefits and/or improvements that they considered the project could bring, “employability” (39%) “stimulation of economic activities” (16%) and “improvement of quality of life” (45%) stand out.

It is thus concluded that no objections were raised to the project preparation phase, thus meeting all the conditions to carry out an environmental and social impact assessment, considering it to be an excellent starting point for the entire process of participation and involvement of the Stakeholders and successful implementation of the project.

In order to demonstrate the performance of public consultations, **Annex XIV** presents the attendance record of the people consulted within the scope of the Public Consultation process. Additionally, the following figures present a photographic record of the survey activities, surveys and project presentation (*see* **Figures 238** to **247**).

Annex XV presents the leaflet prepared for the presentation of the project within the scope of the consultation process, participation and public consultation of the project.

Figure 238 – Photographic record of the consultation and participation session held at the Municipal Administration of Luau.

Figure 239 – Photographic record of the consultation and participation session held at the Municipal Administration of Alto Zambeze - Cassombo.

Figure 240 – Photographic record of the consultation, consultation and participation session carried out in the Communal Administration of the Cavungo – Alto Zambeze.

Figure 241 – Photographic record of the consultation, consultation and group participation session held at the Communal Headquarters of Cavungo.

Figure 242 – Photographic record of the listening, consultation and group participation session held in Neighborhood Lunachi, Cazombo, Alto Zambeze.

Figure 243 – Photographic record of the listening session, consultation and group participation held in the Commune of Nana Candungo, Alto Zambeze.

Figure 244 – Photographic extract of the listening, consultation and individual participation sessions carried out in the Communes in the area of direct influence of the project.

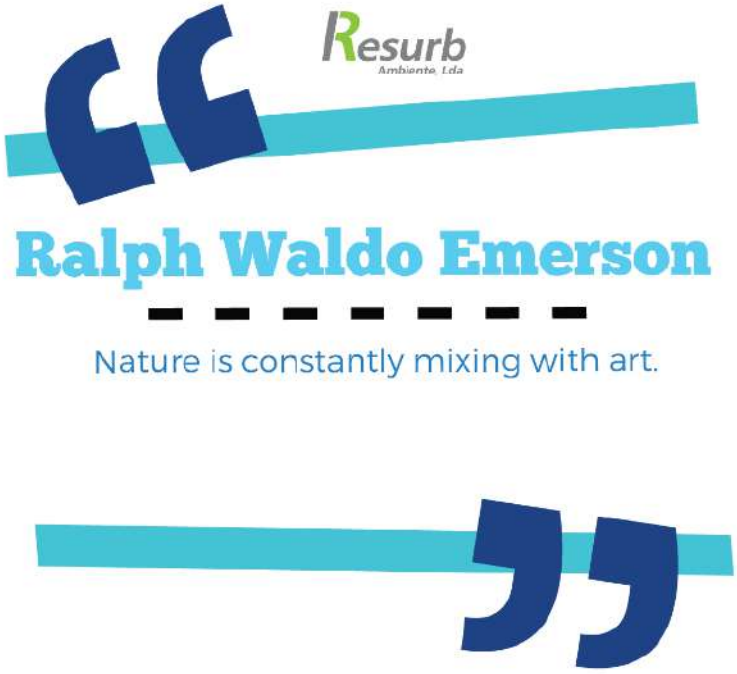
Figure 245 – Photographic extract of the listening, consultation and individual participation sessions carried out in the Communes in the area of direct influence of the project.

Figure 246 – Photographic extract of the listening, consultation and individual participation sessions carried out in the Communes in the area of direct influence of the project.

Figure 247 – Photographic extract of the listening, consultation and individual participation sessions carried out in the Communes in the area of direct influence of the project.

XII.

MANAGEMENT OF COMPLAINTS AND GRIEVANCES


Resurb
Ambiente, Lda
Ralph Waldo Emerson
Nature is constantly mixing with art.

12. MANAGEMENT OF COMPLAINTS AND GRIEVANCES

The project has a Complaints Management Policy, which is why it will establish and maintain a Complaints and Grievances Management Procedure (PGQR) open to all stakeholders. This procedure meets IFC requirements and will be established from the early stages of the project and maintained throughout the project lifecycle. The aim is to provide a fair and responsive system for recording and handling any complaints and/or grievances related to the project. For this purpose it will be written in the national language.

One of its main objectives is to avoid resorting to the judicial system and to seek an amicable solution in as many situations as possible, thus preserving the interests of the complainants and the Project and limiting the risks, inevitably, associated with legal action.

12.1. Key Principles

People who wish to file a complaint or raise a concern will only do so if they are confident that the complaints will be handled in a timely, fair and safe manner for themselves or others. The fear of reprisal (the act of taking revenge on a person who has made a complaint) is often feared among complainants.

To ensure that a grievance system is efficient, reliable and operational, some basic principles must be observed:

- **Participation:** The success and effectiveness of the system will only be ensured if it is developed with a strong participation of representatives from all stakeholder groups and if it is fully integrated into the project activities. Beneficiaries, or affected groups, must participate in all stages of the process;
- **Context and relevance:** Any grievance management system development process must be localized to be adapted to the local context, in accordance with local governance structures and within the specific framework of the implemented programme. It is reiterated that it can only be achieved if the procedure is designed in a participatory manner in consultation with stakeholders;
- **Safety:** To ensure that people are protected and that they can file a complaint or express a safety concern, it is necessary to carefully assess the potential risks for different stakeholders and integrate them into the design of a CGMP. It is also essential to guarantee the safety of those who use the procedure to guarantee its reliability and efficiency;

- **Confidentiality:** To create an environment where stakeholders can easily raise concerns, have confidence in the procedure and be assured that there will be no retaliation, confidential procedures must be guaranteed. Confidentiality helps ensure the safety and protection of people who file a complaint, as well as their targets. This requires limiting the number of people with access to confidential information;
- **Transparency:** Stakeholders should be clearly informed of the process to follow to gain access to the PGQR and the various procedures that will follow once they do so. It is important that the purpose and function of the procedure be communicated in a transparent manner;
- **Accessibility:** It is essential that the procedure is accessible (easy reference from a system and language point of view) to as many people as possible from different stakeholder groups; especially those who are often excluded or who are the most marginalized or vulnerable. When the risk of deletion is high, special attention should be paid to secure mechanisms that do not require reading and writing.

12.2. Complaints and Grievances Management Procedure

The project handles complaints and requests received by the means summarized below:

- An online service to provide stakeholder feedback on the project;
- A dedicated telephone number that allows contact with the team designated by the Project Coordinator;
- An e-mail;
- An information pamphlet on the public grievance procedure (accompanied by a grievance form);
- Other means, in particular through suggestion boxes installed in strategic locations (Faculty, NGOs, Environmental and Social Associations, etc.).

All complaints and grievances received will be recorded on a dedicated complaints form to assign an individual reference number.

The complaints register is also used to track the progress of the process, analyze the frequency of complaints, their geographic distribution, typical sources and causes of complaints, as well as to identify dominant themes and recurring trends.

The complaints register will contain the following information:

- The unique reference number;

- The date of the complaint received;
- Where the complaint was received/submitted and in what form;
- The name and contact details of the complainant (in the case of non-anonymous investigations and complaints);
- The content;
- Identification of the parties responsible for the treatment and solution of the problem;
- The opening and completion dates for the handling of the complaint;
- The conclusions of the treatment;
- Information on the proposed corrective actions to be sent to the complainant (unless they are anonymous) and the date of the reply sent regarding the corrective measures;
- Deadlines for internal actions required of project staff;
- Indication of whether a statement of satisfaction has been received from the person filing the complaint (complainant), or whether there is a reason not to resolve the complaint;
- The closing date of the complaint;
- All pending actions for unresolved grievances.

The project will appoint a responsible team to collect and record requests/complaints, maintain the complaints register, coordinate responses and manage the problem-solving process. The project should ensure adequate training for employees on the management of complaints in order to ensure the good performance of the process.

During public consultations, an information flyer on the Complaints and Grievances Management Procedure should be distributed in the local language.

When a solution to the identified problem cannot be provided within the allotted time period, the designated project team will notify the complainant.

The project will ensure that the complainant's name and contact details are not disclosed without their consent and that only the team working directly on the complaint will have access to all information deemed confidential.

In cases where the processing of a complaint requires the transmission of all or part of the information to the bodies named in the following sections for resolution, the complainant's consent to its disclosure will be sought as appropriate.

The availability of the public grievance procedure will not prevent complainants from seeking other legal remedies in accordance with applicable laws and regulations in Angola.

The grievance procedure will be operational after the public disclosure of this CGMP.

12.3. Main Steps of the Procedure

The complaints and grievances management procedure can be summarized in the following steps, starting with the registration of the complaint or complaint and filing the resolution or complaint file:

1) Reception and Registration of the complaint or grievance;
2) Analysis of the complaint;
3) Investigation of the basis of the complaint;
4) Response proposal;
5) Review of the response in situations where there is no immediate resolution;
6) Implementation of corrective measures;
7) Closing the complaint;
8) Communication;
9) Archive.

It should be noted that each stage must be limited to a maximum of 15 days/two weeks from the receipt of a complaint/grievance until the decision is taken.

It is strongly recommended that all necessary steps be taken to ensure that solutions are adopted by consensus based on negotiation and agreement.

Detailed procedures for handling complaints and for the appeals process should be disseminated among Project Affected People, who should be trained to use them when they deem it appropriate.

The procedures must be disseminated during all phases of the ESIA and ESMP.

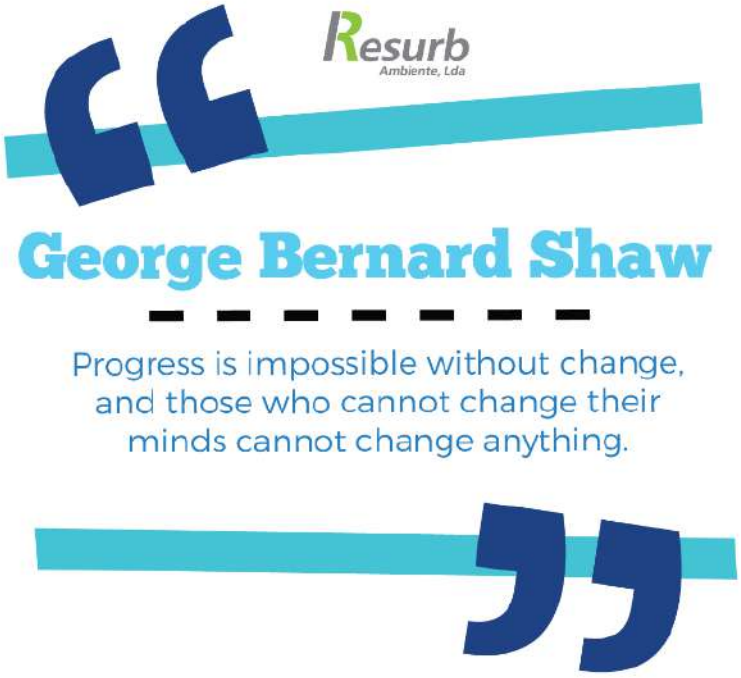
Throughout the project, this process should be monitored by the appointed team and periodic internal reports on complaints/comments should be prepared for the Project Coordinator/Team, including the following information:

- Number of Complaints/Comments received;
- Compliance with operational standards;

- Problems raised by complaints/comments;
- Causes of complaints/comments;
- Justification of corrective measures;
- Effectively agreed repairs;
- Recommendations/strategies to prevent or limit recurrence.

XIII.

INFORMATION GAPS


Resurb
Ambiente, Lda
George Bernard Shaw
Progress is impossible without change,
and those who cannot change their
minds cannot change anything.

13. INFORMATION GAPS

In general terms, the main difficulties that the Team faced in preparing the Environmental and Social Impact Assessment of the project "Contract for the Rehabilitation of Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo", should be to the absence of bibliographic elements of specific regulations for some socio-environmental descriptors.

Given the specificities of each descriptor, the gaps identified in each of them are presented below.

During the elaboration of the Biodiversity and Ecological Factors descriptor, some technical and knowledge gaps were identified that do not condition the environmental assessment of the implementation of this project, are considered worthy of reference and which are listed below:

- Scarce information on faunal and floristic species;
- Outdated phytogeographic maps;
- In terms of fauna, a basic characterization of population trends is also necessary, as well as a survey of the constituent species of the different groups. It should be noted that there is practically no national data on species of reptiles, amphibians, bats and non-flying micromammals.

Finally, the absence of a robust legal framework in terms of measures for the management of species and habitats with conservation relevance is highlighted.

In the descriptor Land Use and Territorial Planning, the lack of access to the Municipal Master Plan of the Municipalities directly affected by the project is highlighted.

In the descriptors of Water Quality, Noise and Air Quality, it refers to the lack of reference data, updated and available, for the areas of influence of the project, having been carried out environmental monitoring and surveys to fill these gaps.

In the Cultural Heritage descriptor, the information gaps stem from the constraints of field prospecting, associated with the state of the soil, visibility and those inherent to the very nature of the archaeological heritage, whose presence and importance is not always perceptible from the surface remains at the level of the soil or in an aquatic environment. Thus, only with the implementation of the excavation and opening of trenches it will be possible to have access to information that is now inaccessible.

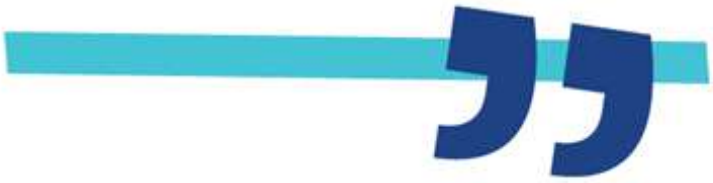
During the elaboration of the Socio-Economy descriptor, some information gaps were identified, at the local level, making it difficult to characterize and analyze population dynamics. Surveys were carried out as part of the process of participation, consultation and public consultation with the population to mitigate the lack of information at a more local level. At the same time, reference is made to the lack of available data on the registration of existing networks in the area directly affected by the project, as well as the unavailability of technical information inherent to the integration of the water supply system networks for the Republic of Angola.

The data presented in this Environmental and Social Impact Assessment reflect the surveys carried out and complemented with some available information, although not always updated.

XIV.

CONCLUSIONS

"If you work hard and are persistent, you will get what you want."



14. CONCLUSIONS

According to the studies carried out, bibliographical research and analysis of reference documents/data, socio-environmental monitoring and technical field work, including relevant data obtained during the process of auscultation and public consultation with stakeholders, as well as the framework of the project in relation to the applicable legal and international requirements and Project Management Policies and respective predicted mitigation measures, it was possible to establish a set of conclusions that are indicated below.

The Project under analysis, in this report, concerns the rehabilitation of the section of roads EC 192/EN 250/EC 254/EC 385 that integrates the roads that develop between Luau and Cazombo, in the Province of Moxico, which is a structural road section, since it will allow the road connection between the municipal headquarters and the circulation in the aforementioned section, which currently, due to the bad conditions, also aggravated by the rainy season, has favored the vulnerability of the surrounding Municipalities, since the non-existence and/or deterioration of the road section, which makes road traffic in safe conditions impossible, favors the isolation of the population and delays the socio-economic development of the region, since it prevents the free movement of people and goods and the socio-economic dynamism of the Province, thus it is considered that the project itself is already a compensatory measure.

The objective of the environmental and social assessment carried out was to identify the environmental and social implications associated with the project's road rehabilitation, with a length of 246 km and which will include the rehabilitation/construction of the bridges. The environmental and social assessment of the project covered the entire life cycle of the project (construction, exploration and deactivation phase) and also focused on preventing the main risks and environmental and socio-economic impacts. Given that the project concerns road rehabilitation, alternatives were not considered, and the environmental and social impact assessment carried out in the present study was carried out by comparing it with alternative zero (h0), which refers to non-implementation of the project.

The present Environmental and Social Impact Assessment (ESIA) considered the structure defined in the National Legislation, as well as the international requirements, namely those defined by the Equator Principles, the Performance Standards of the International Finance Corporation (IFC) and EHS Guidelines, since Angola is a Non-Designated Country. Also noteworthy is the fact that the project intends to comply with International Conventions and Good Practices, namely, the Human Rights Convention, the International Convention for Labor

Organization (ILO), Environmental, Health and Safety Guidelines (EHS Guidelines) and Measures defined in the National Strategy for Adaptation to Climate Change. From the comparative analysis carried out, between the national legal requirements and the Bank's international requirements, there is a harmonization with regard to the risk categorization of the project, since both the National Environmental Legislation and the IFC international standards and the Equator Principles frame the "Contract for the Rehabilitation of Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo" project as Risk Category B, that is, of moderate environmental and social risk. The risk categorization was mainly supported by the fact that the project under analysis:

- be related to the rehabilitation of an existing road section that runs between Luau and Cazombo, which is why it is not foreseen, to date, the need to carry out any physical and/or economic resettlement since the area of project intervention will be restricted to the road easement area;
- and its route does not cross any place considered as critical natural habitat, namely, that which is legally protected; officially proposed to be protected; and unprotected, but with high environmental value (whether according to the national and/or international IUCN classification) and because the approach to ecosystem services concludes that the project does not foresee that the project will affect priority services;
- not affect indigenous people. When characterizing the socio-environmental reference situation of the project and the consultation and consultation process with the local community, RESURB identified the presence of ethnic groups in the areas of influence of the project, however the respective communities that speak some dialects/mother tongues also speak the official language (Portuguese) and do not identify themselves as belonging to a distinct indigenous cultural group and are recognized as such. At the same time, they are fully integrated into society;
- and the potential negative impacts and socio-environmental risks identified and evaluated are, reduced in number, generally local, largely reversible and mitigated.

For this purpose, for the studies of the physical, biotic and social environment, different areas of influence of the project were defined, namely the Directly Affected Area (DAA) the Direct Influence Area of the Project (DIA) and the Indirect Influence Area (IIA). The DAA corresponds to the area where the rehabilitation activities of the road section, including bridges, will be carried out; the DIA for the studies of the physical environment and the biotic environment,

was defined as a radius of 1.000 m around the DAA since this will be the area where the impacts generated during the construction, exploration and deactivation period are expected to be directly felt of the project. The DIA for the socioeconomic component was defined taking into account the relevance that the project will have in the surrounding community, namely the Municipalities of Luau, Luacano and Alto Zambeze, as the road project will cross these three Municipalities and will contribute to local socioeconomic dynamism; finally, the IIA was defined for studies of the physical and biotic environment, as the area corresponding to a radius of 3 km around the DIA. With regard to the socio-economic environment, the Province of Moxico was considered as an IIA, since it will be the one that will benefit most from this project, since it will allow the creation of road corridors in the Province.

The characterization of the reference situation made it possible to verify the socioeconomic importance of the implementation of the project under analysis in this ESIA, since, with regard to accessibility, there are several isolated and vulnerable Communes in view of the high state of degradation of the road section and whose some bridges are destroyed and impassable. The Province of Moxico is a region that lives essentially from trade and the provision of services, based on the Province's vulnerability to agriculture, which is why road rehabilitation is a structural and priority for the Province. In a more environmental component, it was found that the project implementation area is characterized by meadows, savannahs, bushy savannahs and tropical and subtropical forests, typical of the Angolan Miombo Forest and Central Zambezian ecoregions and is not part of any conservation or area of high ecological interest. There were also some sources of pollution, essentially of anthropogenic origin, as a result of the lack of sanitation and water supply infrastructure networks (100% of the sampled population reported that there is no type of water supply and sanitation network) and deficient management of urban waste, which lead the local community to carry out bad environmental practices. Of the population sampled, it was recorded that 29% deposited waste on the ground due to the non-existence and/or poor functioning of the waste collection and management system in the Province of Moxico, 42% stated that they set fires to control and treat the waste produced and the remaining 36% declared sometimes burying waste. With regard to waste management, all interviewees stated that there was no municipal collection of waste in their Municipality/Commune.

In order to complement the collection of primary data, in order to carry out the assessment of the project's environmental impact, and given the absence of reference values for pollutant emissions as well as reference environmental characterizations for the project implementation area, Several *in situ* monitoring points were carried out (4 environmental noise monitoring

points including road traffic counts, 4 air quality monitoring points, biophysical factors (DAA and DIA) and 8 water resources monitoring points). The results of the monitoring carried out are in line with the characterization of the socio-environmental reference situation, since, although, as mentioned above, Resurb's technical team has identified some sources of pollution of anthropogenic origin, the parameters of water quality, air and noise fully comply with the reference limit values considered as an indication, namely the WHO reference values, Directive 2019/130 and EHS Guidelines, since, on the other hand, the current state of degradation of the road section also does not allow for a greater dynamism and fixation of economic activities in the region, that eventually, could reflect negatively on the results of monitoring carried out during the month of January 2023.

In order to carry out the Assessment of Social and Environmental Impacts, Public Consultations were also carried out and surveys carried out *in loco* with the local community in the Communes of Cazombo, Lumbala Caquengue and Nana Candungo. Regarding the question referring to the benefits and/or improvements that they considered the project could bring, the highlights were "employability" (39%) "stimulation of economic activities" (16%) and "improvement in the quality of life" (45%). The three biggest needs mentioned by the stakeholders were access to drinking water, electricity and telecommunications (59%), the rehabilitation of transport infrastructure (roads and bridges) (24%) and the rehabilitation of service infrastructure (schools, hospitals/health centers, bank branches) (18%).

It was concluded that this project with compensatory nature for the local population is much awaited by the community since the population hopes to obtain an improvement in accessibility conditions with the consequent development of socio-economic activities and an improvement in the quality of life. During the process of participation, auscultation and public consultation in the preparation phase of the project, no objections were raised by the various stakeholders consulted. As part of this process, 194 stakeholders were interviewed during the project preparation phase and 6 group sessions were also held to present the Project, the Stakeholder Engagement Plan, publicize the complaints and grievances management mechanism, Project Management Policies and socio-environmental impact assessment procedure.

In terms of socio-environmental risks identified for the project, these are generally associated with emergency and accident/incident scenarios and may, eventually, be inherent to existing constraints on the site, materials applied with special risks, equipment installed with risk in use, conservation and maintenance, maintenance of infrastructures and equipment, works

whose access and circulation present risks, transport of materials/equipment, poor storage/treatment of domestic and industrial wastewater, infrastructural and technological risks, intentional acts/malvolence, technical failure or human life, biological hazards and natural hazards. The Risk Management Plan identifies, for each accident scenario, the danger, risks and respective prevention control measures - pre-accident scenario and control measures - post-accident scenario, where the means available for minimizing these same are described risks, allowing effective risk management.

With regard to the negative impacts identified for the construction phase, the following stand out:

- Pollution and disturbance associated with carrying out the works, namely the carrying out of earthworks, paving and rehabilitation of works of art (bridges), although globally with reduced expression;
- Disturbance due to the existence of jobsites, concrete plants, bituminous concrete and crushing, work accesses and areas for depositing excess land;
- Disturbance of the environmental noise surrounding the road section, inherent to construction activities, support infrastructures for the work and movement of heavy vehicles and machinery.

It should also be noted that these negative impacts can be prevented, avoided or mitigated through the adoption of control and socio-environmental management measures recommended in the Environmental and Social Management Plan of the ESIA, which are included in the Mitigation, Compensation and Socio-environmental Improvement Program and the Monitoring Program and Social and Environmental Monitoring, the following Plans:

- Socio-environmental monitoring and implementation of a socio-environmental management system;
- Security Monitoring;
- Water Monitoring Plan for Human Consumption;
- Waste Water Monitoring Plan;
- Soil Monitoring Plan;
- Air Quality Monitoring Plan;
- Environmental Noise and Occupational Noise Monitoring Plan;

- Waste Management Plan;
- Decommissioning Plan for Jobsites, Support Centers and Biophysical Recovery of Affected Areas.

With regard to positive socio-environmental impacts, the following stand out:

- Improved accessibility at local and regional level, and increased internal cohesion, particularly in the Moxico region;
- Improvement in the level of service and, consequently, a reduction in travel times and average costs, benefiting the economic context of families and bringing people together, as well as economic activities;
- Increased convenience, speed and safety in circulation, promoting accessibility and consequent attractiveness of the surrounding area for the settlement of population and industrial/commercial units.

In this way, the completion of the project will contribute to improving the quality of life in the surrounding area of Luau-Cazombo-Lumbala Caquengue.

In all the factors of socio-environmental interest, the cumulative impacts foreseen in the construction, exploration and deactivation phases of the project were also evaluated in order to carry out an integrated analysis of the impacts, having been concluded that for most of the impacts identified there is cumulative of the same. Of particular note in this context is the planned implementation of various socio-economic development projects for the Province of Moxico in accordance with the various National Strategic Policies of the Republic of Angola in progress.

In summary, according to the assessment carried out, no impacts were identified that would make the implementation of the project unfeasible, socially and environmentally. It should be noted that without the rehabilitation of the project (hypothesis of non-implementation of the project), there would most likely be a lack of socio-economic dynamism in the region, isolation and/or exodus from the community, an increase in road accidents, as well as the growing aggravation of the vulnerability of isolated stakeholders and the quality of life of the population. It should also be noted that the implementation of the project could have positive effects related to reducing the risk of road accidents, favoring social inclusion and boosting the socio-economic activities inherent to the free movement of goods and people that, eventually, will result from the road rehabilitation of road EC 192 /EN 250/EC 254/EC 385 between Luau and Cazombo.

XV.

GLOSSARY

Resurb
Ambiente, Lda

Oscar Wilde

It seems to me that we all look at Nature too much, and live with her too little

15. GLOSSARY

ABIOTICAL – A place or process without living beings. Characterized by the absence of life.

ANTHROPIC – Result of human activities in the environment.

AQUIFERUM - Formation or group of geological formations that can store groundwater.

ARCHEOLOGICAL HERITAGE - It consists of all traces, goods and other signs of the evolution of the planet, life and human beings.

AVIFAUNA – Set of bird species found in a given area.

BIOME - Biome is a biogeographic unit characterized according to the macroclimate, the phytophysiognomy (aspect of the vegetation of a place), the soil and altitude, as well as the origin of animal species.

CHIMPACA - Chimpaca is the term used in southern Angola to refer to ponds built to store water for use in irrigation and/or animal drinking fountains.

CULTURAL HERITAGE - It encompasses the built, archaeological, architectural and ethnographic heritage.

CUMULATIVE IMPACTS – They result from the project in association with the presence of other projects, existing or planned, as well as the associated projects.

DRAINAGE AREA - Area of a watershed, or contributing area, in which water runoff contributes to a given section.

DRILLING - Study carried out in a field through drilling, verifying its geological nature, groundwater level, among other situations.

EMBANKMENT - A rise in the level of a terrain, naturally or artificially.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) - Document containing a description of the project, identification and assessment of positive and negative environmental impacts, the foreseeable evolution of the situation without the project being carried out, the environmental management measures to avoid, minimize or offset negative impacts, the project follow-up plan and the Non-Technical Summary of this information.

ENVIRONMENTAL IMPACT - Set of favourable and unfavourable changes produced in environmental and social parameters, in a certain period of time and in a certain area, resulting from the realization of a project, compared with the situation that would occur, in that period of time and in that area, if that project did not take place.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) – Environmental policy instrument based on studies, consultations and public participation.

EVOTRANSPIRATION - Loss of water to the atmosphere by evaporation from the soil and by transpiration from plants.

GROUNDWATER - All water that is below the surface of the ground, in the saturated zone, and in direct contact with the ground or subsoil.

INDIGENOUS (OR AUTOCHTON) SPECIES - Designation attributed to species that inhabit their territory of origin. This term is synonymous with indigenous or native and is applicable to both plant and animal species.

INLAND WATER - All lentic or lotic (current) surface waters and all groundwater that are on the land side of the baseline from which territorial waters are marked.

JOBSITE - Designation of the place where machines, tools and materials are stored, where preparatory work is carried out, where personnel and work support services are found.

KYOTO PROTOCOL - The Kyoto Protocol is an international legal treaty that explicitly intends to limit the quantified emissions of greenhouse gases from developed countries, according to most scientific investigations, as causes of global warming. Through the protocol, a timetable was created by which developed countries commit to reducing the emission of greenhouse gases by at least 5.2% compared to 1990 levels, in the period between 2008 and 2012.

MITIGATION MEASURES - Mitigation measures include mitigation measures and compensation measures.

MONITORING - Process of observation and systematic collection of data on the state of the environment or on the environmental effects of a given project and periodic description of these effects through reports, under the responsibility of the promoter, with the aim of allowing the evaluation of the effectiveness of the planned measures in the EIA procedure to avoid, minimize or compensate for significant environmental impacts resulting from the execution of the respective project.

MONITORING PLAN - Set of Monitoring Programs applicable to a given infrastructure.

NON-TECHNICAL SUMMARY (NTS) - Simplified document, which will support public participation and which, as such, should describe, in a language accessible to the general public and in a synthetic way, the information contained in the ESIA.

OWNER OF WORK – The person or collective entity, which we call the promoter, who owns the investment and provides the execution of the projects. It is the entity with its own responsibility and that must challenge so that the entire process develops within the legal framework.

PARGA **-** Place where the soil from the stripping of the land is stored.

PERFORMING/EXECUTING ENTITY – Any company contracted by the promoter to carry out all or part of the work, in accordance with the approved project and the applicable legal or regulatory provisions.

PLAN - Drawing to a certain scale that represents the horizontal section of a building, or of a land.

PROJECT - In the context of the elaboration of ESIA and the EIA procedure, it is understood in a broad sense, that is, covering the design, construction and operation.

PROPONENT - Individual or legal person, public or private, that formulates a request for authorization or licensing of a project and that corresponds to the infrastructure promoter, being responsible for triggering the process, for the elaboration of the ESIA (the material support of the EIA procedure) and forwarding it to the competent authorities; in most cases, the tenderer contracts the preparation of the ESIA to external consultants.

PUBLIC CONSULTATION - Form of public participation aimed at collecting opinions, suggestions and other contributions from the interested public on each project subject to EIA.

RAIN WATER - That which comes immediately from the rains.

RURAL AREA - Area of the Municipality from which urban areas are excluded, where rural activities are predominantly developed.

SAMPLE – Taking small parts (samples) to represent the properties of a set or whole.

SCALE - Relationship between distances or dimensions, represented on a plan or map, and their dimensions in reality. When this relationship is presented in numerical values it is called a numerical scale, when the relationship is presented by a line segment on which a comparison is made with reality, it is called a graphic scale; There is also a scale ruler, which is a graduated ruler with several scales for reading drawings.

SENSITIVE RECEIVER - Housing, school, hospital or similar building or leisure space for human use.

SPILL/DUMPING PLACE - Place where the rubble, residues and leftovers of land excavated in construction are leaked.

SURFACE WATER - Inland waters, with the exception of groundwater, transitional waters, coastal waters, including territorial waters in this category, with regard to chemical status.

THERMAL RANGE - Difference between the average of maximum temperatures and the average of minimum temperatures.

URBAN AREA - City itself, inhabited or urbanized, defined from all points of view, geographical, ecological, demographic, social, economic, etc., except the political-administrative.

WAREHOUSE - Place where materials are kept; reservoir.

WATER BASINS – A watershed or drainage basin of a watercourse is the area where, due to relief and geography, rainwater flows into a main river and its tributaries.

XVI.

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Ambiente, Lda
Barbara Ward
"We've forgotten how to be good guests,
how to walk lightly on earth like other
creatures do."

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XVII.

ANNEXES

Resurb
Ambiente, Lda

Jane Goodall

You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of difference you want to make.

17. ANNEXES

Annex I – Certificate of the consulting company – Resurb Ambiente Lda.;

Annex II – Stakeholder Engagement Plan;

Annex III – List of Equipment that will be used in the Construction Phase of the Project;

Annex IV – OP 02 Coexistence Rules_EN_Rev03;

Annex V - Environmental Monitoring Sheets – Water Resources;

Annex VI - Environmental Monitoring Sheets - Traffic Count;

Annex VII - Environmental Monitoring Sheets – Environmental Noise;

Annex VIII - Results of Environmental Monitoring - Characterization of the Environmental Noise;

Annex IX – Environmental Monitoring Sheets – Air Quality;

Annex X – Environmental Monitoring Sheets – Soils;

Annex XI – List of potential flora and fauna species in the Project's area of influence;

Annex XII – Photographic record of flora species identified in the Project's area of influence;

Annex XIII - Environmental and Social Impact Assessment Matrix;

Annex XIV - Record of the presence of the people auscultated in the scope of the Public Consultation process;

Annex XV - Brochure prepared for the presentation of the project in the scope of the process of auscultation, participation and public consultation of the project.

Anexo XVI - Project Management Policies;

Annex XVII - Approach to Ecosystem Services;

Annex XVIII – Register of existing aqueducts;

Annex XIX – Quarry Tests.

Annex I – Certificate of the consulting company – Resurb Ambiente Lda.

REPÚBLICA DE ANGOLA

MINISTÉRIO DA CULTURA, TURISMO E AMBIENTE

GABINETE JURÍDICO

CERTIFICADO DE CONSULTORIA AMBIENTAL

N.º 20816908221

O Gabinete Jurídico do Ministério da Cultura, Turismo e Ambiente, atesta que foram cumpridas todas as formalidades legais conducentes ao Registo Técnico da Sociedade de Consultoria Ambiental RESURB AMBIENTE LIMITADA, nos termos do Decreto Executivo nº 86/12, de 23 de Fevereiro de 2012, que aprova o Regulamento sobre o Registo Técnico de Sociedade de Consultoria Ambiental.

Emitida em,	**Válida até,**
08 de Setembro de 2022	08 de Setembro de 2023

Assinatura

DANIEL JOÃO JORGE

(DIRECTOR DO GABINETE JURÍDICO)

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Annex II – Stakeholder Engagement Plan

STAKEHOLDER ENGAGEMENT PLAN

CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

JANUARY 2023

Resurb
Ambiente, Lda

PROJECT DESIGNATION: CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

PROMOTING ENTITY: Angola Roads Institute – Ministry of Public Works, Urbanism and Housing

EXECUTING ENTITY: QG Konstruktion GmbH

CONSULTANT ENTITY: RESURB AMBIENTE, LDA.

(Company registered with the Ministry of Environment, as an Environmental Consultant, with Certificate No. 20816908221, valid until 08/09/2023)

Luanda, January 28, 2023

Elaborated:	**Aproved:**
Edite Machado	
Edite Machado (Technical Coordination - RESURB)	Patrícia de Castro Gonçalves (Manager) Resurb Ambiente, Lda.

INDEX

ANNEXES

Annex I – Summary report of public consultations;

Annex II – Questionnaire Template

1. INTRODUCTION

For the good performance of a project, it is essential to ensure an open and transparent stakeholder engagement process as it can improve the environmental and social sustainability of projects, improve acceptance and offer significant contributions to the effective design and implementation of the project. Consequently, the stakeholder engagement process must be an inclusive process carried out throughout the project life cycle.

When properly designed and implemented, it supports the development of strong, constructive and responsive relationships, which are important to the successful management of the project's environmental and social impacts. Stakeholder involvement is most effective when carried out early in the project development process, being a key part of initial project decisions, and the assessment, management and monitoring of its environmental and social risks and impacts.

1.1. SCOPE AND OBJECTIVE OF THE STAKEHOLDER ENGAGEMENT PLAN

The Stakeholder Engagement Plan (SEP) applies to all projects supported by the Bank through Investment Project Financing. The project proponent will consult with stakeholders as a fundamental part of the environmental and social assessment process and project implementation.

The main objectives of the Stakeholder Engagement Plan are:

- Establish a systematic stakeholder engagement strategy that will help the Project Proponent/Team to create and maintain a constructive relationship with stakeholders and, in particular, those affected by the project;
- Assess the level of stakeholder interest and support for the project and allow their views to be considered in the project design and environmental and social performance;
- Promote and provide means for effective and inclusive engagement of project-affected parties throughout the project lifecycle on issues that could affect them;
- Ensure that appropriate information on the environmental and social risks and impacts of the project is disseminated to stakeholders in a timely, accessible, understandable and appropriate manner;
- Ensure that project-affected communities have accessible and inclusive means to raise issues and grievances, and enable the Project Proponent/Team to respond to and manage such issues and grievances.

2. BRIEF DESCRIPTION OF THE PROJECT

2.1. PROJECT OBJECTIVES AND JUSTIFICATION

In Angola, local transport infrastructure, namely secondary roads, lanes and bridges that provide access to farms, markets, wells/holes/sources, schools and health posts, are in an advanced state of degradation, and in some cases impassable for most of the year (in Long-Term Development Strategy for Angola - 2025).

The objective of this project is the Construction/Rehabilitation of the section of the road between Luau-Cazombo-Lumbala Caquengue. The section in question is approximately 260 kilometers long.

The current situation of this section brings risk and insecurity for users, in addition to incurring financial and social losses, as it impairs movement between Communes, access to health infrastructure, access to educational institutions and the transport of loads, between others.

It should be noted that the lack of conservation and continuous maintenance of the roads, the increase in the volume of traffic and the deficiency of inspection are the main factors that are at the origin of the degradation of the roads. The World Bank, in the report issued in 2019, highlights the lack of quality of the roads and the discrepancy between costs and execution. The report also mentions, as an example, that between 2008 and 2017 the Government of Angola spent more than US$20 billion on roads, at a cost of US$2.52 million per kilometer paved, with only two lanes. However, in the same period, only an annual average of 28 million dollars was devoted to road maintenance. Indeed, in the list of global competitiveness, in 2019, Angola was among the last ten countries in terms of road network quality, in position 136 out of 141 countries (World Bank, 2019).

In view of the above, it is essential to carry out the construction/rehabilitation of the section of the road in question in order to mitigate all the problems that affect the road and its surroundings, thus providing dignified conditions for the users who use it. It should be noted that the pavement of the section in question has several deformations and is quite deteriorated, due to the lack of maintenance, and within the scope of this project, it will have to be rebuilt almost in its entirety.

In this sense, the rehabilitation of the section will allow the development of regional potential, the reduction of the overall cost and time of transport, the increase in traffic safety, the satisfaction of international traffic (between Moxico Province and the Democratic Republic of Congo), the reduction in the need for maintenance of the vehicles that use the road and the

dynamization of economic activities, thus improving the quality of life of the populations that use this stretch of road.

2.2. IDENTIFICATION OF THE ENTITIES INVOLVED IN THE PROJECT

The promoting entity of the project is the Angola Roads Institute of the Ministry of Public Works, Urbanism and Housing of the Republic of Angola. The executing entity is QG Konstruktion GmbH.

The table below (*see* **Table 1**) presents the relevant data of the entities involved in the elaboration of the ESIS, as well as the main information related to the project.

Table 1 –Identification of entities involved in the project

Identification of the Promoting Entity	
Entity	Roads Institute of Angola – Ministry of Public Works, Urbanism and Housing
Full address	Via AL,Edifício Transbrás, 4º,5º e 6º andares, Talatona.
Contact Person (s)	Eng. Fernando Manuel
E-mail (s)	fmanuel.inea@gmail.com
Identification of the Executing Entity	
Social denomination	QG Konstruktion, GmbH - Sucursal Angola
Complete address(es)	Rua Comandante Gika 261 D-B Sala 1, Alvalade
Share Capital	AKZ 200.000,00
NIF	5417683477
Contact Person (s)	Bruno Morais
Contact (s)	937405560
E-mail (s)	bruno.morais@qgmic.com
Project data	
Project Name	Contract for the Rehabilitation of the EC 192 / EN 250 / EC 254 / EC 385 Road, Luau / Cazombo
Investment Value	USD 276.091.402,01
Project Location	Between Luau, Cazombo and Lumbala Caquengue in Moxico Province
Geographic Coordinates	PK 0+000 11°13'6.65"S 22°14'26.39"E / PK 70+000 12°22'42.07"S 22°35'1.30"E
Number of Estimated Employees for the Project	500

2.3. SOCIODEMOGRAPHIC AND CULTURAL CHARACTERISTICS OF THE PROJECT AREA

2.3.1. DEMOGRAPHY

According to the Definitive Results of the 2014 Census, the population in Angola was 25.789.024 people, of whom about 63% live in urban areas and 37% in rural areas. The female gender dominates in Angola with a population of 13.289.983, corresponding to 52% of the total, while the male population is 12.499.041, representing 48% of the total population.

Regarding to the Province of Moxico, at the time of the General Population and Housing Census, developed in 2014, there were 758,568 inhabitants, of which 369,437 were male and the remaining 389,131 were female. According to the same source, the municipality of Luena is the most populous, concentrating 48% of the province's population, followed by the municipalities of Alto Zambeze with 14%, Luau with 12% and Budas-Lumbala, Nguimbo with 9%. These 4 Municipalities concentrate 83% of the total resident population in the Province. The Municipality of Luchazes registers the smallest number of residents with 2% of the population of the Province. Four other Municipalities follow with a population of less than 5% of the province's population, namely Camanongue with 5%, Léua with 4%, Cameia with 4% and Luacano with 3%. These five Municipalities concentrate only 17% of the province's population.

The masculinity index at provincial level is 95, that is, in Moxico Province there are 95 men for every 100 women, which means that the population of Moxico is made up mostly of women. The Municipality of Luau has the lowest masculinity rate with about 92 men for every 100 women (Census, 2014).

With regard to ethnic groups, the Province of Moxico is the territory of the Bantu peoples who are subdivided into 4 ethnic groups, namely Cokwe, Lunda, Ganguela (or Nganguela) and Lubas. Thus, the following figure (*see* **Figure 1**) shows the distribution of the main ethnic groups in Angola.

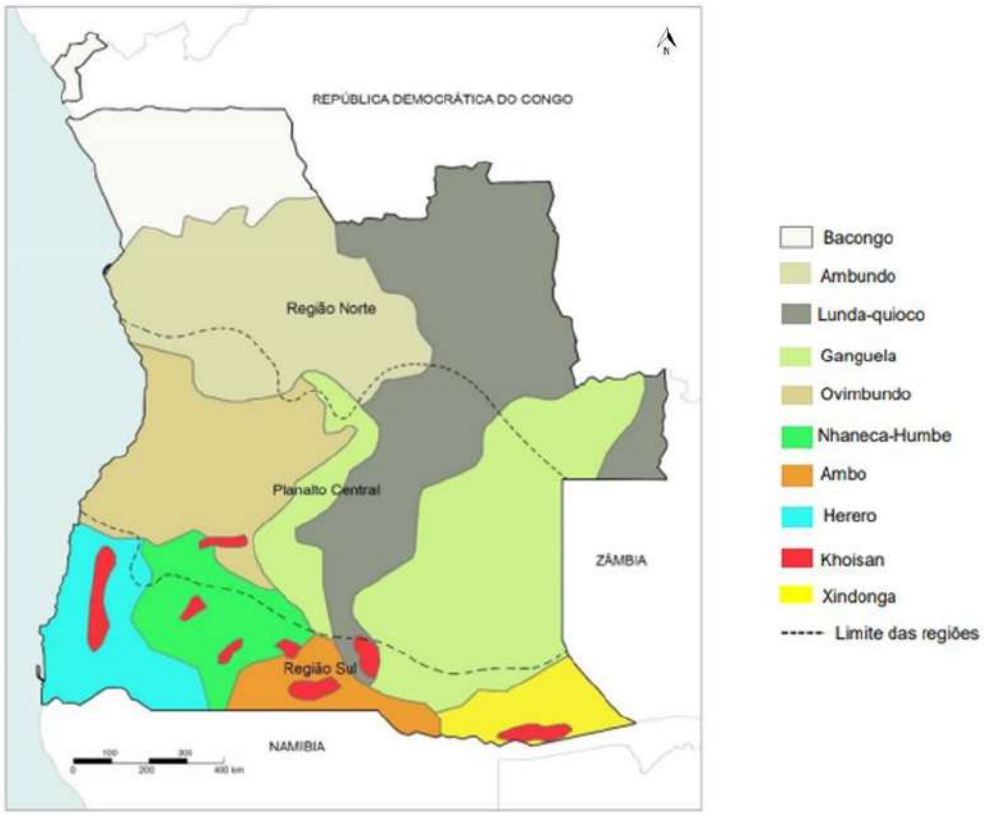

Figure 1 – Illustration of ethnic groups in Angola (Source: adapted from Redinha, 2009).

Through the analysis of the previous figure (*see* **Figure 1**) it is verified that the project implementation area located in the Province of Moxico, intersects the Ganguela (or Ngangela) ethnic group.

Portuguese is the only official language in Angola, however, given the existence of different ethnic groups, shown above and given the ethnic heterogeneity of the Province of Moxico, the Portuguese language coexists with other native languages of that region. Most of the population of Moxico Province is bilingual or multilingual, due to contact and reciprocal influences between languages and peoples. After Portuguese, the most widely spoken languages in Moxico Province are Tchokwe, Luvale, Lutchaz and Mbunda (the last two are variants of Nganguela), related to the respective groups that occupy vast areas and have a large number of speakers (FTP , 1973).

In a detailed analysis of the project implementation area, it is concluded that most of the languages spoken, in addition to Portuguese, are: Luvale, Lunda, Minungo, Tchokwe and Umbundo. However, there are other relatively small subgroups and native languages, often dispersed in small ethnic spots, but which are still significant or important in the diversification and enrichment of the region's culture.

2.3.2. HEALTH

Table 2 shows the number of doctors, nurses and technicians in the public sector by province in 2009. The total ratio of health workers per 1.000 inhabitants in Angola is close to the value recommended by the World Health Organization (WHO) of 2,28 workers per 1.000 inhabitants (WHO 2006), however, there is the serious problem of its irregular distribution in the country, given the high variation of health workers per 1.000 inhabitants at provincial level.

Table 2 – Personnel at Work in the Health Sector in Angola, by Province, 2009

Province	Doctors*		Nurses		Technical		Total	
	No.	Nº per 1.000 Inhabitant	No.	Nº per 1.000 Inhabitant	No.	Nº per 1.000 Inhabitant	No.	Nº per 1.000 Inhabitant
Bengo	87	0,41	954	4,49	99	0,47	1.140	5,36
Benguela	184	0,09	2.809	1,37	391	0,19	3.384	1,65
Bié	106	0,18	1.468	2,45	80	0,13	1.654	2,76
Cabinda	126	0,29	1.256	2,90	278	0,64	1.660	3,83
Cunene	103	0,28	922	2,51	73	0,20	1.098	2,99
Huambo	163	0,17	1.796	1,89	343	0,36	2.302	2,42
Huila	187	0,10	2.052	1,11	495	0,27	2.734	1,48
Cuando Cubango	39	0,13	642	2,14	65	0,22	746	2,49
Cuanza Norte	115	0,46	1.051	4,20	88	0,35	1.254	5,02
Cuanza Sul	182	0,19	1.026	1,08	131	0,14	1.339	1,41
Luanda	982	0,22	8.750	1,97	2.590	0,58	12.322	2,78

Province	Doctors*		Nurses		Technical		Total	
	No.	Nº per 1.000 Inhabitant	No.	Nº per 1.000 Inhabitant	No.	Nº per 1.000 Inhabitant	No.	Nº per 1.000 Inhabitant
Lunda Norte	94	0,16	839	1,40	89	0,15	1.022	1,70
Lunda Sul	87	0,33	753	2,90	67	0,26	907	3,49
Malange	147	0,33	1.146	2,55	82	0,18	1.375	3,06
Moxico	**81**	**0,14**	**1.233**	**2,06**	**93**	**0,16**	**1.407**	**2,35**
Namibe	103	0,56	941	5,13	257	1,40	1.301	7,10
Uíge	94	0,10	1.222	1,36	132	0,15	1.448	1,61
Zaire	76	0,38	732	3,66	82	0,41	890	4,45
Total	**2.956**	**0,17**	**29.592**	**1,74**	**5.435**	**0,32**	**37.983**	**2,24**

* Includes foreign doctors (Source: MINSA 2009[1])

In the case of Moxico, the Province under study, there are 81 doctors, which corresponds to about 2.75% of the total number of doctors, giving a ratio of 1.4 doctors per ten thousand inhabitants, considering the values estimated population in 2009. Regarding nurses, the ratio is 20.6 nurses per ten thousand inhabitants. In terms of technical personnel, the ratio stands at 16 technicians per ten thousand inhabitants In the case of Moxico, the Province under study, there are 81 doctors, which corresponds to about 2.75% of the total number of doctors, giving a ratio of 1.4 doctors per ten thousand inhabitants, considering the estimated population values in 2009. Regarding nurses, the ratio is 20.6 nurses per ten thousand inhabitants. In technical personnel, the ratio stands at 16 technicians per ten thousand inhabitants (*see* **Table 2**).

The biggest health problem is the lack of basic sanitation that leads to the appearance of malaria and other diseases, but most of these are preventable as long as vaccination campaigns are promoted, thus raising the protection rates of the population. Public health campaigns mobilize community members and local organizations such as churches and schools, community groups and municipal administration to work together to promote a healthy environment. These types of campaigns help people to understand how to avoid epidemics such as polio, malaria and yellow fever and also to distribute vaccines. Volunteers are essential for the success of campaigns as they visit people directly in their homes, thus reaching a wider range of population (adapted from Forum de Viana | 2014 Atlas).

This is because Cunene Province, like the whole country, has an exceptional water potential who's relative lack is only of a seasonal nature.

Moxico's health sector has seen significant improvements, with deaths from malaria falling compared to the previous two years, according to statistics from the main health units in the

[1] Table presented from: "Evaluation of the Health System in Angola 2010", USAID – 2010. Available at: http://www.healthsystems2020.org/content/resource/detail/2770/

Province. According to data from the Provincial Health Office, in 2017 there were 167,077 cases of malaria, with 1,274 deaths, and, with the implementation of the public health operational plan, in 2018 the numbers decreased to 155,162, with a record of 300 deaths (in www.jornaldeangola.ao). However, one of the major problems in the Province is due to the distance between existing health units. According to LAULEMO, an association that fights to defend the rights of communities in Moxico Province, the population living in remote areas is obliged to travel to Zambia to receive medical treatment. It was also mentioned that "of the hospitals that exist, some are so far from the communities that to gain access it is necessary to walk hundreds of kilometers, while in other units there is no medicine or food, which makes some inhabitants prefer to go to Zambia in search of medical assistance" (*in voaportugues.com*).

2.3.3. EDUCATION AND TRAINING

At the national level, there are several problems related to education: the country's weak monetary capacity, as well as the lack of qualified teachers, insufficient public schools, a high rate of school dropouts and children excluded from school because they do not have a birth certificate or because they are carriers of any disability. In addition to these, there is also corruption, sexual harassment and teacher absenteeism. Levels of schooling at country and province level are mostly in primary education, but the percentage of the population without any level of education remains high.

In the visits made to the site where the project was being implemented, it was found that the majority of the interviewed population had completed secondary education. However, the continuity of studies corresponds to a reduced fraction of the population.

According to the 2014 General Population Census, the literacy rate at national level was 66%, with the urban area being about twice as high as the rural area, respectively 79% against 41%. The population that does not know how to read and write is essentially elderly, with only 27% of the population aged 65 or over knowing how to read and write. It is in the Provinces of Bié, Moxico and Malanje that the lowest literacy rates are found, that is, about half of the population aged 15 or over in these 3 Provinces cannot read or write.

The Education and Culture Sector of the Province of Moxico is characterized by two branches, the public and the private, which operate with some difficulties, as this was one of the provinces most affected by the war. The Public Sector of Education focuses on the nine Municipalities of the Province. The Private Sector is limited to the city of Luena, with an Agrarian Institute, a Seventh-day Adventist College, a Pentecostal Institute and a Dom Bosco Center (in Governo de Angola, 2022).

Regarding the availability of education infrastructure, according to statistics provided by the provincial education directorates of the eastern region to the Statistical Study and Planning Office, until 2018 there were 490 schools in Moxico Province.

2.3.4. ECONOMIC ACTIVITIES

Agriculture, Livestock and Fisheries

Despite the recent growth of the Province of Moxico, the main activity of the population is subsistence agriculture, with cassava being the most exploited food, which serves as the basis of the diet of the majority of the population. Other foods are produced in smaller quantities, such as beans, corn or honey (VIS, 2012). In addition to agriculture, families raise animals (chickens and goats), allowing them to enrich their diet and do business. Despite the recent growth of Moxico Province, the main activity of the population is subsistence agriculture, cassava being the most exploited, which serves as the basis of food for the majority of the population. Other foods are produced in smaller quantities, such as beans, corn or honey (VIS, 2012). In addition to agriculture, families raise animals (chickens and goats) allowing them to enrich their diet and do business.

The Province has favorable soils and climate conditions for rice cultivation and defended the use of technologies to increase the quality of the product. The Province of Moxico was the largest producer of rice in the country, with more than 70 tons per year, which corresponds to a third of what is currently produced in the entire Angolan territory (www.jornaldeangola.ao).

Currently, agricultural activity is limited to 257 registered small and medium-sized agricultural and livestock companies, with around twelve operating in the Municipality of Moxico. The activity of the traditional sector is carried out in an uncontrolled manner, limited to subsistence production, lacking framework and technical assistance for its development (Government of Angola, 2022).

There is some forest exploitation in the Municipality of Moxico, mainly extracted from areas planted with eucalyptus and pine trees. The wood logs are exported for consumption on the coast and outside the country, with a fraction used locally (Governo de Angola, 2022).

In the livestock subsector, the Province is one of the national centers specializing in the production of meat and milk, with cattle, sheep, goats and pigs (Portal São Francisco, 2018).

As far as fishing is concerned, this is an artisanal activity, but with great abundance due to the rivers and lakes as well as the flooding of the territory during the rainy season. The numerous rivers, lakes, lagoons and extensive swamps in the rainy season, enhance the practice of river

and lagoon fishing, whose exploration through targeted projects, could be a factor of economic development and social promotion of the populations (Government of Angola, 2022).

Trade and Industry

In the Province of Moxico, the commercial subsector is based on wholesale centers that distribute processed and semi-processed products to the province's localities, and is concentrated in Luena, Luau and Cazombo (Portal São Francisco, 2018). Trade in other locations works informally (Government of Angola, 2022).

There are also service activities dedicated to logistics, given that the Benguela Railway and numerous roads cross the Province of Moxico (Portal São Francisco, 2018).

The industrial parks of Moxico are specialized in the agroindustry for the transformation of meat, milk and eggs, also registering the production of food, beverages, clothing, transformation of furniture and construction materials. The areas of greatest industrial concentration are in Luena and Luau (Portal São Francisco, 2018).

Regarding to mining, the mining potential of the Province is diversified (copper, gold, tungsten, diamonds, manganese and uranium, inert for civil construction (Government of Angola, 2022).

Tourism

There are several potentially tourist areas in the Province, namely Cangongo (Luena), Lago Calundo (Leua), Lago Dilolo (Luacano), Cameia National Park and falls of the Luizavo River (Alto Zambeze), however, these are not explored, due to lack of investments (Government of Angola, 2022).

Moxico's hotel sector has registered 8 hotels, 5 pensions and 34 bars and restaurants (Governo de Angola, 2022). Of these, only one hotel operates outside Luena (in www.dn.pt).

2.4. Potential Social Risks and Impacts

During the process of involving stakeholders, potential risks and social impacts may arise, related to:

a) Poor dissemination of information/messages about the project

Communication is the pillar of all interventions or activities initiated to carry out the project. The project must be based on a clear, dynamic and inclusive communication strategy. Communication must evolve according to the stages of the project and be adapted to the social context of each stakeholder. It will be addressed not only to the people concerned, but to all entities interested in or likely to support the implementation of the project, such as

administrative authorities, elected officials, civil society organizations (CSOs) or community, religious, press, among others.

In fact, inadequate communication or a communication gap can lead to the construction of false information or rumors and lead to stakeholder resistance or other behaviors detrimental to the success of the project.

b) Poor integration of the press, elected officials, CSOs, training and employment stakeholders

The media should be based on a dynamic strategy built and implemented in partnership with the press, civil society organisations, elected officials and training and employment stakeholders. The option of collaborating with the aforementioned actors can help to convey fair, targeted and real-time information to improve the social support of project stakeholders. Its low level of integration can present the risk of building false rumors that can lead to a bad perception of the project and generate frustrations, sources of social revolt, but also to constitute an obstacle to the project. These entities must be partners and their collaboration in carrying out the Project is more than useful.

c) Failure to consider the needs of vulnerable groups

Because of their cognitive, physical or visual impairments, or related to their health status, gender or marital or expatriation status, some stakeholders and their families are at risk of not taking advantage of the opportunities offered by the Project. These people and groups must be identified, their socio-economic situation and specific needs well understood in order to adequately define targeted and sustainable support measures, allowing them to improve their situation (e.g. access for girls and people with disabilities to training and to employment).

Qualitative research on the expectations of vulnerable young people was carried out as part of the elaboration of the SEP and made it possible to identify and analyze their difficulties and needs in order to be able to offer relevant and appropriate assistance measures.

The definition of risk assessment mitigation measures for gender-based violence and the implementation and follow-up of the Action Plan will make it possible to assess their implementation during the project. The same applies to monitoring exploitation at work.

Project ownership to better meet community expectations will have to establish strong communication and citizen engagement to receive feedback from beneficiaries, especially women.

d) Potential exclusion of vulnerable or disadvantaged groups from accessing information services and/or media

Vulnerable groups may not have access to information and communication services, a situation that could promote the process of marginalization. It should be noted that marginalization is a sociological concept that is related to social, cultural, political or economic exclusion.

e) Potential breach of data privacy or misuse of data

These different risks and social impacts were considered in the project design through the following measures:

- The identification system is designed to be universal. All people in the territory will be included, regardless of their nationality or socio-economic characteristics;
- Development of data protection mechanisms;
- The data to be collected will be limited to biometrics, name, gender, date of birth, etc.;
- Conducting awareness-raising campaigns and developing communication strategies in order to eliminate barriers in the overall process.

2.5. METHODOLOGY FOR DEVELOPING THE STAKEHOLDER ENGAGEMENT PLAN

This Stakeholder Engagement Plan will follow the following methodology:

1. Carrying out visits to the project implementation site;
2. Identification of stakeholders who may be affected by the project;
3. Identification of the information to be disclosed in the public domain, languages and places/means where it will be disclosed;
4. Dissemination of project information and explanation of the possibilities for public consultation;
5. Call for identified interested parties to present the project and gather relevant information to analyze their needs and expectations;
6. Presentation and brief description of the project and activities to interested parties;
7. Description and explanation of the project's grievance mechanism;
8. Commitment to the publication of routine information on the project's environmental and social performance, including additional consultation possibilities, as well as monitoring the handling of complaints.

3. IDENTIFICATION AND ANALYSIS OF INTERESTED PARTIES

For the purposes of this plan, the term "Stakeholders" refers to individuals or groups that:

a) Intervene or have a specific interest in any level of project implementation;

b) Are affected or likely to be affected by the project;

c) Individuals or groups that may be less favored or vulnerable.

In the following subchapters, each of these interested parties is detailed.

3.1. POTENTIAL PROJECT STAKEHOLDERS

Project stakeholders bring together actors or groups of actors who intervene or have a specific interest at any level of project implementation. They are composed of:

- Actors from Ministries and Agencies;
- Teaching and research institutions;
- Public and private structures for professional training and employment;
- Local Authorities;
- Traditional neighborhood leaders ("sobas")
- Religious Organizations;
- Non-Governmental Organizations (NGOs);
- Environmental and Social Associations;
- Entities executing the project;
- Funding entities.

3.2. STAKEHOLDERS LIKELY TO BE AFFECTED BY THE PROJECT

With regard to the planned activities, the stakeholders likely to be directly affected by the project may include, in addition to the community surrounding the project, direct workers and indirect workers. Direct workers are project employees (technicians assigned and/or recruited staff) with formal contracts. Indirect workers are agents of partner companies in the project and agents of subcontracted companies, etc.

3.3. DISADVANTAGED OR VULNERABLE INDIVIDUALS OR GROUPS

It is particularly important to identify the people and groups who may have the most difficulty in participating and those who may be unequally or otherwise disproportionately affected by the Project because of their vulnerable situation, such as:

- women and youth without identity documents and likely to be excluded from the single identification system due to their marginalization;
- disabled people;
- elderly people, especially those living in rural areas;
- refugees;
- people in situations of extreme precariousness and/or specific difficulties (adult orphans, poor people living alone, widows, people without a fixed home or living on the street, etc.);
- people belonging to "disadvantaged" minority groups, such as minority communities in numbers or with a specific way of life (transhumants), people with a specific sexual orientation, sex sellers/prostitutes, chronic diseases, etc.

4. STAKEHOLDER ENGAGEMENT PLAN

4.1. OBJECTIVES AND SCHEDULE OF THE STAKEHOLDER ENGAGEMENT PLAN

The purpose of the Stakeholder Engagement Plan is to identify stakeholders as well as their concerns, define the roles and responsibilities of the various actors that will intervene in its implementation, as well as the deadlines for carrying out activities and costs (if necessary) consultations and engagement and participation activities.

Thus, the stakeholder involvement and participation plan will be translated into a budgeted program of activities that clearly defines the phases of project implementation (beginning and end of activities), as well as the costs of the various interventions and responsibilities of the stakeholders. During the implementation of the Stakeholder Engagement Plan and its continuous monitoring, it may be adjusted according to the management of social risks and the implementation phase of the project.

4.2. PROPOSED STRATEGY FOR DISSEMINATING INFORMATION

The notification and dissemination of information will be carried out through the media including radio, television, newspapers, social networks, Local Administrations, educational and research institutions, churches, sobas ("the chief of the village") and communal administrators, associations and NGOs, among other channels adapted to the local context.

Posters will also be placed in strategic locations so that they are clearly identified and accessible to all interested parties, including vulnerable groups. In addition, brochures and information leaflets will be distributed in order to spread the information.

Information and awareness campaigns will be carried out dedicated to local communities, mainly the most disadvantaged, in order to promote inclusive communication and participation.

The following table (*see* **Table 3**) presents a synthesis matrix of the project's dissemination strategy.

Table 3 – Summary of the Project Dissemination Strategy

PROJECT PHASE	LIST OF INFORMATION TO COMMUNICATE	MEANS	PROPOSED METHOD	PLACES/DATES	TARGET STAKEHOLDERS	RESPONSABILIDADES
Project preparation	- Presentation of the Project (purpose, nature, dimension of the project and duration of activities); - Participation in the definition of social risk management instruments for the project; - Facilitation of consultations and stakeholder participation.	- email; - Letter; - Telephone; - Face-to-face meetings; - Videoconference meetings (eg Teams Platform, Zoom, Skype, etc.); - Social networks; - Digital/physical didactic material.	- Dissemination of project documents through brochures, posters, PPT presentation, among other channels adapted to the local context; - Carrying out the relevant stakeholder consultation.	- Meeting room for institutional and/or other actors; - Strategic physical locations; - Housing. *To be carried out before and during the project evaluation phase.*	- Actors from Ministries and Agencies; - Teaching and research institutions; - Public and proven structures for professional training and employment; - Local Authorities; - Traditional leaders of the neighborhoods (“sobas”) and community; - Leaders of vulnerable groups; - Religious Organizations; - Non-Governmental Organizations (NGOs); - Environmental and Social Associations; - Local community; - Entities executing the project; - Funding entities.	- Project team; - Consulting company.
	- Objectives, impacts and mitigation measures of the project, opportunities, means of participation and stakeholder involvement; - Process and means for grievances to be presented and addressed.		- Conducting relevant stakeholder consultation on the development of social risk management tools for the project; - Dissemination of the project's social risk management documents and instruments.	- Meeting room for institutional and/or other actors; - Strategic physical locations; - Housing. *To be carried out before and during the project evaluation phase.*		
Project implementation	- Dissemination of the project's social risk management contents; - Methods of implementing mitigation measures; - Role of the different actors responsible for implementing the Project Stakeholder Engagement Plan; - Process and means for grievances to be presented and addressed.	- email; - Letter; - Telephone; - Face-to-face meetings; - Videoconference meetings (eg Teams Platform, Zoom, Skype, etc.); - Social networks; - Digital/physical didactic material.	- Carrying out the relevant stakeholder consultation; - Dissemination of documents and instruments for managing the social risks of the project and those responsible for implementing the plan; - Training and awareness-raising for interested parties; - Support in the complaints and grievances management process.	- Project Influence Areas; - Strategic physical locations. *Throughout the project life cycle.*	- Project team; - Implementation and monitoring technical team; - Actors from the Ministries and Agencies involved; - Teaching and research institutions; - Traditional leaders of the neighborhoods (“sobas”) and community; - Leaders of vulnerable groups; - Local authorities; - NGOs/Associations; - Local community.	- Project team; - Consulting company.
Monitoring and Evaluation	- Activity implementation indicators; - Results indicators; - Functions of the various actors in collecting information/data; - Information/data collection period; - Data Verification Source.	- Project implementation report.	- Processing of the information collected during the relevant consultations and monitoring visits to the websites.	*During the project life cycle*	- Project team; - Monitoring Technical Team.	- Project team; - Financing Entity/Inspector.

Annex I present the Summary Report of the Public Consultations, which contains the Public Consultation leaflet prepared for the carrying out of the actions of consultation and consultation with the interested parties, which discloses the following information in a summarized and appealing way:

- Scope, objective and location of the project;
- Duration of the contract;
- Project Management Policies, including the Complaints and Grievances Management and Data Protection Mechanism;
- Explanation of the environmental and social impact assessment process and main expected impacts;
- Explanation of the consultation and public consultation process and objectives of these processes.

4.3. PROPOSED STRATEGY FOR THE CONSULTATION

The stakeholder consultation methods will be adapted according to the target audience:

- Interviews will be carried out with the various State actors (ministries and structures concerned, etc.);
- Interviews and questionnaires will be used to obtain the opinions of those consulted;
- Information workshops for stakeholders,
- Public or community meetings or focus groups will be regularly organized for the most distant and/or vulnerable actors. Stakeholders will be clearly identified and involved according to the topics to be addressed and/or discussed.

As previously mentioned, when choosing an appropriate consultation technique, it is necessary to consider that the consultation methods are adapted to the culture and purpose of the participation of a particular group or individual of stakeholders. The most used techniques for the planned activities are shown in **Table 4** below:

Table 4 – Engagement techniques envisaged for carrying out stakeholder consultations

Engagement technique	Appropriate application of the technique
Correspondence (Phone/e-mail)	- Distribute information to government officials, Provincial Government, Local Administrations, NGOs and associations and organizations/agencies; - Invite stakeholders to meetings and follow-up.
Individual Meetings	- Survey Research; - Allow stakeholders to speak freely about sensitive issues;

Engagement technique	Appropriate application of the technique
	- Build personal relationships; - Conducting questionnaires; - Record the content of the meetings.
Formal meetings	- Present project information to a stakeholder group; - Allow the group to comment opinions and points of view; - Build an impersonal relationship with high-level stakeholders; - Disseminate technical information; - Record the content of the meetings.
Public meetings	- Present project information to a large group of stakeholders, especially communities; - Allow the group to give their views and opinions; - Build relationships with communities, especially those affected; - Distribute non-technical information; - Facilitate meetings with oral presentations, PowerPoint presentations, posters, etc.; - Record comments, questions and discussions.
Group meetings discussion (*focus group*)	- Present project information to a stakeholder group; - Allow interested parties to give their opinion on the intended background information; - Build relationships with communities; - Record the answers.
Website of the project/project page on social networks	- Display project information and progress updates; - Disclose environmental and social assessment documents; (eg ESMP) among other relevant project documents.
Project brochure	- Brief project information to provide regular updates; - Site project specific information.

Annex II presents the questionnaire model used within the scope of the consultation and consultation process.

4.4. PROPOSED STRATEGY TO TAKE INTO ACCOUNT THE VIEWS OF VULNERABLE GROUPS

Community consultations will be carried out based on the principle of inclusion, namely the participation of all segments of the community, including people with reduced mobility and other vulnerable people. If necessary, logistical assistance will be provided for remote communities, people with reduced mobility and/or with insufficient financial means to enable them to attend public meetings organized by the project. In situations where vulnerable status may result in people's reluctance or physical inability to participate in meetings, the project team will organize separate discussions in small groups and in an easily accessible location.

To facilitate contact with vulnerable groups, some options are presented below:

- Identify the leaders of vulnerable and marginalized groups in order to reach the group;
- Involve community leaders, Civil Society Organizations, Associations and NGOs;

- Organize individual interviews and focus groups with vulnerable people in different municipalities;
- Facilitate the access of these people to the complaint management mechanism established by the project.

This approach will be used throughout project implementation, based on the results of the project's social risk assessment.

4.5. Treatment of Information from the Consultation and Participation of Stakeholders

When interested parties are consulted, all written comments will be collected and processed. Suggestions, complaints and other contributions from interested parties will be compiled in a specific form, created for this purpose, and which will be filled in during the consultations carried out. Interested parties will also be able to send their feedback via email, phone and social media.

For people living in remote rural areas, in addition to correspondence, they will have the opportunity to send their feedback through field technicians who will carry out visits to the communities.

All feedbacks will be compiled by a technical team and will be shared with the Project Coordinator.

It'll be delivered a report that will include the following information:

- A summary of the understanding of the comment/feedback submitted by the stakeholder;
- Explanation of the proposed solution(s);
- The accepted solution;
- The procedure for implementing the accepted solution, including deadlines.

All feedbacks will be compiled by a technical team and will be shared with the Project Coordinator.

4.6. Project Implementation Phase

As the Project is implemented, the activities carried out and those that are programmed will be communicated to the interested parties. Thus, they will be aware of the progress of project execution. The dissemination of activities will be carried out through quarterly, half-yearly and annual summary reports.

5. BRIEF DESCRIPTION OF THE CONSULTATION AND PARTICIPATION ACTIVITIES OF INTERESTED PARTIES

Stakeholder consultation and participation is based on an inclusive and participatory approach carried out throughout the project cycle, with the aim of building around stakeholders, effective and efficient buy-in and involvement for the assessment and management of risks and environmental and social impacts of the project.

As part of the preparation of the project's public consultations with stakeholders, they should be informed on the one hand of the project's activities, objective and expected results, potential impacts and planned mitigation measures and, on the other hand, collect concerns, needs and expectations of the interested parties before the same in order to define complementary mitigating and/or compensatory measures for the various phases of the project, if necessary.

At the same time, the complaint mechanism of the project will be described and explained.

The Environmental and Social Management Plan and the Stakeholder Engagement Plan specify the modalities and planning for implementing the measures.

The relevant consultation process is also intended to provide the opportunity for interested parties to express their opinions on risks, impacts and mitigation measures, allowing them to respond to them.

Relevant consultation is a two-way process that begins at the early stage of the planning process, during project preparation, to receive initial input on the project proposal and inform project design and continues uninterrupted throughout project implementation and external dissemination.

5.1. RELEVANT INQUIRY – PROJECT PREPARATION PHASE

Based on the strategies defined within the scope of this document for the process of listening, participating and consulting the various identified interested parties, several visits were made to the areas of influence of the project in order to present the project and collect contacts and requests for authorization from the Provincial Government of Moxico, Municipal and Communal Administrations, Sobas and/or representatives of the neighborhoods to carry out inquiries to the local community, within the scope of the public consultation process.

The calculation of the representative sample of the community to be consulted within the scope of the Public Consultation of the Project considered the following assumptions:

- Population resident in the Province of Moxico (Census, 2014);
- Population distribution;
- Margin of error (5%);
- Reliability (95%).

The following table (*see* **Table 5**) shows the number of inquiries carried out by the Commune within the scope of the Public Consultation process, considering the above-listed assumptions.

Table 5 – Number of inquiries developed within the scope of the Public Consultation, distributed by Commune

Municipality	COMMUNE	NO. OF INQUIRIES
Alto Zambeze	Cazombo	28
	Lumbala Caquengue	16
	Nana Candungo	150
	REPRESENTATIVE SAMPLE	**194**

The Face-to-face Public Consultations to the Community, during the Project Preparation Phase, were carried out during the month of January 2023.

Table 6 presents a summary of the dates, locations and respective photographic record, when available, of the project presentation meetings and public consultations carried out, in the preparation phase of the project under analysis.

Table 6 – Locations, dates and respective photographic record of project presentation sessions and public consultations held in groups

PLACE	DATE	PHOTOGRAPHIC REGISTER
Municipal Administration of Luau	05/01/2023	

PLACE	DATE	PHOTOGRAPHIC REGISTER
Municipal Administration of Alto Zambeze - Cassombo	05/01/2023	
Lunachi, Cazombo, Alto Zambeze	05/01/2023	
Communal Administration of Cavungo – Alto Zambeze	06/01/2023	

PLACE	DATE	PHOTOGRAPHIC REGISTER
Cavungo Communal Headquarters	06/01/2023	
Nana Candungo, Alto Zambeze	06/01/2023	

As previously mentioned, **Annex I** presents the summary report of the consultations carried out within the scope of the project, based on the information collected during the public meetings held to present the project and individual meetings when carrying out the surveys.

6. RESOURCES AND RESPONSIBILITY TO IMPLEMENT STAKEHOLDER ENGAGEMENT ACTIVITIES

6.1. RESOURCES

The resources that will be allocated to the management and implementation of the Stakeholder Engagement Plan mainly include:

a) Human Resources;

b) Material resources; and

c) Financial resources.

6.2. MANAGEMENT FUNCTIONS AND RESPONSABILITIES

Stakeholder engagement activities form an integral part of the project's environmental and social mitigation measures. Based on the project's reduced social and environmental risk classification, it is not considered necessary that the monitoring of the involvement, participation and consultation process be carried out by a specialist sociologist.

The implementation of the activities foreseen for the involvement and participation of the interested parties will be the responsibility of the project proponent and of the respective technical project team appointed for this purpose. These must ensure the implementation of this Stakeholder Involvement Plan and monitor the degree of implementation of the actions defined therein, so that periodic feedback can be given to interested parties.

7. PROJECT COMPLAINTS AND GRIEVANCES MANAGEMENT MECHANISM

The complaints and grievances management procedure can be summarized in the following steps, starting with the registration of the complaint or grievance and filing the resolution or complaint file:

1) Reception and Registration of the complaint or grievance;
2) Analysis of the complaint;
3) Investigation of the basis of the grievance;
4) Response proposal;
5) Review of the response in situations where there is no immediate resolution;
6) Implementation of corrective measures;
7) Closing the claim;
8) Communication;
9) Archive.

It should be noted that each step must be limited to a maximum of 15 days/two weeks from receipt of a complaint/grievance to decision-making.

It is strongly recommended that all necessary steps be taken to ensure that solutions are adopted by consensus based on negotiation and agreement.

Detailed procedures for handling complaints and for the appeal process must be disseminated among Project-affected Persons, who must be empowered to use them when they deem it convenient.

8. MONITORING AND PREPARATION OF STAKEHOLDERS ENGAGEMENT PLANO REPORTS

The activities related to the Stakeholder Engagement Plan will be detailed in the periodic reports (monthly, quarterly and annually) that will specify for each action or activities planned, those responsible, the actors involved, the necessary resources (budget) and the deadline for its implementation.

The person responsible for monitoring the implementation of the activities described in the Stakeholder Engagement Plan should monitor the degree of implementation of the actions.

9. CONCLUSION

The Stakeholder Engagement Plan is an essential tool for managing the potential social risks of the Project "Contract for the Rehabilitation of Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo". Under the provisions of the new World Bank and IFC Environmental and Social Policy Framework, the Stakeholder Engagement Plan is an integral part of the contractual documents to be prepared prior to any project approval.

It should be noted that this document was developed in a comprehensive and participatory approach, with 6 public meetings/project presentation group and 194 surveys of the local community, including disadvantaged or vulnerable individuals or groups. The public consultations carried out covered the various neighborhoods of the following Communes in the Province of Moxico:

- Cazombo;
- Lumbala Caquengue;
- Nana Candungo.

It should be noted that the Stakeholder Engagement Plan is a dynamic document that will evolve over the various phases of the project in order to consider the needs and expectations of the interested parties whose actions should provide added value in achieving the objectives defined for the project. project.

The public consultation process in the project preparation phase led to the conclusion that the main economic activity carried out in the Province of Moxico is agriculture, having been mentioned by 44% of the population sampled. However, it should be noted that a large number of respondents were unemployed (39%).

The three biggest needs mentioned by the stakeholders were access to potable water, electricity and telecommunications (59%), the rehabilitation of transport infrastructure (roads and bridges) (24%) and the rehabilitation of service infrastructure (schools, hospitals/health centers, bank branches) (18%). Regarding the type of improvements that the community considered that the project could bring, "employability" (39%) "stimulation of economic activities" (16%) and "improvement of the quality of life" (45%) stand out.

In view of the data obtained, it is expected that the project under analysis will meet the needs and expectations of the interested parties who were present at the public consultation sessions.

It is therefore concluded that the strategies defined in this document are adjusted to the various interested parties and that no objections were raised to the project preparation phase, thus meeting all the conditions to proceed with the next phases of environmental impact assessment and social, considered to be an excellent starting point for the entire process of participation and involvement of the Stakeholders and successful implementation of the project.

10. ANNEXES

Annex I – Summary report of public consultations;

Annex II – Questionnaire Template

Annex I –Summary report of public consultations

PUBLIC CONSULTATION REPORT – PROJECT PREPARATION PHASE

CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

JANUARY 2023

Resurb
Ambiente, Lda

PROJECT DESIGNATION: CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

PROMOTING ENTITY: ANGOLA ROADS INSTITUTE – MINISTRY OF PUBLIC WORKS, URBANISM AND HOUSING

EXECUTING ENTITY: QG Konstruktion GmbH

CONSULTANT ENTITY: : RESURB Ambiente, Lda.

(Company registered with the Ministry of Environment, as an Environmental Consultant, with Certificate No. 20816908221, valid until 08/09/2023)

1. SCOPE AND OBJECTIVES

The purpose of this report is to present a summary of the consultations carried out within the scope of the Presential Consultations inherent to the Preparation Phase of the Project for the EC Road Rehabilitation Project 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo", during the month of January 2023.

The Public Consultation sessions aim to comply with the requirements of the World Bank, IFC and Equator Principles for the assessment of the project's environmental and social impact. At the same time, it is an integral part of the environmental and social assessment and aims to ensure the effective commitment of all Interested Parties directly involved in the implementation of the project, as well as the surrounding population.

2. METHODOLOGY

The methodology adopted for carrying out the In-person Public Consultations was based on the strategies defined in the Stakeholder Engagement Plan (SEP), with various communication channels being used to publicize the Public Consultation sessions, in particular, the invitation and consultation face-to-face in order to also include the most vulnerable and/or disadvantaged groups/individuals, with the aim of guaranteeing the inclusion and participation of the various stakeholders potentially affected by the project. In this sense, several previous visits were carried out (days before the public consultations) to the neighborhoods identified in the SEP in order to contact directly with the Municipal and Communal Administrations and the “Soba” (traditional leader/authority of the neighborhood) in order to obtain superior approval for the convening and carrying out of public consultations, in order to guarantee the adhesion of the interested parties.

3. PLACE AND DATE OF CONSULTATION

The Presidential Public Consultations of the Project Preparation Phase were held between the 5th and 6th of January of 2023.

The following table (*see* **Table 1**) presents a summary of the places where the various group sessions were held for the presentation and dissemination of the project and the carrying out of public consultations on the project.

Annex IV of the Summary Report of the Environmental and Social Impact Study contains the flyer presenting the project and the presentation of socio-environmental risk management tools and mechanisms for consultation, consultation and participation of interested parties, distributed when carrying out the queries.

Table 1 – Locations where the project's public consultations will take place

GROUP PROJECT PRESENTATION SESSIONS		
Municipal Administration of do Luau		
Municipal Administration of Alto Zambeze - Cassombo		
Communal Administration of Cavungo – Alto Zambeze		
INDIVIDUAL PUBLIC CONSULTATIONS		
Municipality	**Commune**	**Neighborhood**
Alto Zambeze	Cazombo	Lunachi
		Manguxi
	Lumbala Caquengue	Cassombo
	Nana Candungo	Capango
		Fazenda
		Sede Comunal
		Kakheleca

4. STAKEHOLDERS (INTERESTED PARTIES)

Within the scope of the consultation process and public consultation of the project, individual interviews were carried out with 194 interested parties distributed by the neighborhoods listed in the previous table (*see* **Table 1**), according to the following table (*see* **Table 2**).

Table 2 – Number of inquiries carried out within the scope of the Public Consultation, distributed by Commune

MUNICIPALITY	COMMUNE	NO. OF INQUIRIES
Alto Zambeze	Cazombo	28
	Lumbala Caquengue	16
	Nana Candungo	150
	REPRESENTATIVE SAMPLE	**194**

In **Annex XIV** of the Summary Report of the Environmental and Social Impact Study, there is a list of the attendance of participants in the public consultation sessions held and in **Annex I** a compilation of the photographic record of the public consultation process.

5. RESULTS OF THE PUBLIC CONSULTATION SESSION

The presentation of the Project, as well as the component inherent to the Environmental and Social Impact assessment and the questionnaires within the scope of the public consultation process, were carried out by the company Resurb Ambiente, Lda., duly registered with the Ministry of the Environment as a consulting company.

The main results of the In-person Public Consultation sessions are presented below:

- The presentations made and brochures delivered, of the project and the environmental and social impact assessment, were appealing and in a language appropriate to the participants;
- Whenever necessary, the vocabulary was adjusted to ensure efficient and effective communication with stakeholders, especially the most vulnerable;
- The preferred means referred to by interested parties for obtaining information about the project was verbal, followed by radio and, finally, written dissemination (leaflets, posters, etc.);
- The majority of stakeholders reported that they were aware of the project through the project members themselves and the rest of the IP were aware through their Municipal and Communal Administrations;
- Most of the stakeholders consulted did not have access to drinking water;
- Most of the stakeholders consulted do not have access to the electricity and sanitation network;
- The three biggest needs mentioned by stakeholders were access to drinking water, electricity and telecommunications, the rehabilitation of transport infrastructure (roads and bridges) and the rehabilitation of service infrastructure (schools, hospitals/health posts, bank branches);
- Consider that the project could improve the community from the point of view of employability, enhance economic activities and improve the quality of life.

In the public consultations carried out, some observations were collected which are presented below:

- It is a beneficial project for the local community;
- It could improve the quality of life and employability;
- There are not enough teachers and education infrastructures in the Auscultated Communes;
- The main and secondary roads connecting the various Neighborhoods and Communes are, in general, on dirt and destroyed bridges, which makes it difficult to access health, commercial and school services. At the same time, there are crocodiles in some rivers which makes travel quite dangerous;

- The population does not have access to drinking water by doing their personal hygiene in the surface water lines existing near their Neighborhood/Commune.

The results obtained allow us to conclude that, at this stage of project preparation, it meets the needs and expectations of the IP that were present in the public consultation sessions.

All information collected will be considered in the design of the project and preparation of the Environmental and Social Impact Study of the project, as well as serve as the basis for the next public consultation sessions, provided for in the SEP.

It is therefore concluded that no objections have been raised to the preparation phase of the project, thus meeting all the conditions for proceeding with the next phases of environmental and social impact assessment.

6. ANNEXES

Annex I – Compilation of the photographic record of the public consultation process.

Annex I – Compilation of the photographic record of the public consultation process

Annex I - Photographic Record of Public Consultations

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Annex II – Questionnaire Template

Resurb Ambiente, Lda	**DESIGNAÇÃO DO PROJECTO:** REABILITAÇÃO/CONSTRUÇÃO DO TROÇO DA ESTRADA ENTRE LUAU-CAZOMBO-LUMBALA (CERCA DE 260KM), NA PROVÍNCIA DO MOXICO

Módulo 1 - Caracterização da situação de referência sócioambiental			
1. Dados de Controlo			
Data e hora de Realização do inquérito (DD-MM-AAA HH:MM):			
Referência/código do questionário:			
Localização:	Província		
	Município		
	Comuna		
	Bairro		
	Distrito Urbano		
Temos sua permissão para realizar esta entrevista e registar, analisar ou compartilhar com segurança essas informações?			
2. Identificação do entrevistado			
Nome do entrevistado			
Coordenadas GPS WGS84 UTM ZONE 33S			
Género			
Idade			
Nível de escolaridade do entrevistado			
Contacto (opcional)			
2.1. Identificação do Soba ou Chefe/Representante da Comunidade			
Nome			
2.2. Caracterização do agregado familiar			
2.2.1. Dimensão do agregado familiar			
N.º de adultos na habitação	Homens		
	Mulheres		
N.º de idosos na habitação	Homens		
	Mulheres		
N.º de crianças na habitação	Meninos		
	Meninas		
2.2.2. Caracterização			
Estado civil do entrevistado			
Encontra-se empregado?			
Se sim, qual a sua profissão?			
N.º de pessoas com deficiencia ou incapacidade no grupo familiar			

Religião predominante na família	
Nível de escolaridade mais alto dentro do agregado familiar	
A família pertence a algum destes grupos indígenas	
2.2.3. Educação	
Existência de infraestrutura de educação nas imediações?	
Se sim, qual o tipo de infra-estruturas?	
Qual o tempo necessário para chegar à escola?	
Qual a distância para chegar à escola?	
Principal tipo de transporte para a escola.	
Alguém da família em idade escolar não frequenta a escola?	
Razão por não frequentar a escola	
2.2.4. Saúde	
Existência de infraestrutura de saúde nas imediações?	
Se sim, qual o tipo de infra-estruturas?	
Porque razão não tem acesso a serviços médicos?	
Qual a distância para chegar aos serviços médicos?	
Qual o tempo necessário par chegar aos serviços médicos?	
2.2.5. Serviços Básicos	
Tem acesso à água potável?	
Se não, faz algum tratamento à água para poder bebê-la?	
Principal fonte/origem da água consumida	

Quanto tempo leva para recolher água por dia?	
A sua casa está ligada à rede eléctrica?	
Principal fonte de energia de iluminação	
Principal fonte de energia para cozinhar	
Existe rede de saneamento público para tratar os esgotos sanitários?	
Para onde é encaminhado o esgoto/águas residuais domésticas produzidas na sua habitação?	
Existe recolha municipal de resíduos onde habita?	
Se sim, quem gere os resíduos urbanos?	
Onde deposita os resíduos produzidos?	
Existe lixeira controlada ou aterro na proximidade da sua habitação?	
2.2.6. Condições de Habitação	
Possui habitação própria?	
Materiais de construção da habitação (predominante) - paredes	
Materiais de construção da habitação (predominante) - tecto	
Módulo 2 - Auscultação, Participação e Consulta às Partes Interessadas	
Q1 - Já ouviu falar do Projecto? Se sim, como?	
Q2 - Que benefícios e/ou melhorias considera que o projecto irá trazer?	
Q3 - Ao longo do projecto como prefere receber informação?	
Q4 - Que medidas compensatórias poderão ser implementadas na sua comunidade para melhorar a qualidade de vida? (resposta livre)	

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Annex III – List of Equipment that will be used in the Construction Phase of the Project

HISTOGRAMAS

COD	DESCRICION	CANT. PICO	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
	EQUIPAMENTOS		136	127	131	208	226	235	235	235	226	235	127	139	136	127	131	216
IEP017	CAMINHAO BASCULANTE (6x4/16 m3)	200	-	-	-	-	-	-	6	8	9	10	23	45	67	105	127	92
IEP123	MOTONIVELADORA (160 a 190 hp)	22	-	-	-	-	-	-	1	1	1	2	3	5	8	12	14	10
IEP266	CENTRAL DE BRITAGEM FIXA (080 a 120 m3/h) NOVO	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP078	ESCAVADEIRA HIDRAULICA SOBRE ESTEIRAS (35 t / 2,2 m3)	15	-	-	-	-	-	-	1	1	1	1	2	4	5	8	9	7
IEP039	CAMINHAO PIPA ASPERSOR (6x4 / 20.000 litros)	25	-	-	-	-	-	-	1	1	1	2	3	6	9	13	16	12
IEP170	TRATOR DE ESTEIRAS COM RIPPER (200 hp)	12	-	-	-	-	-	-	1	1	1	1	2	3	4	6	8	6
IEP157	ROLO VIBRATÓRIO AUTOPROPULSOR LISO-PATA (12t)	26	-	-	-	-	-	-	1	1	2	2	3	6	9	14	17	12
IEP179	USINA DE ASFALTO GRAVIMETRICA FIXA (120 a 140 t/h)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP043	CARREGADEIRA FRONTAL DE PNEUS (18 t / 3,0 m3)	7	-	-	-	-	-	-	1	1	1	1	1	2	3	4	4	3
IEP216	CAVALO MECÂNICO (6X4)	9	-	-	-	-	-	-	1	1	1	1	1	2	3	5	6	4
IEP042	CARREGADEIRA FRONTAL DE PNEUS (12 t / 1,8 m3)	8	-	-	-	-	-	-	1	1	1	1	1	2	3	4	5	4
IEP257	ACABADORA / DISTRIBUIDORA DE AGREGADOS (160HP 700 ton/h)	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP181	USINA DE SOLOS SEMI-MOVEL (500t/h)	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP174	TRATOR DE PNEUS AGRICOLA (120 hp / 05 t)	14	-	-	-	-	-	-	1	1	1	1	2	3	5	7	9	7
IEP147	RETROESCAVADEIRA (7 t / 0,8 m3)	9	-	-	-	-	-	-	1	1	1	1	1	2	3	5	6	4
IEP101	GUINDASTE PNEUS AT / LANÇA TELESCOPICA CAP. 080t / LANÇA = 50,0m	2	-	-	-	-	-	-	1	1	1	1	1	1	1	1	2	1
IEP154	ROLO VIBRATORIO AUTOPROPULSOR DE PNEUS (27t com lastro)	7	-	-	-	-	-	-	1	1	1	1	1	2	3	4	4	3
IEP026	CAMINHAO DIST. ASFALTO (6x4) + TANQUE ESPARGIDOR EHR600	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP020	CAMINHAO BETONEIRA (6x4 / 08 m3)	4	-	-	-	-	-	-	1	1	1	1	1	1	2	2	3	2
IEP046	CARRETA DE PERFURAÇÃO HIDRAULICA (13 t / furos de 2" a 4")	2	-	-	-	-	-	-	1	1	1	1	1	1	1	1	2	1
IEP159	SEMIRREBOQUE (PRANCHA) 3 EIXOS 45t	9	-	-	-	-	-	-	1	1	1	1	1	2	3	5	6	4
IEP097	GRUPO GERADOR (500 KVA)	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP032	CAMINHAO GUINDAUTO (CAP = 15tm)	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP023	CAMINHAO CARROCERIA (cap. carga = 07 t)	4	-	-	-	-	-	-	1	1	1	1	1	1	2	2	2	2
IEP189	VIBROACABADORA DE ASFALTO SOBRE ESTEIRAS 700T/H	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP041	CAMINHAO SILO DE CIMENTO 26T COM COMPRESSOR	2	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP183	VEICULO UTILITARIO PICK-UP CS 4X4 (CAP CARGA = 1000 KG)	4	-	-	-	-	-	-	1	1	1	1	1	1	2	2	3	2
IEP091	GRUPO GERADOR (125 KVA)	4	-	-	-	-	-	-	1	1	1	1	1	1	2	2	3	2
IEP118	MARTELO ROMPEDOR HIDRÁULICO 2.500kg	2	-	-	-	-	-	-	1	1	1	1	1	1	1	1	2	1
IEP167	TORRE DE ILUMINAÇÃO REBOCAVEL (4 X 1000 W)	15	-	-	-	-	-	-	1	1	1	1	2	4	5	8	10	7
IEP057	CENTRAL DE CONCRETO MISTURADORA FIXA (60 m3/h)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP095	GRUPO GERADOR (275 KVA)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP088	GRUPO GERADOR (040 KVA)	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP165	TANQUE DE ASFALTO A QUENTE (10 a 30 m3)	4	-	-	-	-	-	-	1	1	1	1	1	1	2	2	3	2
IEP061	COMPACTADOR DE PLACA VIBRATORIA (20 kN)	4	-	-	-	-	-	-	1	1	1	1	1	1	2	2	2	2
IEP151	ROLO COMPACTADOR ESTÁTICO TANDEM (10 t)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP067	CONJUNTO MOTO BOMBA (SAÍDA = 03")	5	-	-	-	-	-	-	1	1	1	1	1	2	2	3	4	3
IEP182	VASSOURA MECANICA AUTOPROPELIDA	3	-	-	-	-	-	-	1	1	1	1	1	1	1	2	2	2
IEP021	CAMINHAO BOMBA DE CONCRETO (40 a 60 m3/h)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP126	MOTOSERRA A GASOLINA 3.1CV	7	-	-	-	-	-	-	1	1	1	1	1	2	3	4	5	4
IEP163	TANQUE DE AGUA REFORÇADO (20 a 30 m3)	7	-	-	-	-	-	-	1	1	1	1	1	2	3	4	5	4
IEP262	MAQUINA EXTRUSORA DE MEIO-FIO IMB 900-G	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP113	MAQUINA DE SOLDA RETIFICADORA	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP063	COMPRESSOR DE AR PORTATIL DIESEL (200 a 300 pcm)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP185	SILO PARA CENTRAL DE CONCRETO COMPLETO 70t	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP059	CENTRAL DE PENEIRAMENTO (500 T/h)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP060	CONJUNTO OXI-CORTE	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP089	GRUPO GERADOR (075 KVA)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP116	MAQUINA PARA DOBRAR FERRO (CA50 até 38 mm)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP115	MAQUINA PARA CORTAR FERRO (CA50 até 50 mm)	1	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP186	VIBRADOR DE IMERSAO A GASOLINA (diametro = 105 mm)	2	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
IEP209	CAMINHAO GUINDAUTO (cap = 23tm)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IEP219	CENTRAL DE BRITAGEM FIXA (80 a 120m3/h)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	EQUIPAMENTOS PESADOS	133	0	0	0	0	0	0	16	16	17	18	23	36	50	73	87	65
	EQUIPAMENTOS LEVES	255	0	0	0	0	0	0	15	17	18	20	34	60	89	135	163	120
	EQUIPAMENTOS INDUSTRIAIS	8	0	0	0	0	0	0	4	4	4	4	4	4	4	6	6	6
	EQUIPAMENTOS DIVERSOS	74	0	0	0	0	0	0	21	21	21	21	22	28	35	45	54	43
	EQUIPAMENTOS MECANICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	470	0	0	0	0	0	0	56	58	60	63	83	128	178	259	310	234

COD	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32
EQUIPAMENTOS	218	235	235	235	226	235	127	145	174	166	163	208	226	235	235	235
IEP017	109	102	104	108	113	108	200	175	146	153	156	122	113	108	108	108
IEP123	12	11	12	12	13	12	22	19	16	17	17	14	13	12	12	12
IEP266	2	2	2	2	2	2	3	3	2	2	3	2	2	2	2	2
IEP078	8	8	8	8	8	8	15	13	11	11	12	9	8	8	8	8
IEP039	14	13	13	14	14	14	25	22	18	19	19	15	14	14	14	14
IEP170	7	6	6	7	7	7	12	10	9	9	9	7	7	7	7	7
IEP157	14	14	14	14	15	14	26	23	19	20	21	16	15	14	14	14
IEP179	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP043	4	4	4	4	4	4	7	6	5	5	5	4	4	4	4	4
IEP216	5	5	5	5	5	5	9	8	7	7	7	6	5	5	5	5
IEP042	4	4	4	4	5	4	8	7	6	6	6	5	5	4	4	4
IEP257	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2
IEP181	2	2	2	2	2	2	3	3	2	3	3	2	2	2	2	2
IEP174	8	7	7	8	8	8	14	12	10	11	11	9	8	8	8	8
IEP147	5	5	5	5	5	5	9	8	7	7	7	6	5	5	5	5
IEP101	1	1	1	1	2	1	2	2	2	2	2	2	2	1	1	1
IEP154	4	4	4	4	4	4	7	6	5	5	5	4	4	4	4	4
IEP026	2	2	2	2	2	2	3	3	2	3	3	2	2	2	2	2
IEP020	2	2	2	2	2	2	4	3	3	3	3	2	2	2	2	2
IEP046	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1
IEP159	5	5	5	5	5	5	9	8	7	7	7	6	5	5	5	5
IEP097	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	2
IEP032	2	2	2	2	2	2	3	3	2	2	3	2	2	2	2	2
IEP023	2	2	2	2	2	2	4	3	3	3	3	2	2	2	2	2
IEP189	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP041	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
IEP183	2	2	2	2	3	2	4	4	3	3	3	3	3	2	2	2
IEP091	2	2	2	2	2	2	4	4	3	3	3	3	2	2	2	2
IEP118	1	1	1	1	2	1	2	2	2	2	2	2	2	1	1	1
IEP167	8	8	8	8	9	8	15	13	11	11	12	9	9	8	8	8
IEP057	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP095	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP088	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	2
IEP165	2	2	2	2	2	2	4	4	3	3	3	3	2	2	2	2
IEP061	2	2	2	2	2	2	4	3	3	3	3	2	2	2	2	2
IEP151	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP067	3	3	3	3	3	3	5	5	4	4	4	4	3	3	3	3
IEP182	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2
IEP021	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP126	4	4	4	4	4	4	7	6	5	6	6	5	4	4	4	4
IEP163	4	4	4	4	4	4	7	6	5	5	6	4	4	4	4	4
IEP262	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP113	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP063	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP185	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP059	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP060	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP089	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP116	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP115	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEP186	1	1	1	1	1	1	2	2	1	2	2	1	1	1	1	1
IEP209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IEP219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EQUIPAMENTOS PESADOS	75	72	73	75	79	75	133	117	99	102	104	85	79	75	75	75
EQUIPAMENTOS LEVES	140	132	134	139	145	139	255	223	186	195	199	156	145	139	139	139
EQUIPAMENTOS INDUSTRIAIS	6	6	6	6	6	6	8	8	6	7	8	6	6	6	6	6
EQUIPAMENTOS DIVERSOS	45	45	45	45	47	45	74	68	59	61	63	52	47	45	45	45
EQUIPAMENTOS MECANICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	266	255	258	265	277	265	470	416	350	365	374	299	277	265	265	265

COD	M33	M34	M35	M36	M37	M38	M39	M40	M41	M42	M43	M44	M45	M46	M47	M48
EQUIPAMENTOS	226	235	163	172	174	166	163	208	226	235	235	235	226	235	160	174
IEP017	113	108	156	148	146	153	156	122	106	81	57	23	7	3	-	-
IEP123	13	12	17	16	16	17	17	14	12	9	7	3	1	1	-	-
IEP266	2	2	3	2	2	2	3	2	2	2	1	1	1	1	-	-
IEP078	8	8	12	11	11	11	12	9	8	6	4	2	1	1	-	-
IEP039	14	14	19	18	18	19	19	15	13	10	7	3	1	1	-	-
IEP170	7	7	9	9	9	9	9	7	6	5	4	2	1	1	-	-
IEP157	15	14	21	20	19	20	21	16	14	11	8	3	1	1	-	-
IEP179	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP043	4	4	5	5	5	5	5	4	4	3	2	1	1	1	-	-
IEP216	5	5	7	7	7	7	7	6	5	4	3	1	1	1	-	-
IEP042	5	4	6	6	6	6	6	5	4	3	3	1	1	1	-	-
IEP257	2	2	2	2	2	2	2	2	2	2	1	1	1	1	-	-
IEP181	2	2	3	3	2	3	3	2	2	2	1	1	1	1	-	-
IEP174	8	8	11	10	10	11	11	9	8	6	4	2	1	1	-	-
IEP147	5	5	7	7	7	7	7	6	5	4	3	1	1	1	-	-
IEP101	2	1	2	2	2	2	2	2	1	1	1	1	1	1	-	-
IEP154	4	4	5	5	5	5	5	4	4	3	2	1	1	1	-	-
IEP026	2	2	3	2	2	3	3	2	2	2	1	1	1	1	-	-
IEP020	2	2	3	3	3	3	3	2	2	2	1	1	1	1	-	-
IEP046	1	1	2	2	2	2	2	2	1	1	1	1	1	1	-	-
IEP159	5	5	7	7	7	7	7	6	5	4	3	1	1	1	-	-
IEP097	2	2	3	3	3	3	3	2	2	2	1	1	1	1	-	-
IEP032	2	2	3	2	2	2	3	2	2	2	1	1	1	1	-	-
IEP023	2	2	3	3	3	3	3	2	2	2	1	1	1	1	-	-
IEP189	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP041	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP183	3	2	3	3	3	3	3	3	2	2	2	1	1	1	-	-
IEP091	2	2	3	3	3	3	3	3	2	2	1	1	1	1	-	-
IEP118	2	1	2	2	2	2	2	2	1	1	1	1	1	1	-	-
IEP167	9	8	12	11	11	11	12	9	8	6	5	2	1	1	-	-
IEP057	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP095	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP088	2	2	3	3	3	3	3	2	2	2	1	1	1	1	-	-
IEP165	2	2	3	3	3	3	3	3	2	2	1	1	1	1	-	-
IEP061	2	2	3	3	3	3	3	2	2	2	1	1	1	1	-	-
IEP151	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP067	3	3	4	4	4	4	4	4	3	3	2	1	1	1	-	-
IEP182	2	2	2	2	2	2	2	2	2	1	1	1	1	1	-	-
IEP021	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP126	4	4	6	5	5	6	6	5	4	3	2	1	1	1	-	-
IEP163	4	4	6	5	5	5	6	4	4	3	2	1	1	1	-	-
IEP262	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP113	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP063	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP185	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP059	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP060	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP089	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP116	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP115	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
IEP186	1	1	2	1	1	2	2	1	1	1	1	1	1	1	-	-
IEP209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IEP219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EQUIPAMENTOS PESADOS	79	75	104	100	99	102	104	85	74	58	44	23	16	16	0	0
EQUIPAMENTOS LEVES	145	139	199	188	186	195	199	156	136	107	75	34	16	12	0	0
EQUIPAMENTOS INDUSTRIAIS	6	6	8	7	6	7	8	6	6	6	4	4	4	4	0	0
EQUIPAMENTOS DIVERSOS	47	45	63	59	59	61	63	52	45	40	30	22	21	21	0	0
EQUIPAMENTOS MECANICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	277	265	374	354	350	365	374	299	261	211	153	83	57	53	0	0

Annex IV – OP 02 Coexistence Rules_EN_Rev03

Version	Date	Short Description
00	02/01/2018	Initial Issue
01	09/09/2020	General revision of the procedure
02	04/08/2021	General revision replacement of the word HSEQSR by Area of Sustainability or just Sustainability.
03	16/08/2022	General review.

INDEX

1 Purpose

Set up basic rules of coexistence in the works and accommodation of QGMI.

2 Aplication

This procedure is applicable to all QGMI projects.

3 Clarifications / Definitions

Construction Site/Camp – Demarcated, closed area with access control, where our offices, workshops, industrial areas, cafeteria, etc. are installed and are dedicated to the work and coexistence of our employees.

4 Responsabilities

DIDEN:

Disseminate this procedure to all enterprises and support and monitor compliance with this procedure in the works.

SUOPE:

Ensure that the requirements of this procedure are fully complied with.

READI:

- Disseminate and implement this procedure;
- Designate the resources to monitor and ensure that the procedure is followed by all QGMI workers and third parties, during the entire term of the contract;

5 Description

5.1 QGMI Construction Facilities

A key aspect in the mobilization of the works is the construction of the construction works. Although most of the time it is a temporary structure, building it properly is of extremely important for the support and success of the activities that will be developed later. The construction sites must be functional and planned to meet the contract, the QGMI demands of the administrative and operational departments, the inspection and the client. QGMI's construction sites also transmit the Construction company's image to society, customers, employees, etc.

Therefore, its location and access should be the subject of preliminary analysis to avoid costs arising from excessive travel time. Its construction must take into account the

contractual term and demobilization to avoid undue costs in the consumption of materials, maintenance labor and facilities of sophisticated and extensive utilities. The construction site must be properly identified and in accordance with the QGMI brand manual. All of this is of course, without losing the focus on the preferred customer of the facilities - the employees - who must be assisted in their basic needs of hygiene, comfort and safety.

The standard models of construction sites are basically composed of the following administrative and industrial facilities:

- Office of QGMI;
- Client's office;
- Inspection Office;
- Wharehouse;
- Clinic;
- Body shop;
- Laboratory;
- Cafeterias;
- Parking lots;
- Industrial Plants;
- Preparation yards of materials, precast, cut and bend steel, etc.
- Accommodation;
- Leisure and Living Areas.

In order for these facilities to function in an organized manner and in line with the philosophy of QGMI, it is essential that the rules of coexistence described below are followed.

5.2 Connivance Rules in QGMI's construction facilities

5.2.1 Entrance and Exit:

- Entry and exit to the project facilities must be made through the main gates properly identified. It is forbidden to use other entry or exit points;
- Vehicles can be inspected by the security guards systematically or randomly;
- Only QGMI employees and outsourced employees are allowed to enter, duly identified with the badge provided by QGMI. It is forbidden to lend the personal badge to third parties;

- Visitors who are not employees of QGMI or Subcontracted Companies, must identify themselves at the entrance and await authorization from security guards;
- Outsourced personnel who will stay, will only be able to access the accommodation module with prior formal authorization issued by a QGMI employee;
- QGMI employees visiting the site, who will be staying at the accommodation, must inform the Administrative Manager (READI) of the site in advance;

Visitors of any gender or age are prohibited from entering the accommodation without prior authorization of a Construction Manager.

5.2.2 Coexistence Rules:

- It is prohibited to transport, carry, consume or sell alcoholic beverages or drugs;
- The company will carry out alcohol and drug detection tests on the accommodation staff, either occupational tests or checks that can be carried out at the camp, if deemed necessary;
- Smoking is forbidden in the office, rooms, and other areas that are not designated for this purpose;
- It is forbidden to carry fuels, heaters, bottled gases, electrical devices for food preparation or any other device that may cause fire, asphyxiation or poisoning;
- It is prohibited to carry and possess weapons of any kind;
- All staff are required to maintain order and cleanliness in bedrooms, cafeterias, recreation spaces, bathrooms, changing rooms, offices, etc.;
- Gambling and any other type of games involving betting are prohibited;
- Personal disputes with verbal and physical offenses are prohibited;
- Periodic inspections will be carried out by security personnel and general services in homes, recreation spaces, cafeterias, offices, etc.
- Any and all material damage generated on purpose or through negligence, must be reimbursed to QGMI by the person responsible for the damage, either replacing the damaged material or paying the financial value of the damage;
- Every worker will sign a liability form for the goods that will be in their room in the accommodation. In the case of shared rooms, this form must also be signed by all occupants. If an incident occurs, the person responsible will be investigated, so that the necessary action is taken;

- It is not allowed to make physiological needs outside the appropriate places for this (bathrooms and chemical toilets);
- It is forbidden to walk in underwear or without a shirt;
- Any symptoms of illness, malaise, congestion, fever, etc. must be reported to the immediate head and the medical service;
- It is forbidden to change rooms without prior authorization;
- It is prohibited to modify (paint or change the initial configuration) of the beds and furniture that are in the accommodation;
- Male workers are prohibited from entering female housing areas and vice versa, with the exception of cleaning, maintenance, surveillance and medical attention employees who need to perform their duties in this location;
- Everyone must respect the times for recreation and rest in the accommodation;
  - Night hours of rest between 22:00 and 05:30 must be respected. During these times, avoid using equipment or devices that generate noise, such as stereos, recorders, television at high volume, among others;
  - Avoid keeping the lights on in corridors and common areas after 10:00 pm
- QGMI will be able to monitor through cameras in common areas;

The company is not responsible for any accident or damage that may occur outside of QGMI's premises during non-working hours.

5.2.3 Vehicles:

- All motor vehicles, such as trucks, light vehicles and motorcycles, must be parked in the assigned parking spot and identified by the Administration;
- Vehicles parked outside the spots assigned by the Administration, will be removed from QGMI areas and the owner of the vehicle will be notified. In the event of a repeat offense, the vehicle will not be allowed to enter QGMI's premises;
- The maximum speed of any vehicle within the QGMI areas (construction sites, accommodation, etc.) is 15 km/h;
- Inside the construction site, vehicles must be parked in reverse;
- The use of QGMI vehicles, outside the work shift, can only be done with prior authorization of the work management.

5.2.4 Non-compliance with the rules:

- Any breach of the rules described above, must be reported to the Administrative Manager (READI) and/or the Contract Manager (RECON), who will take the appropriate measures;
- Any breach of rules may be sanctioned with the work suspension of the offending person, and in the most serious cases, dismissal for just cause or other sanctions, as permitted by the country's labor law.

5.3 Operational Controls for Safety, Environment, Health and Social Responsibility

Depending on the Aspects, Impacts, Dangers and Significant Damages identified, related to the rules of coexistence, they should, when applicable:

- Control the waste generated as described in a corporate procedure or in a specific procedure for waste control;
- Depending on the necessary activities described in this procedure, ergonomic care must be identified;
- Adopt, in an emergency, procedures related to the escape route and the prompt attendance to such situations.

6 Records

Liability Form

Facilities Inspection Report

7 References

Not applicable.

8 Attachments

Not applicable.

Annex V – Environmental Monitoring Sheets – Water Resources

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 14h00

Meteorological conditions:

Temperature: 26 ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P1

Description: River Sapo located next to the bridge at km 79+400 on the road section between Rio Sapo and Cazombo

Coordinates (GPS):

Latitude = -11.195270°

Longitude = 22.713942°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	20,67
pH (Sorensen Scale)	7,35
Electrical Condutivity (µS/cm)	244,00
Dissolved oxygen (%)	113,90

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:

Observations: During the monitoring carried out, it was found that the local population used this water line to carry out their personal hygiene as well as wash their clothes.

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 15h00

Meteorological conditions:

Temperature: 26ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P2

Description: River Maquenhe located next to the bridge at km 86+400 on the road section between River Sapo and Cazombo

Coordinates (GPS):

Latitude = -11.243617°

Longitude = 22.754775°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	21,02
pH (Sorensen Scale)	8,09
Electrical Condutivity (µS/cm)	235,00
Dissolved oxygen (%)	106,12

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:



Observations: During the monitoring carried out, it was found that the local population used this water line to carry out their personal hygiene. At the same time, near the river it was found that the population had spilled oil directly on the ground.

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 10h30

Meteorological conditions:

Temperature: 26ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P3

Description: Waterline located next to the bridge at km 118+500 on the road section between River Sapo and Cazombo

Coordinates (GPS):

Latitude = -11.495995°

Longitude = 22.850787°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	20,43
pH (Sorensen Scale)	7,40
Electrical Condutivity (µS/cm)	188,00
Dissolved oxygen (%)	125,10

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:

Observations: During the monitoring carried out, it was found that the local population used this water line to carry out their personal hygiene.

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 08h00min

Meteorological conditions:

Temperature: 27ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P4

Description: Waterline located next to the bridge at km 27+450 on the road section between River Sapo and Cazombo

Coordinates (GPS):

Latitude = -12.105154°

Longitude = 22.793214°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	21,39
pH (Sorensen Scale)	7,50
Electrical Condutivity (µS/cm)	191,00
Dissolved oxygen (%)	131,80

Organoleptic Description:

Color: Colorless;

Appearance: Slightly turbid;

Smell: Odorless.

Photographic register:

Observations: The local population used this water line to carry out their personal hygiene.

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 09h30min

Meteorological conditions:

Temperature: 27ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P5

Description: River Muhaco located next to the bridge at km 39+175 on the road section between Cazombo and Lumbala

Coordinates (GPS):

Latitude = -12.170360°

Longitude = 22.716672°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	21,80
pH (Sorensen Scale)	7,18
Electrical Condutivity (µS/cm)	225,00
Dissolved oxygen (%)	115,00

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:

Observations: --

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 10h00

Meteorological conditions:

Temperature: 27ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P6

Description: Waterline located next to the bridge at km 38+175 on the road section between Cazombo and Lumbala

Coordinates (GPS):

Latitude = -12.167186°

Longitude = 22.718134°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	21,04
pH (Sorensen Scale)	7,24
Electrical Condutivity (µS/cm)	230,01
Dissolved oxygen (%)	120,00

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:

Observations: --

Resurb Ambiente, Lda

ENVIRONMENTAL MONITORING FORM

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 11h15min

Meteorological conditions:

Temperature: 27,5ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P7

Description: Waterline located at km 50+590 on the road section between Cazombo and Lumbala where the *Box Culverts* will be implanted.

Coordenadas (GPS):

Latitude = -12.223395°

Longitude = 22.628655°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	20,30
pH (Sorensen Scale)	7,33
Electrical Condutivity (µS/cm)	263,40
Dissolved oxygen (%)	138,10

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:

Observations: --

Resurb Ambiente, Lda

ENVIRONMENTAL MONITORING FORM

ENVIRONMENTAL MONITORING SHEET - SURFACE WATER RESOURCES

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 12h00

Meteorological conditions:

Temperature: 27,5ºC

Sky: Clear

Precipitation: No Occurrence

Monitoring Program:

Point: P8

Description: Waterline located next to the bridge at km 52+700 on the road section between Cazombo and Lumbala

Coordenadas (GPS):

Latitude = -12.233864°

Longitude = 22.613224°

Sampling Type and Method:

- Manual sampling;
- Packing the samples in bottles appropriate to the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Results:

Parameters (*in situ* measurement)	
Temperature (º C)	20,45
pH (Sorensen Scale)	7,37
Electrical Condutivity (µS/cm)	274,00
Dissolved oxygen (%)	127,60

Organoleptic Description:

Color: Colorless;

Appearance: Clear;

Smell: Odorless.

Photographic register:

Observations: --

Annex VI – Environmental Monitoring Sheets - Traffic Count

ENVIRONMENTAL MONITORING SHEET - TRAFFIC COUNT

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 09h00

Meteorological conditions:

Temperature: 26,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: T1

Description: National Road 250 at the beginning of the road section between Sapo River and Cazombo (Pk 0+000)

Period: Daytime

Measuring time: 30min

Coordinates (GPS):

Latitude = -11.218513°

Longitude = 22.240665°

Monitoring Type:

Counting System: Manual

Results:

TRAFFIC COUNT:	
Vehicle Typology	**Number**
Motorcycles	9
Light	5
Heavy	--
Others	--
Total	**14**

Photographic register:

Observations: --

ENVIRONMENTAL MONITORING SHEET - TRAFFIC COUNT

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 16h30

Meteorological conditions:

Temperature: 26,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: T2

Description: National Road 250 at the end of the road section between Sapo River and Cazombo (Pk 196+000)

Período: Daytime

Measuring time: 30 min

Coordinates (GPS):

Latitude = -11.899122°

Longitude = 22.887215°

Monitoring Type:

Counting System: Manual

Results:

TRAFFIC COUNT:	
Vehicle Typology	**Number**
Motorcycles	8
Light	2
Heavy	--
Others	--
Total	**10**

Photographic register:

Observations: --

ENVIRONMENTAL MONITORING SHEET - TRAFFIC COUNT

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Hora: 08h15

Meteorological conditions:

Temperature: 27,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: T3

Description: National Road 190 at the beginning of the road section between Cazombo and Lumbala (Pk 0+000)

Period: Daytime

Measuring time: 30 min

Coordinates(GPS):

Latitude = -11.896476°

Longitude = 22.913628°

Monitoring Type:

Counting System: Manual

Results:

TRAFFIC COUNT:	
Vehicle Typology	**Number**
Motorcycles	8
Light	3
Heavy	1
Others	--
Total	**12**

Photographic register:

Observations: --

ENVIRONMENTAL MONITORING SHEET - TRAFFIC COUNT

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 16h40

Meteorological conditions:

Temperature: 27,5 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: T4

Description: National Road 190 at the end of the road section between Cazombo and Lumbala (Pk 196+000)

Period: Daytime

Measuring time: 30min

Coordinates (GPS):

Latitude = -12.378353°

Longitude = 22.583695°

Monitoring Type:

Counting System: Manual

Results:

TRAFFIC COUNT:	
Vehicle Typology	**Number**
Motorcycles	10
Light	5
Heavy	1
Others	--
Total	**16**

Photographic register:

Observations: --

Annex VII – Environmental Monitoring Sheets – Environmental Noise

ENVIRONMENTAL MONITORING FORM - ENVIRONMENTAL NOISE

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province **Place:** Moxico **Day:** 05/01/2023 **Time:** 09h30	**Meteorological conditions:** **Temperature:** 26,0 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Program: **Point**: Ramb 1 **Description:** Dwellings near the beginning of the road section between River Sapo and Cazombo (Pk 0+000) **Campaign:** Characterization of the Reference Situation **Measurement time:** 30 min	**Coordinates (GPS):** **Latitude =** 11°12'41.24"S **Longitude =** 22°14'30.30"E
Type of Monitoring: **Equipment:** CESVA Sonometer - Class 1 **Model:** SC 310	**Results:**

Point	Value (dB)
Ramb1	54,0

Photographic register:

Observations: During the monitoring, it was found that there were children playing near this place, as well as the noise coming from passing vehicles.

ENVIRONMENTAL MONITORING FORM - ENVIRONMENTAL NOISE

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province **Place:** Moxico **Day:** 05/01/2023 **Time:** 16h40	**Meteorological conditions:** **Temperature:** 26,0 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Program: **Point**: Ramb 2 **Description:** Dwellings are the end of the road section between Sapo River e Cazombo (Pk 196+000) **Campaign:** Characterization of the Reference Situation **Measurement time:** 30 min	**Coordinates (GPS):** **Latitude =** 11°53'47.26"S **Longitude =** 22°54'49.64"E
Type of Monitoring: **Equipment:** CESVA Sonometer - Class 1 **Model:** SC 310	**Results:** Point: Ramb2 — Value (dB): 52,6

Photographic register:

Observations: During monitoring it was noted that noise was coming from vehicles driving on the National Road 250.

ENVIRONMENTAL MONITORING FORM - ENVIRONMENTAL NOISE

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 08h30

Meteorological conditions:

Temperature: 27,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: Ramb 3

Description: Dwellings near the beginning of the road section between Cazombo and Lumbala (Pk 0+000)

Campaign: Characterization of the Reference Situation

Measurement time: 30 min

Coordinates (GPS):

Latitude = 11°53'56.91"S

Longitude = 22°53'12.17"E

Type of Monitoring:

Equipment: CESVA Sonometer - Class 1

Model: SC 310

Results:

Point	Value (dB)
Ramb3	52,9

Photographic register:

Observations: During monitoring, noise from vehicles driving near the monitored site (motorcycles) as well as noise from chirping birds was noted.

Resurb Ambiente, Lda

ENVIRONMENTAL MONITORING FORM

FICHA DE MONITORIZAÇÃO AMBIENTAL – RUÍDO AMBIENTAL

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province **Place:** Moxico **Day:** 06/01/2023 **Hora:** 16h30	**Meteorological conditions:** **Temperature:** 27,5 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Program: **Point**: Ramb 4 **Description:** Dwellings near the end of road section between Cazombo and Lumbala (Pk 196+000) **Campaign:** Characterization of the Reference Situation **Measurement time:** 30 min	**Coordinates (GPS):** **Latitude =** 12°22'59.72"S **Longitude =** 22°34'56.01"E
Type of Monitoring: **Equipment:** CESVA Sonometer - Class 1 **Model:** SC 310	**Results:** Point: Ramb4 — Value (dB): 51,3
Photographic register: 	
Observations: During monitoring noise was observed coming from people talking near the monitored site as well as some vehicles driving on the National Road 190.	

Annex VIII – Results of Environmental Monitoring - Characterization of the Environmental Noise

RESULTS OF ENVIRONMENTAL NOISE MONITORING

Monitoring Point: Ramb1

Date and time: 05/01/2023, 09:30:23

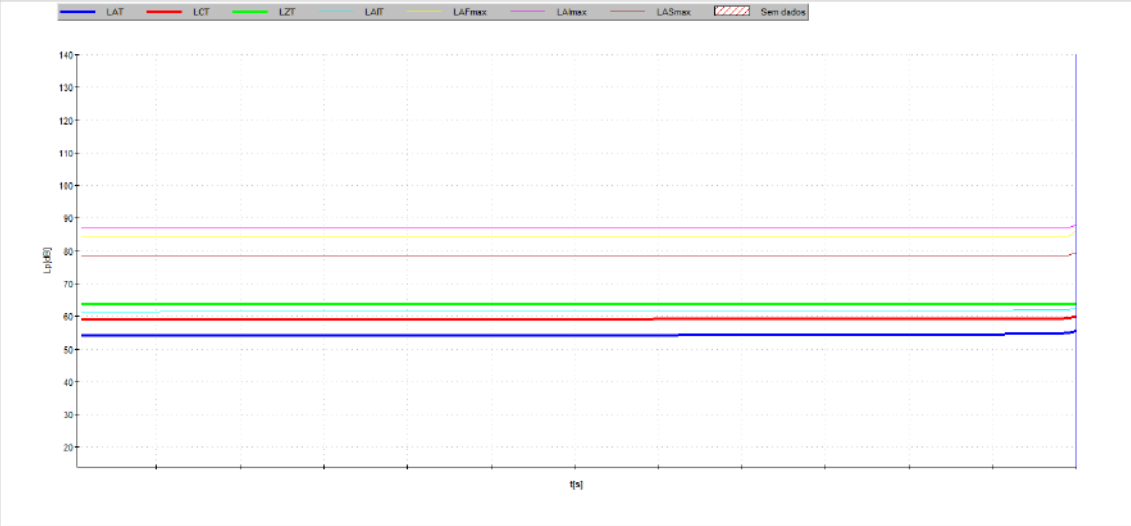


Figure 1 – Time graph, analyzer mode referring to monitoring point RAmb1.

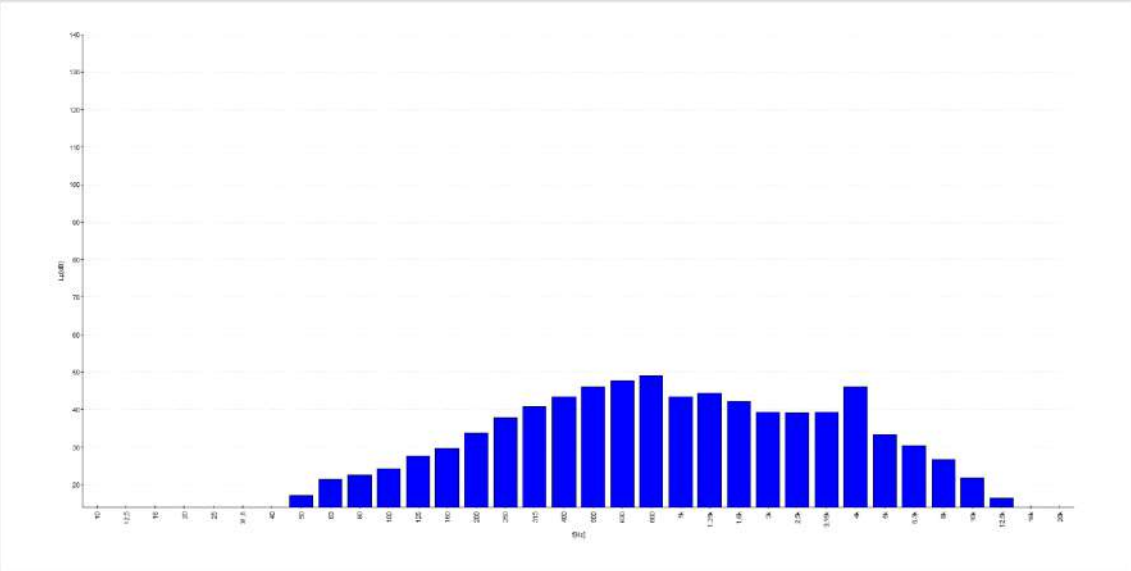


Figure 2 – Frequency graph, analyzer mode referring to the RAmb1 monitoring point.

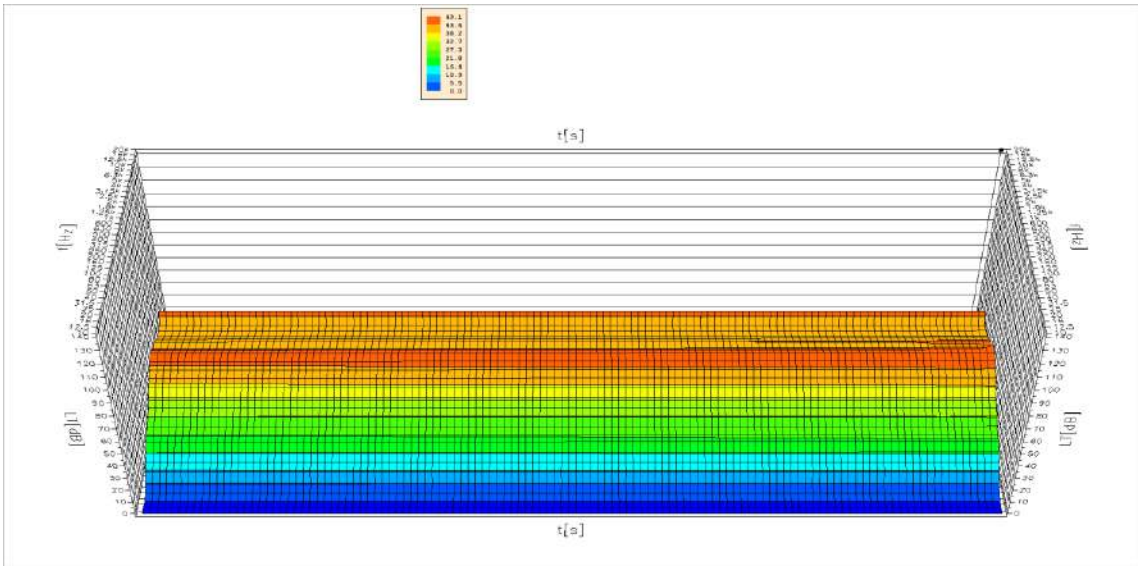


Figure 3 – 3D graph, analyzer mode referring to the RAmb1 monitoring point.

RESULTS OBTAINED

05/01/2023 09:30:23 T:00:30:00

	10Hz	12,5Hz	16Hz	20Hz	25Hz	31,5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	
	630Hz	800Hz	1kHz	1,25kHz		1,6kHz	2kHz	2,5kHz	3,15kHz		4kHz	5kHz	6,3kHz	8kHz	10kHz	12,5kHz		16kHz	20kHz
LT	---	---	---	1,9	5,5	10,7	13,4	17,2	21,4	22,5	24,3	27,6	29,7	33,7	37,9	40,9	43,3	46,0	47,8
	49,1	43,4	44,3	42,1	39,2	39,1	39,2	46,0	33,5	30,5	26,6	21,7	16,3	9,9	4,0				

LAT: 54,0 dBA
LCT: 59,7 dBC
LZT: 64,0 dBZ
LAIT: 62,7 dBA
LAFmax: 86,2 dBA
LAImax: 88,2 dBA
LASmax: 79,5 dBA
LAIT-LAT: 7,3 dBA
LAFmax-LAT: 30,8 dBA
LAImax-LAFmax: 2,0 dBA
LAImax-LASmax: 8,7 dBA

Global data

Duration: 0000:30:00
Beginning: 05/01/2023 09:30:23
End: 05/01/2023 10:00:23

Monitoring Point: Ramb2

Date and Time: 05/01/2023, 16:40:17

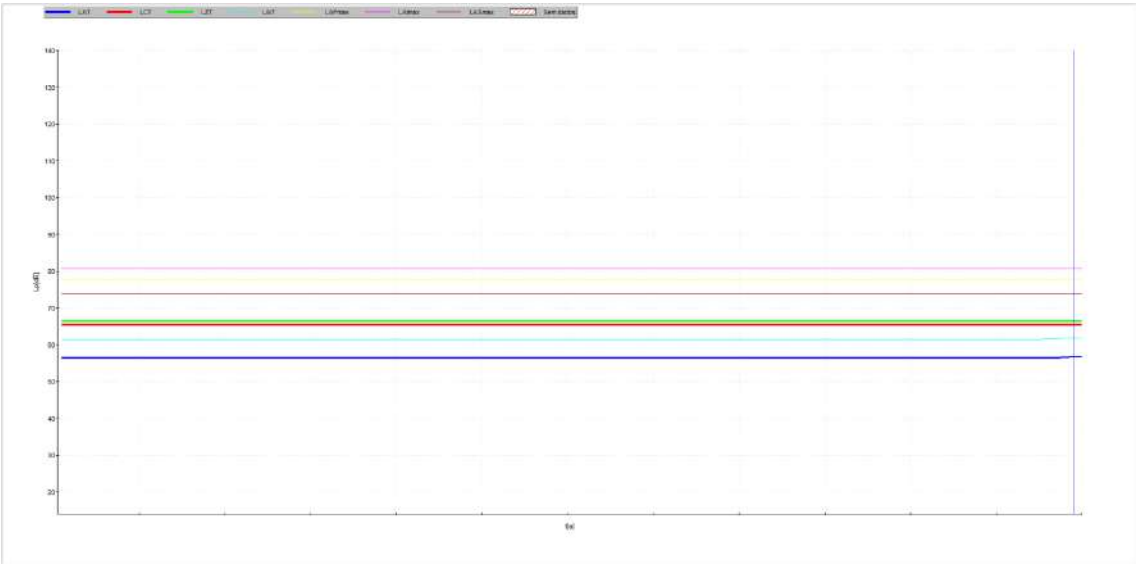


Figure 4 – Time graph, analyzer mode referring to the RAmb2 monitoring point.

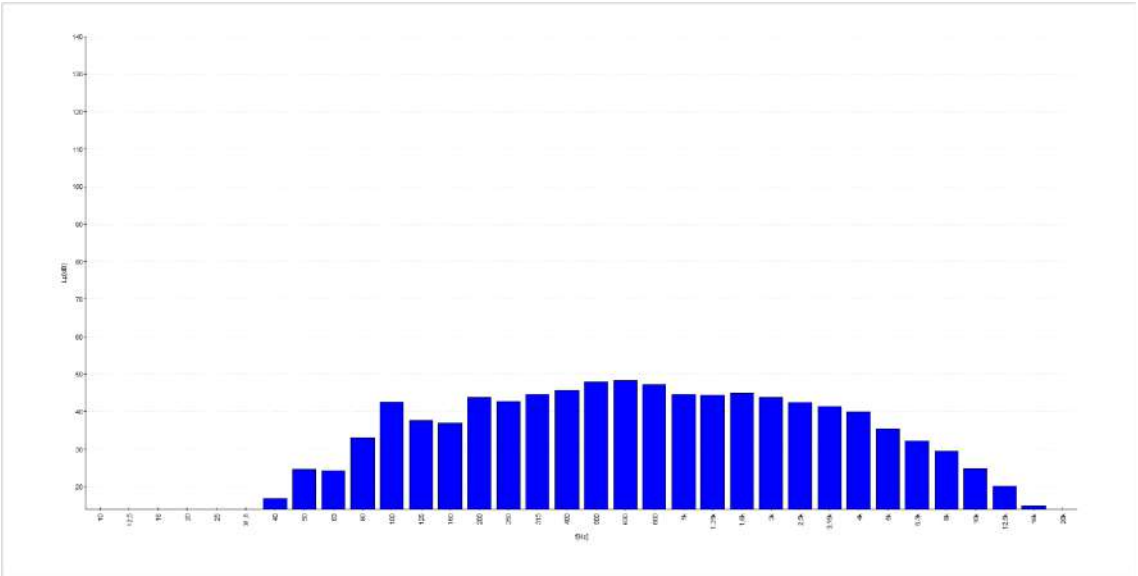


Figure 5 – Frequency graph, analyzer mode referring to the RAmb2 monitoring point.

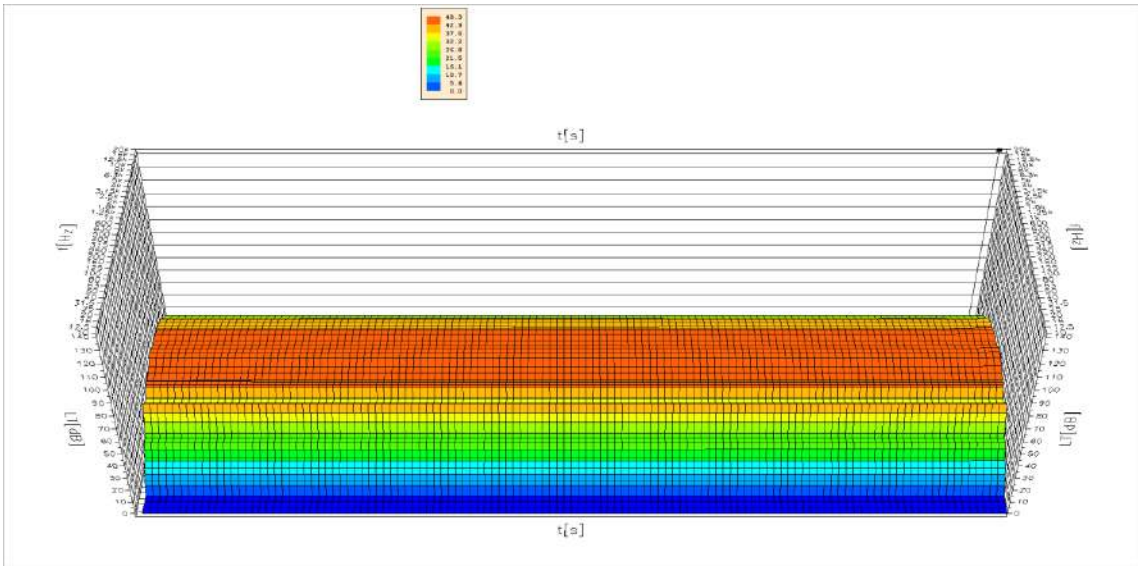


Figure 6 – 3D graph, analyzer mode referring to the RAmb2 monitoring point.

RESULTS OBTAINED

05/01/2023 16:40:17 T:00:30:05

	10Hz	12,5Hz	16Hz	20Hz	25Hz	31,5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	
	630Hz	800Hz	1kHz	1,25kHz		1,6kHz	2kHz	2,5kHz	3,15kHz		4kHz	5kHz	6,3kHz	8kHz	10kHz	12,5kHz		16kHz	20kHz
LT	---	---	---	---	8,2	13,5	16,9	24,6	24,2	33,0	42,6	37,7	36,9	43,9	42,7	44,7	45,8	47,9	48,3
	47,2	44,6	44,3	44,9	43,8	42,4	41,3	39,9	35,4	32,2	29,4	24,8	20,1	14,9	7,9				

LAT: 52,6 dBA
LCT: 65,5 dBC
LZT: 66,4 dBZ
LAIT: 61,8 dBA
LAFmax: 77,9 dBA
LAImax: 80,6 dBA
LASmax: 73,9 dBA
LAIT-LAT: 5,1 dBA
LAFmax-LAT: 21,2 dBA
LAImax-LAFmax: 2,7 dBA
LAImax-LASmax: 6,7 dBA

Global data

Duration: 0000:30:05
Beginning: 05/01/2023 16:40:17
End: 05/01/2023 17:10:22

Monitoring Point: Ramb3

Date and Time: 06/01/2023, 08:30:38

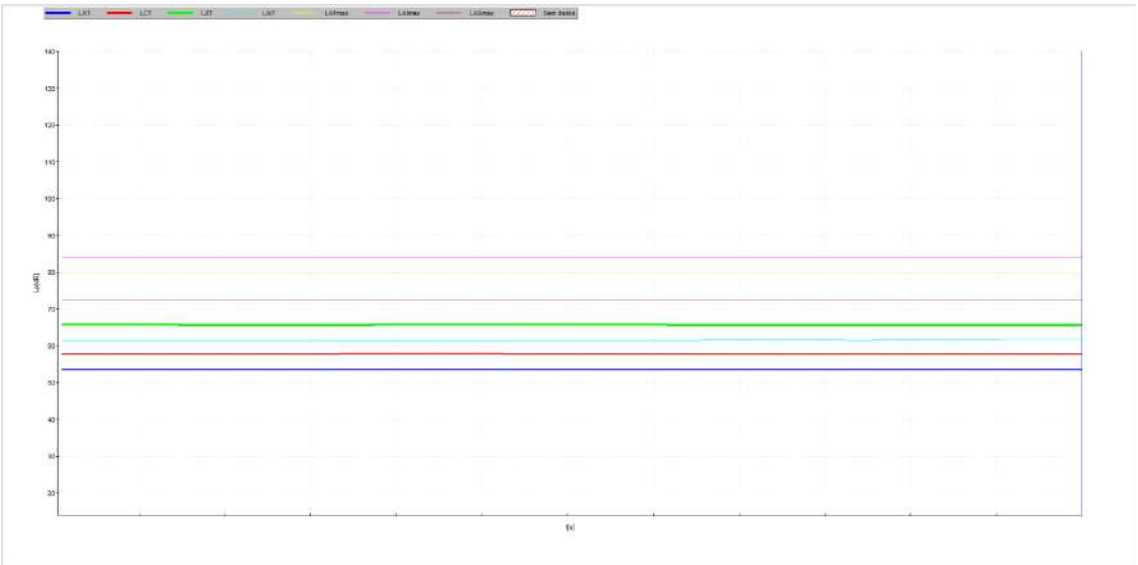


Figure 7 – Time graph, analyzer mode referring to the RAmb3 monitoring point.

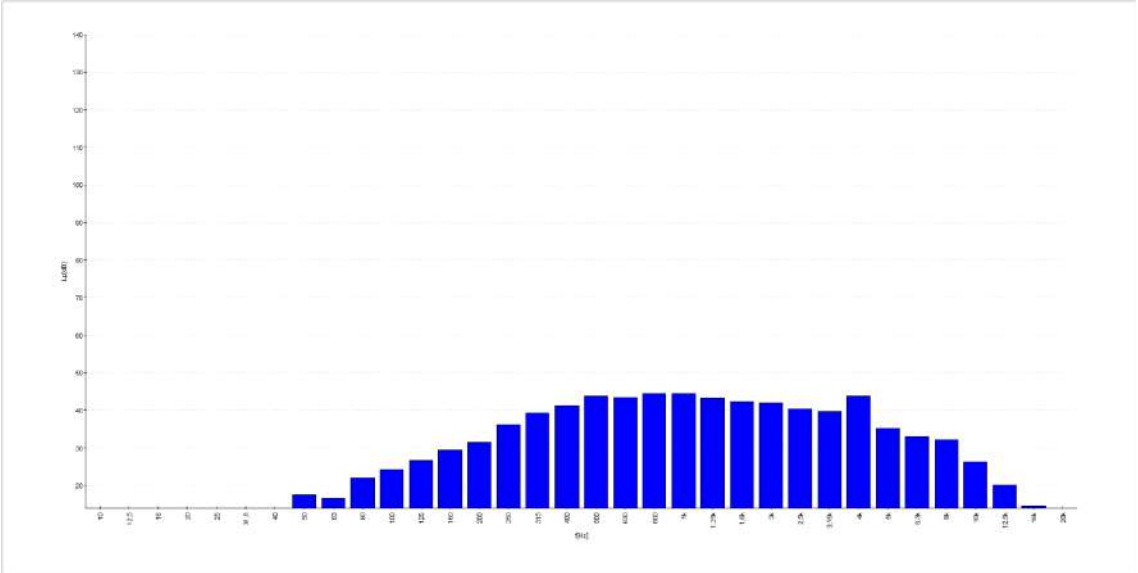


Figure 8 – Frequency graph, analyzer mode referring to the RAmb3 monitoring point.

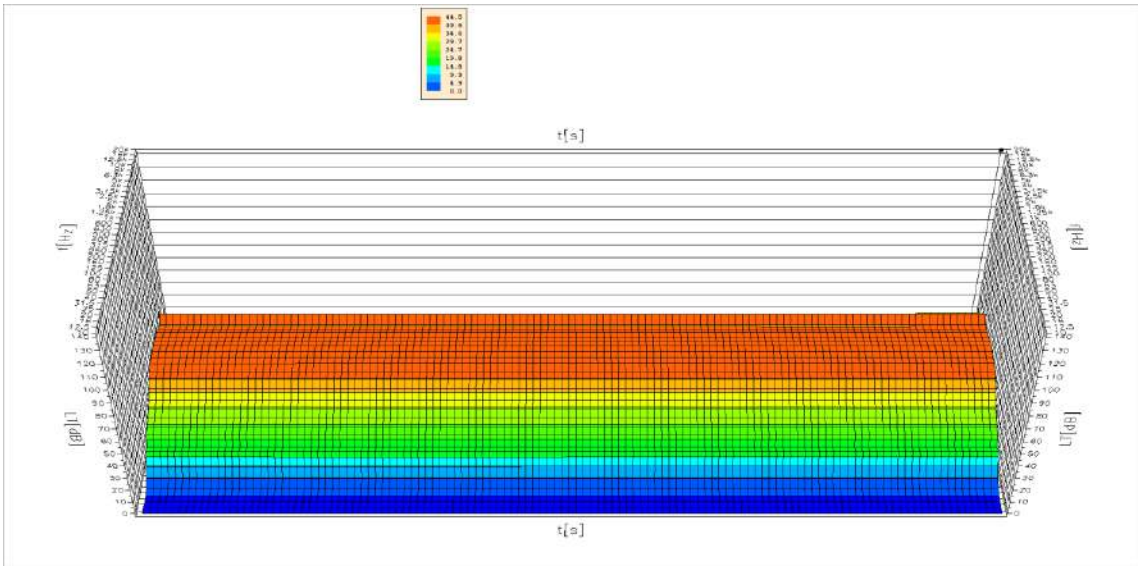


Figure 9 – 3D graph, analyzer mode referring to the RAmb3 monitoring point.

RESULTS OBTAINED

06/01/2023 08:30:38 T:00:30:08

	10Hz	12,5Hz	16Hz	20Hz	25Hz	31,5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	
	630Hz	800Hz	1kHz	1,25kHz		1,6kHz	2kHz	2,5kHz	3,15kHz		4kHz	5kHz	6,3kHz	8kHz	10kHz	12,5kHz		16kHz	20kHz
LT	---	---	---	---	1,6	4,5	9,9	17,5	16,5	22,1	24,2	26,6	29,4	31,6	36,1	39,3	41,2	43,8	43,4
	44,5	44,4	43,2	42,2	42,0	40,3	39,7	43,8	35,2	32,9	32,1	26,3	20,2	14,4	6,4				

LAT: 52,9 dBA
LCT: 57,8 dBC
LZT: 65,7 dBZ
LAIT: 61,8 dBA
LAFmax: 79,8 dBA
LAImax: 84,1 dBA
LASmax: 72,5 dBA
LAIT-LAT: 8,2 dBA
LAFmax-LAT: 26,2 dBA
LAImax-LAFmax: 4,3 dBA
LAImax-LASmax: 11,6 dBA

Global data

Duration: 0000:30:08
Beginning: 06/01/2023 08:30:38
End: 06/01/2023 09:00:46

Monitoring Point: Ramb4

Date and Time: 06/01/2023, 16:40:07

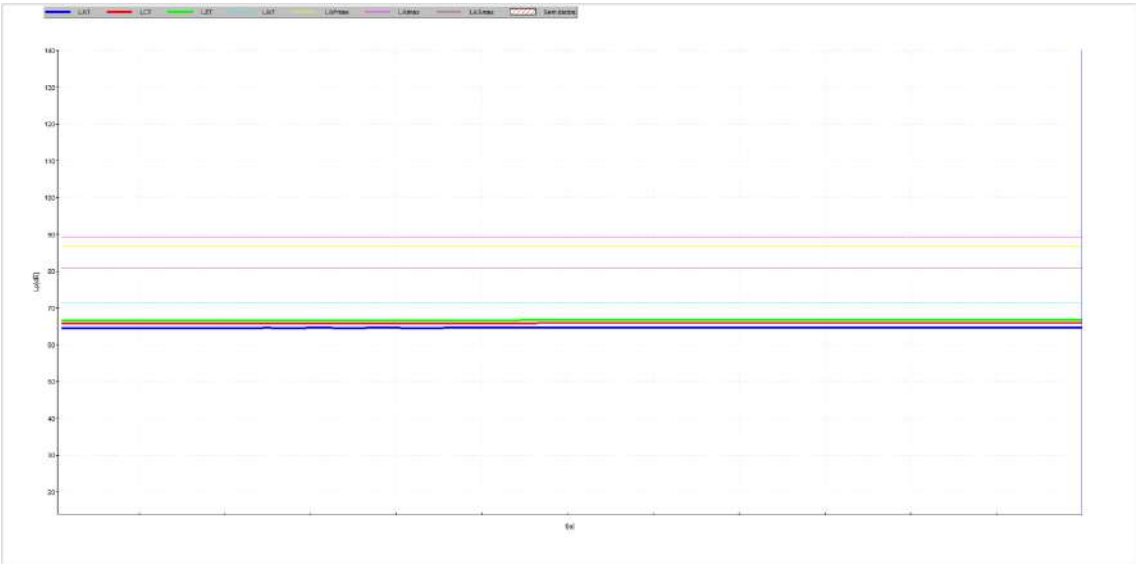


Figure 10 – Time graph, analyzer mode referring to the RAmb4 monitoring point.

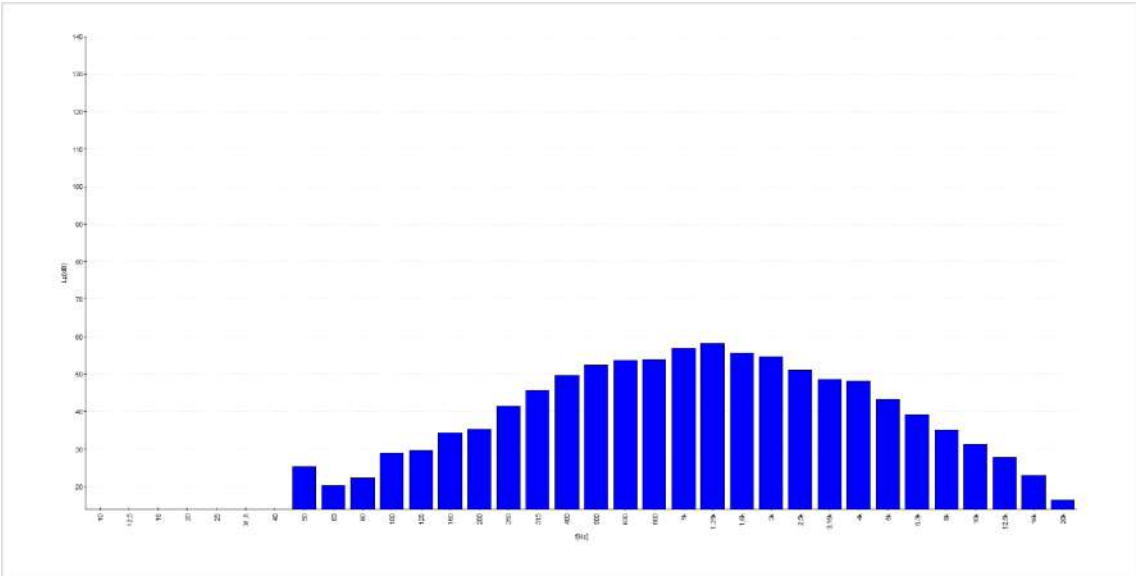


Figure 11 – Frequency graph, analyzer mode referring to the RAmb4 monitoring point.

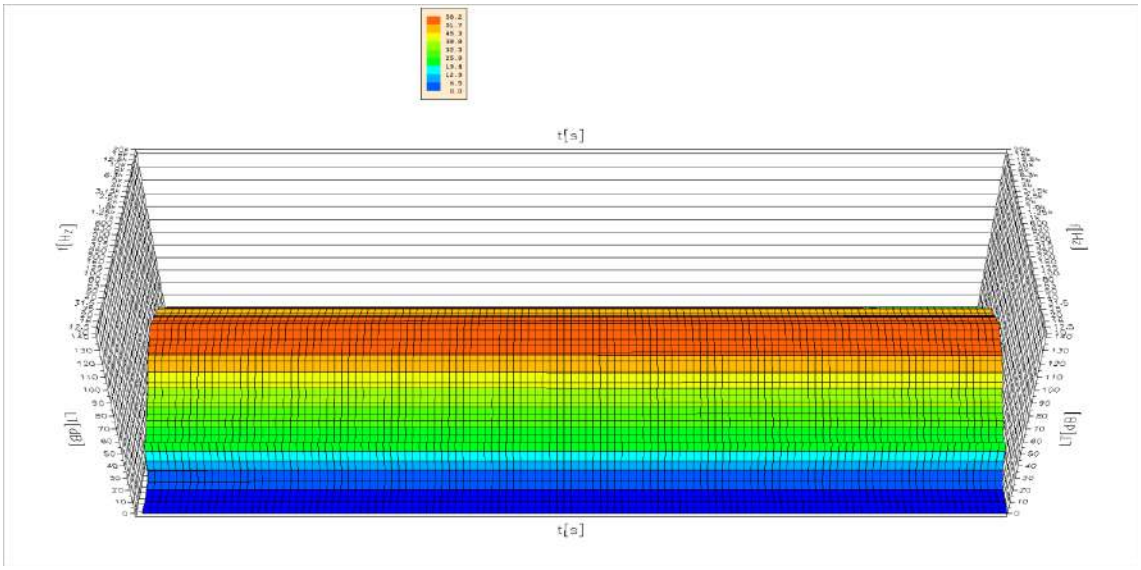


Figure 12 – 3D graph, analyzer mode referring to the RAmb4 monitoring point.

RESULTS OBTAINED

06/01/2023 16:40:17 T:00:30:10

	10Hz	12,5Hz	16Hz	20Hz	25Hz	31,5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	
	630Hz	800Hz	1kHz	1,25kHz		1,6kHz	2kHz	2,5kHz	3,15kHz		4kHz	5kHz	6,3kHz	8kHz	10kHz	12,5kHz		16kHz	20kHz
LT	---	---	---	---	6,9	14,8	18,4	29,3	30,4	31,5	35,7	41,0	42,7	42,4	44,4	44,6	46,1	50,2	49,7
	49,9	48,9	50,3	50,9	47,7	46,0	46,8	45,0	42,0	39,7	36,6	32,2	26,6	19,7	11,7				

LAT: 51,3 dBA
LCT: 66,2 dBC
LZT: 67,2 dBZ
LAIT: 64,8 dBA
LAFmax: 88,8 dBA
LAImax: 89,8 dBA
LASmax: 83,2 dBA
LAIT-LAT: 5,1 dBA
LAFmax-LAT: 29,1 dBA
LAImax-LAFmax: 1,0 dBA
LAImax-LASmax: 6,6 dBA

Global data

Duration: 0000:30:10
Beginning: 06/01/2023 16:40:17
End: 06/01/2023 17:10:27

Annex IX – Environmental Monitoring Sheets – Air Quality

ENVIRONMENTAL MONITORING FORM – AIR QUALITY

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 09h30

Meteorological conditions:

Temperature: 26,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: Qar1

Description: Dwellings near the beginning of the road section between River Sapo and Cazombo (Pk 0+000)

Coordinates (GPS):

Latitude = 11°12'41.24"S

Longitude = 22°14'30.30"E

Type of Monitoring:

- **Equipment:** Suspension Particle Meter
  Model: DustTrak DRX 8533
- **Equipment:** Thermoanemometer-hygrometer
  Model: TSI 9545
- **Equipment:** VOC Analyzer
  Model: MultiRAE Benzene

Results:

Parameters	Results
T (ºC)	26,0
Humidity (%)	44,3
Vair (m/s)	0,93
PM10 (µg/m^3)	57
PM 2.5 (µg/m^3)	32
PM1.0 (µg/m^3)	32
Formaldehydes (HCHO) (mg/m^3)	0,0
VOC (µg/m^3)	0,0
Benzene (mg/m^3)	0,0

Photographic register:

Observations: During monitoring, the movement of people on unpaved roads close to the monitored location was observed.

ENVIRONMENTAL MONITORING FORM – AIR QUALITY

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 05/01/2023

Time: 16h40

Meteorological conditions:

Temperature: 26,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: Qar2

Description: Dwellings near the end of the road section between Sapo River and Cazombo (Pk 196+000)

Coordinates(GPS):

Latitude = 11°53'47.26"S

Longitude = 22°54'49.64"E

Type of Monitoring:

- **Equipment:** Suspension Particle Meter
  Model: DustTrak DRX 8533
- **Equipment:** Thermoanemometer-hygrometer
  Model: TSI 9545
- **Equipment:** VOC Analyzer
  Model: MultiRAE Benzene

Results:

Parameters	Results
T (ºC)	26,0
Humidity (%)	44,6
Vair (m/s)	1,26
PM10 (µg/m^3)	71
PM 2.5 (µg/m^3)	53
PM1.0 (µg/m^3)	53
Formaldehydes (HCHO) (mg/m^3)	0,0
VOC (µg/m^3)	0,0
Benzene (mg/m^3)	0,0

Photographic register:

Observations: During monitoring it was recorded that vehicles were driving on the National Road 250 (unpaved road) near the monitored site**.**

ENVIRONMENTAL MONITORING FORM – AIR QUALITY

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 08h30

Meteorological conditions:

Temperature: 27,0 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: Qar3

Description: Dwellings near the beginning of the road section between Cazombo and Lumbala (Pk 0+000)

Coordinates (GPS):

Latitude = 11°53'56.91"S

Longitude = 22°53'12.17"E

Type of Monitoring:

- **Equipment:** Suspension Particle Meter
  Model: DustTrak DRX 8533
- **Equipment:** Thermoanemometer-hygrometer
  Model: TSI 9545
- **Equipment:** VOC Analyzer
  Model: MultiRAE Benzene

Results:

Parameters	Results
T (ºC)	27,0
Humidity (%)	36,8
Vair (m/s)	0,41
PM10 (µg/m^3)	60
PM 2.5 (µg/m^3)	37
PM1.0 (µg/m^3)	37
Formaldehydes (HCHO) (mg/m^3)	0,0
VOC (µg/m^3)	0,0
Benzene (mg/m^3)	0,0

Photographic register:

Observations: During the monitoring it was noted that residents were circulating on the roadway during the measurement.

ENVIRONMENTAL MONITORING FORM – AIR QUALITY

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in Moxico Province

Place: Moxico

Day: 06/01/2023

Time: 16h30

Meteorological conditions:

Temperature: 27,5 °C

Sky: Clear

Precipitation: without occurrence

Monitoring Program:

Point: Qar4

Description: Dwellings near the end of the road section between Cazombo and Lumbala (Pk 196+000)

Coordinates (GPS):

Latitude = 12°22'59.72"S

Longitude = 22°34'56.01"E

Type of Monitoring:

- **Equipment:** Suspension Particle Meter
  Model: DustTrak DRX 8533
- **Equipment:** Thermoanemometer-hygrometer
  Model: TSI 9545
- **Equipment:** VOC Analyzer
  Model: MultiRAE Benzene

Results:

Parameters	Results
T (ºC)	27,5
Humidity (%)	39,2
Vair (m/s)	0,36
PM10 (µg/m^3)	52
PM 2.5 (µg/m^3)	41
PM1.0 (µg/m^3)	41
Formaldehydes (HCHO) (mg/m^3)	0,0
VOC (µg/m^3)	0,0
Benzene (mg/m^3)	0,0

Photographic register:

Observations: During monitoring it was noted that children were playing ball near the monitored site.

Annex X – Environmental Monitoring Sheets – Soils

ENVIRONMENTAL MONITORING FORM – SOILS

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in the Province of Moxico **Place:** Moxico **Day:** 05/01/2023 **Time:** 09h30	**Meteorological conditions:** **Temperature:** 26,0 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Program: **Point:** S1 **Description:** Soils next to Dwellings located near the beginning of the road section between Rio Sapo and Cazombo (Pk 0+000)	**Coordinates (GPS):** **Latitude =** 11°12'41.24"S **Longitude =** 22°14'30.30"E

Sampling Type and Method:

- Manual sampling;
- Packing the samples in appropriate containers for the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Photographic register:

Observations: The presence of traces of contamination with hydrocarbons near the sampling site was not identified.

ENVIRONMENTAL MONITORING FORM – SOILS

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in the Province of Moxico **Place:** Moxico **Day:** 05/01/2023 **Time:** 16h40	**Meteorological conditions:** **Temperature:** 26,0 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Program: **Point:** S2 **Description:** Soils next to Dwellings located near the end of the road between Sapo River and Cazombo (Pk 196+000)	**Coordinates (GPS):** **Latitude =** 11°53'47.26"S **Longitude =** 22°54'49.64"E

Sampling Type and Method:

- Manual sampling;
- Packing the samples in appropriate containers for the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Photographic register:

Observations: The presence of traces of contamination with hydrocarbons near the sampling site was not identified.

ENVIRONMENTAL MONITORING FORM – SOILS

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in the Province of Moxico **Place:** Moxico **Day:** 05/01/2023 **Time:** 08h30	**Meteorological conditions:** **Temperature:** 27,0 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Prog3ram: **Point:** S **Description:** Soils next to Dwellings located near the beginning of the road section between Cazombo and Lumbala (Pk 0+000)	**Coordinates (GPS):** **Latitude =** 11°53'56.91"S **Longitude =** 22°53'12.17"E

Sampling Type and Method:

- Manual sampling;
- Packing the samples in appropriate containers for the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Photographic register:

Observations: The presence of traces of contamination with hydrocarbons near the sampling site was not identified.

ENVIRONMENTAL MONITORING FORM – SOILS

Project: Rehabilitation/Construction of the road section between Luau-Cazombo-Lumbala (about 260 km), in the Province of Moxico **Place:** Moxico **Day:** 05/01/2023 **Time:** 16h30	**Meteorological conditions:** **Temperature:** 27,5 °C **Sky:** Clear **Precipitation:** without occurrence
Monitoring Program: **Point:** S4 **Description** Soils next to Dwellings located near the end of the road section between (Pk 196+000)	**Coordinates (GPS):** **Latitude =** 12°22'59.72"S **Longitude =** 22°34'56.01"E

Sampling Type and Method:

- Manual sampling;
- Packing the samples in appropriate containers for the different types of analysis to be performed;
- Storage of samples in a thermal bag during transport to the laboratory.

Photographic register:

Observations: The presence of traces of contamination with hydrocarbons near the sampling site was not identified.

Annex XI – List of potential flora and fauna species in the Project's area of influence

Table 1 – Potential flora species in the Project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Adenostemma caffrum	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Adenostemma	caffrum	Least Concern
Alisma plantago-aquatica	LILIOPSIDA	ALISMATALES	ALISMATACEAE	Alisma	plantago-aquatica	Least Concern
Anagallis elegantula	MAGNOLIOPSIDA	ERICALES	PRIMULACEAE	Anagallis	elegantula	Near Threatened
Anagallis kochii	MAGNOLIOPSIDA	ERICALES	PRIMULACEAE	Anagallis	kochii	Near Threatened
Anisotes macrophyllus	MAGNOLIOPSIDA	LAMIALES	ACANTHACEAE	Anisotes	macrophyllus	Least Concern
Anubias gilletii	LILIOPSIDA	ALISMATALES	ARACEAE	Anubias	gilletii	Least Concern
Aponogeton desertorum	LILIOPSIDA	ALISMATALES	APONOGETONACEAE	Aponogeton	desertorum	Least Concern
Aponogeton junceus	LILIOPSIDA	ALISMATALES	APONOGETONACEAE	Aponogeton	junceus	Least Concern
Aponogeton stuhlmannii	LILIOPSIDA	ALISMATALES	APONOGETONACEAE	Aponogeton	stuhlmannii	Least Concern
Aponogeton vallisnerioides	LILIOPSIDA	ALISMATALES	APONOGETONACEAE	Aponogeton	vallisnerioides	Least Concern
Ascolepis capensis	LILIOPSIDA	POALES	CYPERACEAE	Ascolepis	capensis	Least Concern
Ascolepis lineariglumis	LILIOPSIDA	POALES	CYPERACEAE	Ascolepis	lineariglumis	Least Concern
Aspilia helianthoides	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Aspilia	helianthoides	Least Concern
Blyxa hexandra	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Blyxa	hexandra	Least Concern
Brillantaisia owariensis	MAGNOLIOPSIDA	LAMIALES	ACANTHACEAE	Brillantaisia	owariensis	Least Concern
Bulbostylis angolensis	LILIOPSIDA	POALES	CYPERACEAE	Bulbostylis	angolensis	Least Concern
Bulbostylis schoenoides	LILIOPSIDA	POALES	CYPERACEAE	Bulbostylis	schoenoides	Least Concern
Bulbostylis trabeculata	LILIOPSIDA	POALES	CYPERACEAE	Bulbostylis	trabeculata	Data Deficient
Carduus nyassanus	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Carduus	nyassanus	Least Concern
Centrostachys aquatica	MAGNOLIOPSIDA	CARYOPHYLLALES	AMARANTHACEAE	Centrostachys	aquatica	Least Concern
Cladium mariscus	LILIOPSIDA	POALES	CYPERACEAE	Cladium	mariscus	Least Concern
Conyza clarenceana	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Conyza	clarenceana	Least Concern
Crassocephalum picridifolium	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Crassocephalum	picridifolium	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Cyperus alopecuroides	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	alopecuroides	Least Concern
Cyperus amabilis	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	amabilis	Least Concern
Cyperus articulatus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	articulatus	Least Concern
Cyperus aterrimus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	aterrimus	Least Concern
Cyperus compressus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	compressus	Least Concern
Cyperus congensis	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	congensis	Least Concern
Cyperus glaucophyllus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	glaucophyllus	Least Concern
Cyperus papyrus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	papyrus	Least Concern
Cyperus pustulatus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	pustulatus	Least Concern
Cyperus reduncus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	reduncus	Least Concern
Cyperus rotundus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	rotundus	Least Concern
Cyperus schimperianus	LILIOPSIDA	POALES	CYPERACEAE	Cyperus	schimperianus	Least Concern
Dicliptera elliotii	MAGNOLIOPSIDA	LAMIALES	ACANTHACEAE	Dicliptera	elliotii	Least Concern
Eclipta prostrata	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Eclipta	prostrata	Least Concern
Eleocharis cubangensis	LILIOPSIDA	POALES	CYPERACEAE	Eleocharis	cubangensis	Data Deficient
Eleocharis geniculata	LILIOPSIDA	POALES	CYPERACEAE	Eleocharis	geniculata	Least Concern
Eleocharis retroflexa	LILIOPSIDA	POALES	CYPERACEAE	Eleocharis	retroflexa	Least Concern
Enydra fluctuans	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Enydra	fluctuans	Least Concern
Eriocaulon cinereum	LILIOPSIDA	POALES	ERIOCAULACEAE	Eriocaulon	cinereum	Least Concern
Eriocaulon latifolium	LILIOPSIDA	POALES	ERIOCAULACEAE	Eriocaulon	latifolium	Least Concern
Eriocaulon setaceum	LILIOPSIDA	POALES	ERIOCAULACEAE	Eriocaulon	setaceum	Least Concern
Fimbristylis bisumbellata	LILIOPSIDA	POALES	CYPERACEAE	Fimbristylis	bisumbellata	Least Concern
Fimbristylis complanata	LILIOPSIDA	POALES	CYPERACEAE	Fimbristylis	complanata	Least Concern
Fimbristylis dichotoma	LILIOPSIDA	POALES	CYPERACEAE	Fimbristylis	dichotoma	Least Concern
Fimbristylis ferruginea	LILIOPSIDA	POALES	CYPERACEAE	Fimbristylis	ferruginea	Least Concern
Fimbristylis squarrosa	LILIOPSIDA	POALES	CYPERACEAE	Fimbristylis	squarrosa	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Genlisea angolensis	MAGNOLIOPSIDA	LAMIALES	LENTIBULARIACEAE	Genlisea	angolensis	Endangered
Grangea maderaspatana	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Grangea	maderaspatana	Least Concern
Helichrysum formosissimum	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Helichrysum	formosissimum	Least Concern
Heteranthera callifolia	LILIOPSIDA	COMMELINALES	PONTEDERIACEAE	Heteranthera	callifolia	Least Concern
Hydrilla verticillata	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Hydrilla	verticillata	Least Concern
Hydrocharis chevalieri	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Hydrocharis	chevalieri	Least Concern
Hygrophila senegalensis	MAGNOLIOPSIDA	LAMIALES	ACANTHACEAE	Hygrophila	senegalensis	Least Concern
Hypoestes aristata	MAGNOLIOPSIDA	LAMIALES	ACANTHACEAE	Hypoestes	aristata	Least Concern
Inversodicraea cristata	MAGNOLIOPSIDA	MALPIGHIALES	PODOSTEMACEAE	Inversodicraea	cristata	Vulnerable
Inversodicraea ledermannii	MAGNOLIOPSIDA	MALPIGHIALES	PODOSTEMACEAE	Inversodicraea	ledermannii	Least Concern
Isoetes alstonii	LYCOPODIOPSIDA	ISOETALES	ISOETACEAE	Isoetes	alstonii	Least Concern
Isoetes welwitschii	LYCOPODIOPSIDA	ISOETALES	ISOETACEAE	Isoetes	welwitschii	Least Concern
Juncus dregeanus	LILIOPSIDA	POALES	JUNCACEAE	Juncus	dregeanus	Least Concern
Juncus effusus	LILIOPSIDA	POALES	JUNCACEAE	Juncus	effusus	Least Concern
Juncus inflexus	LILIOPSIDA	POALES	JUNCACEAE	Juncus	inflexus	Least Concern
Juncus punctorius	LILIOPSIDA	POALES	JUNCACEAE	Juncus	punctorius	Least Concern
Juncus rigidus	LILIOPSIDA	POALES	JUNCACEAE	Juncus	rigidus	Least Concern
Lagarosiphon cordofanus	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Lagarosiphon	cordofanus	Least Concern
Lagarosiphon ilicifolius	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Lagarosiphon	ilicifolius	Least Concern
Lemna perpusilla	LILIOPSIDA	ALISMATALES	ARACEAE	Lemna	perpusilla	Least Concern
Limnophyton obtusifolium	LILIOPSIDA	ALISMATALES	ALISMATACEAE	Limnophyton	obtusifolium	Least Concern
Litogyne gariepina	MAGNOLIOPSIDA	ASTERALES	ASTERACEAE	Litogyne	gariepina	Least Concern
Marsilea coromandelina	POLYPODIOPSIDA	SALVINIALES	MARSILEACEAE	Marsilea	coromandelina	Least Concern
Marsilea minuta	POLYPODIOPSIDA	SALVINIALES	MARSILEACEAE	Marsilea	minuta	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Najas graminea	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Najas	graminea	Least Concern
Najas marina	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Najas	marina	Least Concern
Najas pectinata	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Najas	pectinata	Least Concern
Nymphaea divaricata	MAGNOLIOPSIDA	NYMPHAEALES	NYMPHAEACEAE	Nymphaea	divaricata	Data Deficient
Nymphaea nouchali	MAGNOLIOPSIDA	NYMPHAEALES	NYMPHAEACEAE	Nymphaea	nouchali	Least Concern
Nymphaea sulphurea	MAGNOLIOPSIDA	NYMPHAEALES	NYMPHAEACEAE	Nymphaea	sulphurea	Data Deficient
Nymphoides brevipedicellata	MAGNOLIOPSIDA	ASTERALES	MENYANTHACEAE	Nymphoides	brevipedicellata	Least Concern
Nymphoides forbesiana	MAGNOLIOPSIDA	ASTERALES	MENYANTHACEAE	Nymphoides	forbesiana	Least Concern
Nymphoides rautanenii	MAGNOLIOPSIDA	ASTERALES	MENYANTHACEAE	Nymphoides	rautanenii	Least Concern
Nymphoides tenuissima	MAGNOLIOPSIDA	ASTERALES	MENYANTHACEAE	Nymphoides	tenuissima	Endangered
Oryza glaberrima	LILIOPSIDA	POALES	POACEAE	Oryza	glaberrima	Least Concern
Oryza longistaminata	LILIOPSIDA	POALES	POACEAE	Oryza	longistaminata	Least Concern
Oryza punctata	LILIOPSIDA	POALES	POACEAE	Oryza	punctata	Least Concern
Oryza schweinfurthiana	LILIOPSIDA	POALES	POACEAE	Oryza	schweinfurthiana	Data Deficient
Ottelia exserta	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Ottelia	exserta	Least Concern
Ottelia kunenensis	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Ottelia	kunenensis	Least Concern
Ottelia muricata	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Ottelia	muricata	Least Concern
Ottelia verdickii	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Ottelia	verdickii	Least Concern
Phaulopsis micrantha	MAGNOLIOPSIDA	LAMIALES	ACANTHACEAE	Phaulopsis	micrantha	Least Concern
Pistia stratiotes	LILIOPSIDA	ALISMATALES	ARACEAE	Pistia	stratiotes	Least Concern
Potamogeton nodosus	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Potamogeton	nodosus	Least Concern
Potamogeton octandrus	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Potamogeton	octandrus	Least Concern
Potamogeton pusillus	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Potamogeton	pusillus	Least Concern
Potamogeton schweinfurthii	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Potamogeton	schweinfurthii	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Potamogeton trichoides	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Potamogeton	trichoides	Least Concern
Protea gaguedi	MAGNOLIOPSIDA	PROTEALES	PROTEACEAE	Protea	gaguedi	Least Concern
Protea welwitschii	MAGNOLIOPSIDA	PROTEALES	PROTEACEAE	Protea	welwitschii	Least Concern
Psilotrichum axilliflorum	MAGNOLIOPSIDA	CARYOPHYLLALES	AMARANTHACEAE	Psilotrichum	axilliflorum	Endangered
Pycreus nuerensis	LILIOPSIDA	POALES	CYPERACEAE	Pycreus	nuerensis	Least Concern
Ranalisma humile	LILIOPSIDA	ALISMATALES	ALISMATACEAE	Ranalisma	humile	Least Concern
Rhipsalis baccifera	MAGNOLIOPSIDA	CARYOPHYLLALES	CACTACEAE	Rhipsalis	baccifera	Least Concern
Rhynchospora corymbosa	LILIOPSIDA	POALES	CYPERACEAE	Rhynchospora	corymbosa	Least Concern
Rhynchospora gracillima	LILIOPSIDA	POALES	CYPERACEAE	Rhynchospora	gracillima	Least Concern
Rhynchospora holoschoenoides	LILIOPSIDA	POALES	CYPERACEAE	Rhynchospora	holoschoenoides	Least Concern
Rhynchospora triflora	LILIOPSIDA	POALES	CYPERACEAE	Rhynchospora	triflora	Least Concern
Rotala gerardii	MAGNOLIOPSIDA	MYRTALES	LYTHRACEAE	Rotala	gerardii	Near Threatened
Rotala robynsiana	MAGNOLIOPSIDA	MYRTALES	LYTHRACEAE	Rotala	robynsiana	Critically Endangered
Rotala smithii	MAGNOLIOPSIDA	MYRTALES	LYTHRACEAE	Rotala	smithii	Vulnerable
Schoenoplectus litoralis	LILIOPSIDA	POALES	CYPERACEAE	Schoenoplectus	litoralis	Least Concern
Schoenoplectus subulatus	LILIOPSIDA	POALES	CYPERACEAE	Schoenoplectus	subulatus	Least Concern
Scleria tessellata	LILIOPSIDA	POALES	CYPERACEAE	Scleria	tessellata	Least Concern
Stuckenia pectinata	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Stuckenia	pectinata	Least Concern
Trapa natans	MAGNOLIOPSIDA	MYRTALES	LYTHRACEAE	Trapa	natans	Least Concern
Typha capensis	LILIOPSIDA	POALES	TYPHACEAE	Typha	capensis	Least Concern
Typha domingensis	LILIOPSIDA	POALES	TYPHACEAE	Typha	domingensis	Least Concern
Typha latifolia	LILIOPSIDA	POALES	TYPHACEAE	Typha	latifolia	Least Concern
Utricularia bracteata	MAGNOLIOPSIDA	LAMIALES	LENTIBULARIACEAE	Utricularia	bracteata	Near Threatened

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Utricularia microcalyx	MAGNOLIOPSIDA	LAMIALES	LENTIBULARIACEAE	Utricularia	microcalyx	Least Concern
Vallisneria spiralis	LILIOPSIDA	ALISMATALES	HYDROCHARITACEAE	Vallisneria	spiralis	Least Concern
Wolffia arrhiza	LILIOPSIDA	ALISMATALES	ARACEAE	Wolffia	arrhiza	Least Concern
Wolffiella repanda	LILIOPSIDA	ALISMATALES	ARACEAE	Wolffiella	repanda	Data Deficient
Xyris angustifolia	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	angustifolia	Near Threatened
Xyris densa	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	densa	Data Deficient
Xyris exigua	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	exigua	Critically Endangered
Xyris gossweileri	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	gossweileri	Data Deficient
Xyris imitatrix	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	imitatrix	Data Deficient
Xyris kundelungensis	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	kundelungensis	Data Deficient
Xyris kwangolana	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	kwangolana	Data Deficient
Xyris lejolyanus	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	lejolyanus	Data Deficient
Xyris sanguinea	LILIOPSIDA	POALES	XYRIDACEAE	Xyris	sanguinea	Data Deficient
Zannichellia palustris	LILIOPSIDA	ALISMATALES	POTAMOGETONACEAE	Zannichellia	palustris	Least Concern
Zantedeschia albomaculata	LILIOPSIDA	ALISMATALES	ARACEAE	Zantedeschia	albomaculata	Least Concern

Table 2 – Potential freshwater mollusc species in the Project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Africanogyrus coretus	GASTROPODA	HYGROPHILA	PLANORBIDAE	Africanogyrus	coretus	Least Concern
Bellamya capillata	GASTROPODA	ARCHITAENIOGLOSSA	VIVIPARIDAE	Bellamya	capillata	Least Concern
Biomphalaria pfeifferi	GASTROPODA	HYGROPHILA	PLANORBIDAE	Biomphalaria	pfeifferi	Least Concern
Bulinus globosus	GASTROPODA	HYGROPHILA	BULINIDAE	Bulinus	globosus	Least Concern
Bulinus truncatus	GASTROPODA	HYGROPHILA	BULINIDAE	Bulinus	truncatus	Least Concern
Burnupia caffra	GASTROPODA	HYGROPHILA	BURNUPIIDAE	Burnupia	caffra	Least Concern
Chambardia wissmanni	BIVALVIA	UNIONIDA	IRIDINIDAE	Chambardia	wissmanni	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Coelatura gabonensis	BIVALVIA	UNIONIDA	UNIONIDAE	Coelatura	gabonensis	Least Concern
Corbicula africana	BIVALVIA	VENERIDA	CYRENIDAE	Corbicula	africana	Least Concern
Eupera ferruginea	BIVALVIA	VENERIDA	SPHAERIIDAE	Eupera	ferruginea	Least Concern
Eupera sturanyi	BIVALVIA	VENERIDA	SPHAERIIDAE	Eupera	sturanyi	Least Concern
Gyraulus costulatus	GASTROPODA	HYGROPHILA	PLANORBIDAE	Gyraulus	costulatus	Least Concern
Lanistes ovum	GASTROPODA	ARCHITAENIOGLOSSA	AMPULLARIIDAE	Lanistes	ovum	Least Concern
Radix natalensis	GASTROPODA	HYGROPHILA	LYMNAEIDAE	Radix	natalensis	Least Concern
Segmentorbis angustus	GASTROPODA	HYGROPHILA	PLANORBIDAE	Segmentorbis	angustus	Least Concern
Sphaerium hartmanni	BIVALVIA	VENERIDA	SPHAERIIDAE	Sphaerium	hartmanni	Least Concern

Table 3 – Potential species of freshwater arthropods by family in the project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Aciagrion africanum	INSECTA	ODONATA	COENAGRIONIDAE	Aciagrion	africanum	Least Concern
Aciagrion steeleae	INSECTA	ODONATA	COENAGRIONIDAE	Aciagrion	steeleae	Least Concern
Aciagrion zambiense	INSECTA	ODONATA	COENAGRIONIDAE	Aciagrion	zambiense	Data Deficient
Acisoma inflatum	INSECTA	ODONATA	LIBELLULIDAE	Acisoma	inflatum	Least Concern
Acisoma trifidum	INSECTA	ODONATA	LIBELLULIDAE	Acisoma	trifidum	Least Concern
Acrophymus ocreatus	INSECTA	ORTHOPTERA	ACRIDIDAE	Acrophymus	ocreatus	Least Concern
Acrotylus patruelis	INSECTA	ORTHOPTERA	ACRIDIDAE	Acrotylus	patruelis	Least Concern
Aethiothemis basilewskyi	INSECTA	ODONATA	LIBELLULIDAE	Aethiothemis	basilewskyi	Least Concern
Aethiothemis bequaerti	INSECTA	ODONATA	LIBELLULIDAE	Aethiothemis	bequaerti	Least Concern
Aethiothemis ellioti	INSECTA	ODONATA	LIBELLULIDAE	Aethiothemis	ellioti	Least Concern
Aethiothemis solitaria	INSECTA	ODONATA	LIBELLULIDAE	Aethiothemis	solitaria	Least Concern
Aethriamanta rezia	INSECTA	ODONATA	LIBELLULIDAE	Aethriamanta	rezia	Least Concern
Africallagma glaucum	INSECTA	ODONATA	COENAGRIONIDAE	Africallagma	glaucum	Least Concern
Africallagma sinuatum	INSECTA	ODONATA	COENAGRIONIDAE	Africallagma	sinuatum	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Africallagma subtile	INSECTA	ODONATA	COENAGRIONIDAE	Africallagma	subtile	Least Concern
Africallagma vaginale	INSECTA	ODONATA	COENAGRIONIDAE	Africallagma	vaginale	Least Concern
Afroaeschna scotias	INSECTA	ODONATA	AESHNIDAE	Afroaeschna	scotias	Least Concern
Agriocnemis exilis	INSECTA	ODONATA	COENAGRIONIDAE	Agriocnemis	exilis	Least Concern
Agriocnemis victoria	INSECTA	ODONATA	COENAGRIONIDAE	Agriocnemis	victoria	Least Concern
Allocnemis wittei	INSECTA	ODONATA	PLATYCNEMIDIDAE	Allocnemis	wittei	Least Concern
Anax ephippiger	INSECTA	ODONATA	AESHNIDAE	Anax	ephippiger	Least Concern
Anax imperator	INSECTA	ODONATA	AESHNIDAE	Anax	imperator	Least Concern
Anax speratus	INSECTA	ODONATA	AESHNIDAE	Anax	speratus	Least Concern
Anax tristis	INSECTA	ODONATA	AESHNIDAE	Anax	tristis	Least Concern
Andronymus caesar	INSECTA	LEPIDOPTERA	HESPERIIDAE	Andronymus	caesar	Least Concern
Arantia fasciata	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Arantia	fasciata	Least Concern
Azuragrion nigridorsum	INSECTA	ODONATA	COENAGRIONIDAE	Azuragrion	nigridorsum	Least Concern
Brachythemis lacustris	INSECTA	ODONATA	LIBELLULIDAE	Brachythemis	lacustris	Least Concern
Brachythemis leucosticta	INSECTA	ODONATA	LIBELLULIDAE	Brachythemis	leucosticta	Least Concern
Cacyreus fracta	INSECTA	LEPIDOPTERA	LYCAENIDAE	Cacyreus	fracta	Least Concern
Caridina togoensis	MALACOSTRACA	DECAPODA	ATYIDAE	Caridina	togoensis	Least Concern
Ceriagrion corallinum	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	corallinum	Least Concern
Ceriagrion glabrum	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	glabrum	Least Concern
Ceriagrion kordofanicum	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	kordofanicum	Least Concern
Ceriagrion platystigma	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	platystigma	Least Concern
Ceriagrion sakejii	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	sakejii	Least Concern
Ceriagrion suave	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	suave	Least Concern
Ceriagrion varians	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	varians	Least Concern
Ceriagrion whellani	INSECTA	ODONATA	COENAGRIONIDAE	Ceriagrion	whellani	Least Concern
Chalcostephia flavifrons	INSECTA	ODONATA	LIBELLULIDAE	Chalcostephia	flavifrons	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Chlorocypha frigida	INSECTA	ODONATA	CHLOROCYPHIDAE	Chlorocypha	frigida	Least Concern
Clonia saussurei	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Clonia	saussurei	Least Concern
Copelatus peridinus	INSECTA	COLEOPTERA	DYTISCIDAE	Copelatus	peridinus	Least Concern
Copelatus pulchellus	INSECTA	COLEOPTERA	DYTISCIDAE	Copelatus	pulchellus	Least Concern
Coryphosima stenoptera	INSECTA	ORTHOPTERA	ACRIDIDAE	Coryphosima	stenoptera	Least Concern
Crenigomphus cornutus	INSECTA	ODONATA	GOMPHIDAE	Crenigomphus	cornutus	Least Concern
Crenigomphus hartmanni	INSECTA	ODONATA	GOMPHIDAE	Crenigomphus	hartmanni	Least Concern
Crocothemis brevistigma	INSECTA	ODONATA	LIBELLULIDAE	Crocothemis	brevistigma	Least Concern
Crocothemis divisa	INSECTA	ODONATA	LIBELLULIDAE	Crocothemis	divisa	Least Concern
Crocothemis erythraea	INSECTA	ODONATA	LIBELLULIDAE	Crocothemis	erythraea	Least Concern
Crocothemis sanguinolenta	INSECTA	ODONATA	LIBELLULIDAE	Crocothemis	sanguinolenta	Least Concern
Crocothemis saxicolor	INSECTA	ODONATA	LIBELLULIDAE	Crocothemis	saxicolor	Least Concern
Desmocaris trispinosa	MALACOSTRACA	DECAPODA	DESMOCARIDIDAE	Desmocaris	trispinosa	Least Concern
Diastatomma soror	INSECTA	ODONATA	GOMPHIDAE	Diastatomma	soror	Least Concern
Diastellopalpus infernalis	INSECTA	COLEOPTERA	SCARABAEIDAE	Diastellopalpus	infernalis	Least Concern
Diplacodes deminuta	INSECTA	ODONATA	LIBELLULIDAE	Diplacodes	deminuta	Least Concern
Diplacodes lefebvrii	INSECTA	ODONATA	LIBELLULIDAE	Diplacodes	lefebvrii	Least Concern
Diplacodes luminans	INSECTA	ODONATA	LIBELLULIDAE	Diplacodes	luminans	Least Concern
Diplacodes pumila	INSECTA	ODONATA	LIBELLULIDAE	Diplacodes	pumila	Least Concern
Eicochrysops messapus	INSECTA	LEPIDOPTERA	LYCAENIDAE	Eicochrysops	messapus	Least Concern
Elattoneura cellularis	INSECTA	ODONATA	PLATYCNEMIDIDAE	Elattoneura	cellularis	Least Concern
Elattoneura flavifacies	INSECTA	ODONATA	PLATYCNEMIDIDAE	Elattoneura	flavifacies	Data Deficient
Elattoneura glauca	INSECTA	ODONATA	PLATYCNEMIDIDAE	Elattoneura	glauca	Least Concern
Eulioptera reticulata	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Eulioptera	reticulata	Least Concern
Gomphidia quarrei	INSECTA	ODONATA	GOMPHIDAE	Gomphidia	quarrei	Least Concern
Graphium angolanus	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Graphium	angolanus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Graphium antheus	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Graphium	antheus	Least Concern
Graphium leonidas	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Graphium	leonidas	Least Concern
Graphium policenes	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Graphium	policenes	Least Concern
Gymnopleurus virens	INSECTA	COLEOPTERA	SCARABAEIDAE	Gymnopleurus	virens	Least Concern
Gynacantha manderica	INSECTA	ODONATA	AESHNIDAE	Gynacantha	manderica	Least Concern
Gynacantha sextans	INSECTA	ODONATA	AESHNIDAE	Gynacantha	sextans	Least Concern
Gynacantha vesiculata	INSECTA	ODONATA	AESHNIDAE	Gynacantha	vesiculata	Least Concern
Hadrothemis camarensis	INSECTA	ODONATA	LIBELLULIDAE	Hadrothemis	camarensis	Least Concern
Hadrothemis coacta	INSECTA	ODONATA	LIBELLULIDAE	Hadrothemis	coacta	Least Concern
Hadrothemis defecta	INSECTA	ODONATA	LIBELLULIDAE	Hadrothemis	defecta	Least Concern
Hemistigma albipunctum	INSECTA	ODONATA	LIBELLULIDAE	Hemistigma	albipunctum	Least Concern
Heteronitis castelnaui	INSECTA	COLEOPTERA	SCARABAEIDAE	Heteronitis	castelnaui	Least Concern
Horatosphaga serrifera	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Horatosphaga	serrifera	Least Concern
Ictinogomphus regisalberti	INSECTA	ODONATA	GOMPHIDAE	Ictinogomphus	regisalberti	Least Concern
Iolaus mimosae	INSECTA	LEPIDOPTERA	LYCAENIDAE	Iolaus	mimosae	Least Concern
Iolaus silarus	INSECTA	LEPIDOPTERA	LYCAENIDAE	Iolaus	silarus	Least Concern
Ischnura senegalensis	INSECTA	ODONATA	COENAGRIONIDAE	Ischnura	senegalensis	Least Concern
Leptomyrina henningi	INSECTA	LEPIDOPTERA	LYCAENIDAE	Leptomyrina	henningi	Least Concern
Lestes amicus	INSECTA	ODONATA	LESTIDAE	Lestes	amicus	Least Concern
Lestes dissimulans	INSECTA	ODONATA	LESTIDAE	Lestes	dissimulans	Least Concern
Lestes plagiatus	INSECTA	ODONATA	LESTIDAE	Lestes	plagiatus	Least Concern
Lestes tridens	INSECTA	ODONATA	LESTIDAE	Lestes	tridens	Least Concern
Lestes uncifer	INSECTA	ODONATA	LESTIDAE	Lestes	uncifer	Least Concern
Lestes virgatus	INSECTA	ODONATA	LESTIDAE	Lestes	virgatus	Least Concern
Macrobrachium chevalieri	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	chevalieri	Least Concern
Macrobrachium dux	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	dux	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Macrobrachium felicinum	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	felicinum	Data Deficient
Macrobrachium lujae	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	lujae	Data Deficient
Macrobrachium macrobrachion	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	macrobrachion	Least Concern
Macrobrachium sollaudii	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	sollaudii	Least Concern
Macrobrachium vollenhoveni	MALACOSTRACA	DECAPODA	PALAEMONIDAE	Macrobrachium	vollenhoveni	Least Concern
Malgassophlebia bispina	INSECTA	ODONATA	LIBELLULIDAE	Malgassophlebia	bispina	Least Concern
Mesocnemis singularis	INSECTA	ODONATA	PLATYCNEMIDIDAE	Mesocnemis	singularis	Least Concern
Microgomphus nyassicus	INSECTA	ODONATA	GOMPHIDAE	Microgomphus	nyassicus	Least Concern
Neodythemis preussi	INSECTA	ODONATA	LIBELLULIDAE	Neodythemis	preussi	Least Concern
Nephila constricta	ARACHNIDA	ARANEAE	ARANEIDAE	Nephila	constricta	Least Concern
Nephila turneri	ARACHNIDA	ARANEAE	ARANEIDAE	Nephila	turneri	Least Concern
Nephilingis cruentata	ARACHNIDA	ARANEAE	ARANEIDAE	Nephilingis	cruentata	Least Concern
Nesciothemis farinosa	INSECTA	ODONATA	LIBELLULIDAE	Nesciothemis	farinosa	Least Concern
Nesciothemis fitzgeraldi	INSECTA	ODONATA	LIBELLULIDAE	Nesciothemis	fitzgeraldi	Least Concern
Neurogomphus cocytius	INSECTA	ODONATA	GOMPHIDAE	Neurogomphus	cocytius	Least Concern
Notogomphus praetorius	INSECTA	ODONATA	GOMPHIDAE	Notogomphus	praetorius	Least Concern
Olpogastra lugubris	INSECTA	ODONATA	LIBELLULIDAE	Olpogastra	lugubris	Least Concern
Onitis mendax	INSECTA	COLEOPTERA	SCARABAEIDAE	Onitis	mendax	Least Concern
Onitis robustus	INSECTA	COLEOPTERA	SCARABAEIDAE	Onitis	robustus	Least Concern
Onthophagus pugionatus	INSECTA	COLEOPTERA	SCARABAEIDAE	Onthophagus	pugionatus	Least Concern
Onychogomphus kitchingmani	INSECTA	ODONATA	GOMPHIDAE	Onychogomphus	kitchingmani	Data Deficient
Onychogomphus nigrotibialis	INSECTA	ODONATA	GOMPHIDAE	Onychogomphus	nigrotibialis	Data Deficient
Orthetrum abbotti	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	abbotti	Least Concern
Orthetrum austeni	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	austeni	Least Concern
Orthetrum brachiale	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	brachiale	Least Concern
Orthetrum caffrum	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	caffrum	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Orthetrum chrysostigma	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	chrysostigma	Least Concern
Orthetrum guineense	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	guineense	Least Concern
Orthetrum hintzi	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	hintzi	Least Concern
Orthetrum icteromelas	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	icteromelas	Least Concern
Orthetrum julia	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	julia	Least Concern
Orthetrum machadoi	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	machadoi	Least Concern
Orthetrum macrostigma	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	macrostigma	Least Concern
Orthetrum monardi	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	monardi	Least Concern
Orthetrum saegeri	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	saegeri	Least Concern
Orthetrum stemmale	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	stemmale	Least Concern
Orthetrum trinacria	INSECTA	ODONATA	LIBELLULIDAE	Orthetrum	trinacria	Least Concern
Palpopleura albifrons	INSECTA	ODONATA	LIBELLULIDAE	Palpopleura	albifrons	Least Concern
Palpopleura deceptor	INSECTA	ODONATA	LIBELLULIDAE	Palpopleura	deceptor	Least Concern
Palpopleura jucunda	INSECTA	ODONATA	LIBELLULIDAE	Palpopleura	jucunda	Least Concern
Palpopleura lucia	INSECTA	ODONATA	LIBELLULIDAE	Palpopleura	lucia	Least Concern
Palpopleura portia	INSECTA	ODONATA	LIBELLULIDAE	Palpopleura	portia	Least Concern
Pantala flavescens	INSECTA	ODONATA	LIBELLULIDAE	Pantala	flavescens	Least Concern
Papilio dardanus	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Papilio	dardanus	Least Concern
Papilio demodocus	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Papilio	demodocus	Least Concern
Papilio echerioides	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Papilio	echerioides	Least Concern
Papilio nireus	INSECTA	LEPIDOPTERA	PAPILIONIDAE	Papilio	nireus	Least Concern
Paragomphus cognatus	INSECTA	ODONATA	GOMPHIDAE	Paragomphus	cognatus	Least Concern
Paragomphus genei	INSECTA	ODONATA	GOMPHIDAE	Paragomphus	genei	Least Concern
Paratettix asbenensis	INSECTA	ORTHOPTERA	TETRIGIDAE	Paratettix	asbenensis	Least Concern
Parazyxomma flavicans	INSECTA	ODONATA	LIBELLULIDAE	Parazyxomma	flavicans	Least Concern
Phalanta eurytis	INSECTA	LEPIDOPTERA	NYMPHALIDAE	Phalanta	eurytis	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Phaneroptera sparsa	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Phaneroptera	sparsa	Least Concern
Phaon iridipennis	INSECTA	ODONATA	CALOPTERYGIDAE	Phaon	iridipennis	Least Concern
Phyllogomphus selysi	INSECTA	ODONATA	GOMPHIDAE	Phyllogomphus	selysi	Least Concern
Phyllomacromia bicristulata	INSECTA	ODONATA	MACROMIIDAE	Phyllomacromia	bicristulata	Least Concern
Phyllomacromia congolica	INSECTA	ODONATA	MACROMIIDAE	Phyllomacromia	congolica	Least Concern
Phyllomacromia contumax	INSECTA	ODONATA	MACROMIIDAE	Phyllomacromia	contumax	Least Concern
Phyllomacromia monoceros	INSECTA	ODONATA	MACROMIIDAE	Phyllomacromia	monoceros	Least Concern
Phyllomacromia overlaeti	INSECTA	ODONATA	MACROMIIDAE	Phyllomacromia	overlaeti	Least Concern
Phyllomacromia picta	INSECTA	ODONATA	MACROMIIDAE	Phyllomacromia	picta	Least Concern
Phymeurus pardalis	INSECTA	ORTHOPTERA	ACRIDIDAE	Phymeurus	pardalis	Least Concern
Phymeurus tricostatus	INSECTA	ORTHOPTERA	ACRIDIDAE	Phymeurus	tricostatus	Least Concern
Pinheyschna moori	INSECTA	ODONATA	AESHNIDAE	Pinheyschna	moori	Data Deficient
Plangia graminea	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Plangia	graminea	Least Concern
Platycypha caligata	INSECTA	ODONATA	CHLOROCYPHIDAE	Platycypha	caligata	Least Concern
Porpax asperipes	INSECTA	ODONATA	LIBELLULIDAE	Porpax	asperipes	Least Concern
Porpax risi	INSECTA	ODONATA	LIBELLULIDAE	Porpax	risi	Least Concern
Potamonautes bayonianus	MALACOSTRACA	DECAPODA	POTAMONAUTIDAE	Potamonautes	bayonianus	Least Concern
Procambarus clarkii	MALACOSTRACA	DECAPODA	CAMBARIDAE	Procambarus	clarkii	Least Concern
Pseudagrion acaciae	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	acaciae	Least Concern
Pseudagrion coeruleipunctum	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	coeruleipunctum	Least Concern
Pseudagrion fisheri	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	fisheri	Least Concern
Pseudagrion glaucescens	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	glaucescens	Least Concern
Pseudagrion greeni	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	greeni	Least Concern
Pseudagrion hamoni	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	hamoni	Least Concern
Pseudagrion inconspicuum	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	inconspicuum	Least Concern
Pseudagrion kersteni	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	kersteni	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Pseudagrion kibalense	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	kibalense	Least Concern
Pseudagrion makabusiense	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	makabusiense	Least Concern
Pseudagrion melanicterum	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	melanicterum	Least Concern
Pseudagrion nubicum	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	nubicum	Least Concern
Pseudagrion rufostigma	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	rufostigma	Least Concern
Pseudagrion salisburyense	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	salisburyense	Least Concern
Pseudagrion sjoestedti	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	sjoestedti	Least Concern
Pseudagrion spernatum	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	spernatum	Least Concern
Pseudagrion sublacteum	INSECTA	ODONATA	COENAGRIONIDAE	Pseudagrion	sublacteum	Least Concern
Pseudorhynchus hastifer	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Pseudorhynchus	hastifer	Least Concern
Pteronemobius monochromus	INSECTA	ORTHOPTERA	TRIGONIDIIDAE	Pteronemobius	monochromus	Data Deficient
Rhyothemis fenestrina	INSECTA	ODONATA	LIBELLULIDAE	Rhyothemis	fenestrina	Least Concern
Rhyothemis semihyalina	INSECTA	ODONATA	LIBELLULIDAE	Rhyothemis	semihyalina	Least Concern
Ruspolia flavovirens	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Ruspolia	flavovirens	Data Deficient
Sceliages augias	INSECTA	COLEOPTERA	SCARABAEIDAE	Sceliages	augias	Data Deficient
Tetrathemis polleni	INSECTA	ODONATA	LIBELLULIDAE	Tetrathemis	polleni	Least Concern
Thermochoria equivocata	INSECTA	ODONATA	LIBELLULIDAE	Thermochoria	equivocata	Least Concern
Tholymis tillarga	INSECTA	ODONATA	LIBELLULIDAE	Tholymis	tillarga	Least Concern
Tramea basilaris	INSECTA	ODONATA	LIBELLULIDAE	Tramea	basilaris	Least Concern
Trichonephila fenestrata	ARACHNIDA	ARANEAE	ARANEIDAE	Trichonephila	fenestrata	Least Concern
Trichonephila senegalensis	ARACHNIDA	ARANEAE	ARANEIDAE	Trichonephila	senegalensis	Least Concern
Trithemis aconita	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	aconita	Least Concern
Trithemis annulata	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	annulata	Least Concern
Trithemis anomala	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	anomala	Least Concern
Trithemis arteriosa	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	arteriosa	Least Concern
Trithemis bifida	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	bifida	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Trithemis dichroa	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	dichroa	Least Concern
Trithemis donaldsoni	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	donaldsoni	Least Concern
Trithemis dorsalis	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	dorsalis	Least Concern
Trithemis furva	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	furva	Least Concern
Trithemis grouti	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	grouti	Least Concern
Trithemis imitata	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	imitata	Least Concern
Trithemis kirbyi	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	kirbyi	Least Concern
Trithemis nuptialis	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	nuptialis	Least Concern
Trithemis pluvialis	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	pluvialis	Least Concern
Trithemis pruinata	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	pruinata	Least Concern
Trithemis stictica	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	stictica	Least Concern
Trithemis werneri	INSECTA	ODONATA	LIBELLULIDAE	Trithemis	werneri	Least Concern
Trithetrum navasi	INSECTA	ODONATA	LIBELLULIDAE	Trithetrum	navasi	Least Concern
Tuxentius melaena	INSECTA	LEPIDOPTERA	LYCAENIDAE	Tuxentius	melaena	Least Concern
Tylopsis bilineolata	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Tylopsis	bilineolata	Least Concern
Tylopsis continua	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Tylopsis	continua	Least Concern
Tylopsis rubrescens	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Tylopsis	rubrescens	Least Concern
Uranothauma nubifer	INSECTA	LEPIDOPTERA	LYCAENIDAE	Uranothauma	nubifer	Least Concern
Urothemis assignata	INSECTA	ODONATA	LIBELLULIDAE	Urothemis	assignata	Least Concern
Urothemis edwardsii	INSECTA	ODONATA	LIBELLULIDAE	Urothemis	edwardsii	Least Concern
Ypthima condamini	INSECTA	LEPIDOPTERA	NYMPHALIDAE	Ypthima	condamini	Least Concern
Zabalius ophthalmicus	INSECTA	ORTHOPTERA	TETTIGONIIDAE	Zabalius	ophthalmicus	Least Concern
Zygonyx atritibiae	INSECTA	ODONATA	LIBELLULIDAE	Zygonyx	atritibiae	Least Concern
Zygonyx eusebia	INSECTA	ODONATA	LIBELLULIDAE	Zygonyx	eusebia	Least Concern
Zygonyx flavicosta	INSECTA	ODONATA	LIBELLULIDAE	Zygonyx	flavicosta	Least Concern
Zygonyx natalensis	INSECTA	ODONATA	LIBELLULIDAE	Zygonyx	natalensis	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Zygonyx torridus	INSECTA	ODONATA	LIBELLULIDAE	Zygonyx	torridus	Least Concern

Table 4 – Potential species of freshwater ichthyofauna per family in the project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Amphilius uranoscopus	ACTINOPTERYGII	SILURIFORMES	AMPHILIIDAE	Amphilius	uranoscopus	Least Concern
Brycinus lateralis	ACTINOPTERYGII	CHARACIFORMES	ALESTIDAE	Brycinus	lateralis	Least Concern
Chiloglanis fasciatus	ACTINOPTERYGII	SILURIFORMES	MOCHOKIDAE	Chiloglanis	fasciatus	Least Concern
Clariallabes platyprosopos	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clariallabes	platyprosopos	Least Concern
Clarias angolensis	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clarias	angolensis	Least Concern
Clarias gariepinus	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clarias	gariepinus	Least Concern
Clarias liocephalus	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clarias	liocephalus	Least Concern
Clarias pachynema	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clarias	pachynema	Least Concern
Clarias stappersii	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clarias	stappersii	Least Concern
Clarias theodorae	ACTINOPTERYGII	SILURIFORMES	CLARIIDAE	Clarias	theodorae	Least Concern
Clypeobarbus bellcrossi	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Clypeobarbus	bellcrossi	Data Deficient
Coptodon rendalli	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Coptodon	rendalli	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Ctenopoma multispine	ACTINOPTERYGII	PERCIFORMES	ANABANTIDAE	Ctenopoma	multispine	Least Concern
Enteromius afrovernayi	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	afrovernayi	Least Concern
Enteromius barnardi	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	barnardi	Least Concern
Enteromius barotseensis	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	barotseensis	Least Concern
Enteromius bifrenatus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	bifrenatus	Least Concern
Enteromius brevidorsalis	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	brevidorsalis	Least Concern
Enteromius eutaenia	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	eutaenia	Least Concern
Enteromius fasciolatus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	fasciolatus	Least Concern
Enteromius haasianus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	haasianus	Least Concern
Enteromius kerstenii	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	kerstenii	Least Concern
Enteromius kessleri	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	kessleri	Least Concern
Enteromius luluae	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	luluae	Least Concern
Enteromius miolepis	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	miolepis	Least Concern
Enteromius multilineatus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	multilineatus	Least Concern
Enteromius neefi	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	neefi	Least Concern
Enteromius paludinosus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	paludinosus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Enteromius radiatus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Enteromius	radiatus	Least Concern
Hemichromis elongatus	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Hemichromis	elongatus	Least Concern
Hemigrammocharax machadoi	ACTINOPTERYGII	CHARACIFORMES	DISTICHODONTIDAE	Hemigrammocharax	machadoi	Least Concern
Hemigrammocharax multifasciatus	ACTINOPTERYGII	CHARACIFORMES	DISTICHODONTIDAE	Hemigrammocharax	multifasciatus	Least Concern
Hippopotamyrus ansorgii	ACTINOPTERYGII	OSTEOGLOSSIFORMES	MORMYRIDAE	Hippopotamyrus	ansorgii	Least Concern
Hydrocynus vittatus	ACTINOPTERYGII	CHARACIFORMES	ALESTIDAE	Hydrocynus	vittatus	Least Concern
Hypsopanchax jubbi	ACTINOPTERYGII	CYPRINODONTIFORMES	POECILIIDAE	Hypsopanchax	jubbi	Least Concern
Kneria angolensis	ACTINOPTERYGII	GONORYNCHIFORMES	KNERIIDAE	Kneria	angolensis	Least Concern
Kneria polli	ACTINOPTERYGII	GONORYNCHIFORMES	KNERIIDAE	Kneria	polli	Least Concern
Labeo cylindricus	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Labeo	cylindricus	Least Concern
Labeo luluae	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Labeo	luluae	Data Deficient
Labeo quadribarbis	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Labeo	quadribarbis	Least Concern
Labeobarbus codringtonii	ACTINOPTERYGII	CYPRINIFORMES	CYPRINIDAE	Labeobarbus	codringtonii	Least Concern
Marcusenius altisambesi	ACTINOPTERYGII	OSTEOGLOSSIFORMES	MORMYRIDAE	Marcusenius	altisambesi	Least Concern
Mastacembelus frenatus	ACTINOPTERYGII	SYNBRANCHIFORMES	MASTACEMBELIDAE	Mastacembelus	frenatus	Least Concern
Micralestes acutidens	ACTINOPTERYGII	CHARACIFORMES	ALESTIDAE	Micralestes	acutidens	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Microctenopoma intermedium	ACTINOPTERYGII	PERCIFORMES	ANABANTIDAE	Microctenopoma	intermedium	Least Concern
Micropanchax johnstoni	ACTINOPTERYGII	CYPRINODONTIFORMES	POECILIIDAE	Micropanchax	johnstoni	Least Concern
Micropanchax katangae	ACTINOPTERYGII	CYPRINODONTIFORMES	POECILIIDAE	Micropanchax	katangae	Least Concern
Mormyrus lacerda	ACTINOPTERYGII	OSTEOGLOSSIFORMES	MORMYRIDAE	Mormyrus	lacerda	Least Concern
Nannocharax macropterus	ACTINOPTERYGII	CHARACIFORMES	DISTICHODONTIDAE	Nannocharax	macropterus	Least Concern
Nanochromis teugelsi	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Nanochromis	teugelsi	Least Concern
Opsaridium zambezense	ACTINOPTERYGII	CYPRINIFORMES	DANIONIDAE	Opsaridium	zambezense	Least Concern
Oreochromis macrochir	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Oreochromis	macrochir	Vulnerable
Parauchenoglanis ngamensis	ACTINOPTERYGII	SILURIFORMES	CLAROTEIDAE	Parauchenoglanis	ngamensis	Least Concern
Petrocephalus simus	ACTINOPTERYGII	OSTEOGLOSSIFORMES	MORMYRIDAE	Petrocephalus	simus	Least Concern
Pharyngochromis acuticeps	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Pharyngochromis	acuticeps	Least Concern
Pseudocrenilabrus philander	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Pseudocrenilabrus	philander	Least Concern
Rhabdalestes maunensis	ACTINOPTERYGII	CHARACIFORMES	ALESTIDAE	Rhabdalestes	maunensis	Least Concern
Sarotherodon galilaeus	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Sarotherodon	galilaeus	Least Concern
Schilbe intermedius	ACTINOPTERYGII	SILURIFORMES	SCHILBEIDAE	Schilbe	intermedius	Least Concern
Serranochromis macrocephalus	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Serranochromis	macrocephalus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Tilapia sparrmanii	ACTINOPTERYGII	PERCIFORMES	CICHLIDAE	Tilapia	sparrmanii	Least Concern

Table 5 – Potential amphibian species by family in the project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Afrixalus wittei	AMPHIBIA	ANURA	HYPEROLIIDAE	Afrixalus	wittei	Least Concern
Amnirana darlingi	AMPHIBIA	ANURA	RANIDAE	Amnirana	darlingi	Least Concern
Amnirana lemairei	AMPHIBIA	ANURA	RANIDAE	Amnirana	lemairei	Least Concern
Arthroleptis lameerei	AMPHIBIA	ANURA	ARTHROLEPTIDAE	Arthroleptis	lameerei	Least Concern
Arthroleptis stenodactylus	AMPHIBIA	ANURA	ARTHROLEPTIDAE	Arthroleptis	stenodactylus	Least Concern
Arthroleptis xenochirus	AMPHIBIA	ANURA	ARTHROLEPTIDAE	Arthroleptis	xenochirus	Least Concern
Breviceps poweri	AMPHIBIA	ANURA	BREVICIPITIDAE	Breviceps	poweri	Least Concern
Chiromantis xerampelina	AMPHIBIA	ANURA	RHACOPHORIDAE	Chiromantis	xerampelina	Least Concern
Hemisus guineensis	AMPHIBIA	ANURA	HEMISOTIDAE	Hemisus	guineensis	Least Concern
Hemisus marmoratus	AMPHIBIA	ANURA	HEMISOTIDAE	Hemisus	marmoratus	Least Concern
Hildebrandtia ornata	AMPHIBIA	ANURA	PTYCHADENIDAE	Hildebrandtia	ornata	Least Concern
Hyperolius benguellensis	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	benguellensis	Least Concern
Hyperolius bocagei	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	bocagei	Least Concern
Hyperolius cinnamomeoventris	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	cinnamomeoventris	Least Concern
Hyperolius dartevellei	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	dartevellei	Least Concern
Hyperolius kivuensis	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	kivuensis	Least Concern
Hyperolius nasutus	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	nasutus	Least Concern
Hyperolius parallelus	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	parallelus	Least Concern
Hyperolius quinquevittatus	AMPHIBIA	ANURA	HYPEROLIIDAE	Hyperolius	quinquevittatus	Least Concern
Kassina kuvangensis	AMPHIBIA	ANURA	HYPEROLIIDAE	Kassina	kuvangensis	Least Concern
Kassina senegalensis	AMPHIBIA	ANURA	HYPEROLIIDAE	Kassina	senegalensis	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Leptopelis bocagii	AMPHIBIA	ANURA	ARTHROLEPTIDAE	Leptopelis	bocagii	Least Concern
Leptopelis cynnamomeus	AMPHIBIA	ANURA	ARTHROLEPTIDAE	Leptopelis	cynnamomeus	Least Concern
Leptopelis parbocagii	AMPHIBIA	ANURA	ARTHROLEPTIDAE	Leptopelis	parbocagii	Least Concern
Mertensophryne melanopleura	AMPHIBIA	ANURA	BUFONIDAE	Mertensophryne	melanopleura	Least Concern
Phrynobatrachus mababiensis	AMPHIBIA	ANURA	PHRYNOBATRACHIDAE	Phrynobatrachus	mababiensis	Least Concern
Phrynobatrachus natalensis	AMPHIBIA	ANURA	PHRYNOBATRACHIDAE	Phrynobatrachus	natalensis	Least Concern
Phrynobatrachus parvulus	AMPHIBIA	ANURA	PHRYNOBATRACHIDAE	Phrynobatrachus	parvulus	Least Concern
Phrynomantis affinis	AMPHIBIA	ANURA	MICROHYLIDAE	Phrynomantis	affinis	Least Concern
Phrynomantis bifasciatus	AMPHIBIA	ANURA	MICROHYLIDAE	Phrynomantis	bifasciatus	Least Concern
Ptychadena anchietae	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	anchietae	Least Concern
Ptychadena ansorgii	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	ansorgii	Least Concern
Ptychadena bunoderma	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	bunoderma	Least Concern
Ptychadena grandisonae	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	grandisonae	Least Concern
Ptychadena guibei	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	guibei	Least Concern
Ptychadena keilingi	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	keilingi	Least Concern
Ptychadena mascareniensis	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	mascareniensis	Least Concern
Ptychadena oxyrhynchus	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	oxyrhynchus	Least Concern
Ptychadena perplicata	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	perplicata	Least Concern
Ptychadena porosissima	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	porosissima	Least Concern
Ptychadena subpunctata	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	subpunctata	Least Concern
Ptychadena taenioscelis	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	taenioscelis	Least Concern
Ptychadena upembae	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	upembae	Least Concern
Ptychadena uzungwensis	AMPHIBIA	ANURA	PTYCHADENIDAE	Ptychadena	uzungwensis	Least Concern
Schismaderma carens	AMPHIBIA	ANURA	BUFONIDAE	Schismaderma	carens	Least Concern
Sclerophrys funerea	AMPHIBIA	ANURA	BUFONIDAE	Sclerophrys	funerea	Least Concern
Sclerophrys gutturalis	AMPHIBIA	ANURA	BUFONIDAE	Sclerophrys	gutturalis	Least Concern
Sclerophrys lemairii	AMPHIBIA	ANURA	BUFONIDAE	Sclerophrys	lemairii	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Sclerophrys pusilla	AMPHIBIA	ANURA	BUFONIDAE	Sclerophrys	pusilla	Least Concern
Tomopterna tuberculosa	AMPHIBIA	ANURA	PYXICEPHALIDAE	Tomopterna	tuberculosa	Least Concern
Xenopus petersii	AMPHIBIA	ANURA	PIPIDAE	Xenopus	petersii	Least Concern

Table 6 – Potential species of reptiles per family in the project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Acanthocercus cyanocephalus	REPTILIA	SQUAMATA	AGAMIDAE	Acanthocercus	cyanocephalus	Least Concern
Afrotyphlops angolensis	REPTILIA	SQUAMATA	TYPHLOPIDAE	Afrotyphlops	angolensis	Least Concern
Afrotyphlops mucruso	REPTILIA	SQUAMATA	TYPHLOPIDAE	Afrotyphlops	mucruso	Least Concern
Afrotyphlops schmidti	REPTILIA	SQUAMATA	TYPHLOPIDAE	Afrotyphlops	schmidti	Data Deficient
Amblyodipsas polylepis	REPTILIA	SQUAMATA	ATRACTASPIDIDAE	Amblyodipsas	polylepis	Least Concern
Aparallactus capensis	REPTILIA	SQUAMATA	ATRACTASPIDIDAE	Aparallactus	capensis	Least Concern
Atractaspis congica	REPTILIA	SQUAMATA	ATRACTASPIDIDAE	Atractaspis	congica	Least Concern
Bitis arietans	REPTILIA	SQUAMATA	VIPERIDAE	Bitis	arietans	Least Concern
Boaedon fuliginosus	REPTILIA	SQUAMATA	LAMPROPHIIDAE	Boaedon	fuliginosus	Least Concern
Causus bilineatus	REPTILIA	SQUAMATA	VIPERIDAE	Causus	bilineatus	Least Concern
Causus rhombeatus	REPTILIA	SQUAMATA	VIPERIDAE	Causus	rhombeatus	Least Concern
Chamaeleo dilepis	REPTILIA	SQUAMATA	CHAMAELEONIDAE	Chamaeleo	dilepis	Least Concern
Chamaeleo gracilis	REPTILIA	SQUAMATA	CHAMAELEONIDAE	Chamaeleo	gracilis	Least Concern
Crocodylus niloticus	REPTILIA	CROCODYLIA	CROCODYLIDAE	Crocodylus	niloticus	Least Concern
Crotaphopeltis hotamboeia	REPTILIA	SQUAMATA	COLUBRIDAE	Crotaphopeltis	hotamboeia	Least Concern
Dalophia angolensis	REPTILIA	SQUAMATA	AMPHISBAENIDAE	Dalophia	angolensis	Least Concern
Dalophia pistillum	REPTILIA	SQUAMATA	AMPHISBAENIDAE	Dalophia	pistillum	Least Concern
Dasypeltis confusa	REPTILIA	SQUAMATA	COLUBRIDAE	Dasypeltis	confusa	Least Concern
Dasypeltis scabra	REPTILIA	SQUAMATA	COLUBRIDAE	Dasypeltis	scabra	Least Concern
Dendroaspis jamesoni	REPTILIA	SQUAMATA	ELAPIDAE	Dendroaspis	jamesoni	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Dendroaspis polylepis	REPTILIA	SQUAMATA	ELAPIDAE	Dendroaspis	polylepis	Least Concern
Dipsadoboa shrevei	REPTILIA	SQUAMATA	COLUBRIDAE	Dipsadoboa	shrevei	Least Concern
Dispholidus typus	REPTILIA	SQUAMATA	COLUBRIDAE	Dispholidus	typus	Least Concern
Elapsoidea guentherii	REPTILIA	SQUAMATA	ELAPIDAE	Elapsoidea	guentherii	Least Concern
Elapsoidea semiannulata	REPTILIA	SQUAMATA	ELAPIDAE	Elapsoidea	semiannulata	Least Concern
Eumecia anchietae	REPTILIA	SQUAMATA	SCINCIDAE	Eumecia	anchietae	Least Concern
Gerrhosaurus auritus	REPTILIA	SQUAMATA	GERRHOSAURIDAE	Gerrhosaurus	auritus	Least Concern
Gerrhosaurus bulsi	REPTILIA	SQUAMATA	GERRHOSAURIDAE	Gerrhosaurus	bulsi	Least Concern
Gerrhosaurus intermedius	REPTILIA	SQUAMATA	GERRHOSAURIDAE	Gerrhosaurus	intermedius	Least Concern
Grayia smithii	REPTILIA	SQUAMATA	GRAYIIDAE	Grayia	smithii	Least Concern
Hemidactylus mabouia	REPTILIA	SQUAMATA	GEKKONIDAE	Hemidactylus	mabouia	Least Concern
Ichnotropis bivittata	REPTILIA	SQUAMATA	LACERTIDAE	Ichnotropis	bivittata	Least Concern
Ichnotropis capensis	REPTILIA	SQUAMATA	LACERTIDAE	Ichnotropis	capensis	Least Concern
Kladirostratus acutus	REPTILIA	SQUAMATA	PSAMMOPHIIDAE	Kladirostratus	acutus	Least Concern
Limaformosa capensis	REPTILIA	SQUAMATA	LAMPROPHIIDAE	Limaformosa	capensis	Least Concern
Limnophis bangweolicus	REPTILIA	SQUAMATA	NATRICIDAE	Limnophis	bangweolicus	Least Concern
Limnophis bicolor	REPTILIA	SQUAMATA	NATRICIDAE	Limnophis	bicolor	Least Concern
Lubuya ivensii	REPTILIA	SQUAMATA	SCINCIDAE	Lubuya	ivensii	Least Concern
Lycophidion multimaculatum	REPTILIA	SQUAMATA	LAMPROPHIIDAE	Lycophidion	multimaculatum	Least Concern
Lygodactylus angolensis	REPTILIA	SQUAMATA	GEKKONIDAE	Lygodactylus	angolensis	Least Concern
Naja nigricollis	REPTILIA	SQUAMATA	ELAPIDAE	Naja	nigricollis	Least Concern
Naja subfulva	REPTILIA	SQUAMATA	ELAPIDAE	Naja	subfulva	Least Concern
Natriciteres bipostocularis	REPTILIA	SQUAMATA	NATRICIDAE	Natriciteres	bipostocularis	Least Concern
Natriciteres olivacea	REPTILIA	SQUAMATA	NATRICIDAE	Natriciteres	olivacea	Least Concern
Philothamnus angolensis	REPTILIA	SQUAMATA	COLUBRIDAE	Philothamnus	angolensis	Least Concern
Philothamnus dorsalis	REPTILIA	SQUAMATA	COLUBRIDAE	Philothamnus	dorsalis	Least Concern
Philothamnus heterolepidotus	REPTILIA	SQUAMATA	COLUBRIDAE	Philothamnus	heterolepidotus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Philothamnus hoplogaster	REPTILIA	SQUAMATA	COLUBRIDAE	Philothamnus	hoplogaster	Least Concern
Philothamnus ornatus	REPTILIA	SQUAMATA	COLUBRIDAE	Philothamnus	ornatus	Least Concern
Philothamnus semivariegatus	REPTILIA	SQUAMATA	COLUBRIDAE	Philothamnus	semivariegatus	Least Concern
Polemon christyi	REPTILIA	SQUAMATA	ATRACTASPIDIDAE	Polemon	christyi	Least Concern
Prosymna ambigua	REPTILIA	SQUAMATA	PROSYMNIDAE	Prosymna	ambigua	Least Concern
Psammophis angolensis	REPTILIA	SQUAMATA	PSAMMOPHIIDAE	Psammophis	angolensis	Least Concern
Psammophis lineatus	REPTILIA	SQUAMATA	PSAMMOPHIIDAE	Psammophis	lineatus	Least Concern
Psammophis mossambicus	REPTILIA	SQUAMATA	PSAMMOPHIIDAE	Psammophis	mossambicus	Least Concern
Psammophis zambiensis	REPTILIA	SQUAMATA	PSAMMOPHIIDAE	Psammophis	zambiensis	Near Threatened
Psammophylax tritaeniatus	REPTILIA	SQUAMATA	PSAMMOPHIIDAE	Psammophylax	tritaeniatus	Least Concern
Pseudaspis cana	REPTILIA	SQUAMATA	PSEUDASPIDIDAE	Pseudaspis	cana	Least Concern
Rhamnophis aethiopissa	REPTILIA	SQUAMATA	COLUBRIDAE	Rhamnophis	aethiopissa	Least Concern
Sepsina angolensis	REPTILIA	SQUAMATA	SCINCIDAE	Sepsina	angolensis	Least Concern
Telescopus semiannulatus	REPTILIA	SQUAMATA	COLUBRIDAE	Telescopus	semiannulatus	Least Concern
Tetradactylus ellenbergeri	REPTILIA	SQUAMATA	GERRHOSAURIDAE	Tetradactylus	ellenbergeri	Least Concern
Thelotornis capensis	REPTILIA	SQUAMATA	COLUBRIDAE	Thelotornis	capensis	Least Concern
Thrasops jacksonii	REPTILIA	SQUAMATA	COLUBRIDAE	Thrasops	jacksonii	Least Concern
Toxicodryas blandingii	REPTILIA	SQUAMATA	COLUBRIDAE	Toxicodryas	blandingii	Least Concern
Trachylepis albopunctata	REPTILIA	SQUAMATA	SCINCIDAE	Trachylepis	albopunctata	Least Concern
Trachylepis bayonii	REPTILIA	SQUAMATA	SCINCIDAE	Trachylepis	bayonii	Least Concern
Trachylepis raymondlaurenti	REPTILIA	SQUAMATA	SCINCIDAE	Trachylepis	raymondlaurenti	Least Concern
Trachylepis striata	REPTILIA	SQUAMATA	SCINCIDAE	Trachylepis	striata	Least Concern
Varanus albigularis	REPTILIA	SQUAMATA	VARANIDAE	Varanus	albigularis	Least Concern
Varanus niloticus	REPTILIA	SQUAMATA	VARANIDAE	Varanus	niloticus	Least Concern
Xenocalamus bicolor	REPTILIA	SQUAMATA	ATRACTASPIDIDAE	Xenocalamus	bicolor	Least Concern
Xenocalamus mechowii	REPTILIA	SQUAMATA	ATRACTASPIDIDAE	Xenocalamus	mechowii	Least Concern
Zygaspis nigra	REPTILIA	SQUAMATA	AMPHISBAENIDAE	Zygaspis	nigra	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Zygaspis quadrifrons	REPTILIA	SQUAMATA	AMPHISBAENIDAE	Zygaspis	quadrifrons	Least Concern

Table 7 – Potential bird species per family in the project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Accipiter badius	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Accipiter	badius	Least Concern
Accipiter melanoleucus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Accipiter	melanoleucus	Least Concern
Accipiter minullus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Accipiter	minullus	Least Concern
Accipiter ovampensis	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Accipiter	ovampensis	Least Concern
Accipiter tachiro	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Accipiter	tachiro	Least Concern
Acrocephalus arundinaceus	AVES	PASSERIFORMES	ACROCEPHALIDAE	Acrocephalus	arundinaceus	Least Concern
Acrocephalus gracilirostris	AVES	PASSERIFORMES	ACROCEPHALIDAE	Acrocephalus	gracilirostris	Least Concern
Acrocephalus schoenobaenus	AVES	PASSERIFORMES	ACROCEPHALIDAE	Acrocephalus	schoenobaenus	Least Concern
Actitis hypoleucos	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Actitis	hypoleucos	Least Concern
Actophilornis africanus	AVES	CHARADRIIFORMES	JACANIDAE	Actophilornis	africanus	Least Concern
Agricola pallidus	AVES	PASSERIFORMES	MUSCICAPIDAE	Agricola	pallidus	Least Concern
Alcedo quadribrachys	AVES	CORACIIFORMES	ALCEDINIDAE	Alcedo	quadribrachys	Least Concern
Alcedo semitorquata	AVES	CORACIIFORMES	ALCEDINIDAE	Alcedo	semitorquata	Least Concern
Alopochen aegyptiaca	AVES	ANSERIFORMES	ANATIDAE	Alopochen	aegyptiaca	Least Concern
Anaplectes rubriceps	AVES	PASSERIFORMES	PLOCEIDAE	Anaplectes	rubriceps	Least Concern
Anas erythrorhyncha	AVES	ANSERIFORMES	ANATIDAE	Anas	erythrorhyncha	Least Concern
Anas sparsa	AVES	ANSERIFORMES	ANATIDAE	Anas	sparsa	Least Concern
Anas undulata	AVES	ANSERIFORMES	ANATIDAE	Anas	undulata	Least Concern
Anastomus lamelligerus	AVES	CICONIIFORMES	CICONIIDAE	Anastomus	lamelligerus	Least Concern
Anhinga rufa	AVES	SULIFORMES	ANHINGIDAE	Anhinga	rufa	Least Concern
Anomalospiza imberbis	AVES	PASSERIFORMES	VIDUIDAE	Anomalospiza	imberbis	Least Concern
Anthoscopus caroli	AVES	PASSERIFORMES	REMIZIDAE	Anthoscopus	caroli	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Anthreptes longuemarei	AVES	PASSERIFORMES	NECTARINIIDAE	Anthreptes	longuemarei	Least Concern
Anthus brachyurus	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	brachyurus	Least Concern
Anthus cinnamomeus	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	cinnamomeus	Least Concern
Anthus hoeschi	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	hoeschi	Near Threatened
Anthus leucophrys	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	leucophrys	Least Concern
Anthus nyassae	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	nyassae	Least Concern
Anthus trivialis	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	trivialis	Least Concern
Anthus vaalensis	AVES	PASSERIFORMES	MOTACILLIDAE	Anthus	vaalensis	Least Concern
Apalis alticola	AVES	PASSERIFORMES	CISTICOLIDAE	Apalis	alticola	Least Concern
Apalis flavida	AVES	PASSERIFORMES	CISTICOLIDAE	Apalis	flavida	Least Concern
Apaloderma narina	AVES	TROGONIFORMES	TROGONIDAE	Apaloderma	narina	Least Concern
Aplopelia larvata	AVES	COLUMBIFORMES	COLUMBIDAE	Aplopelia	larvata	Least Concern
Apus affinis	AVES	CAPRIMULGIFORMES	APODIDAE	Apus	affinis	Least Concern
Apus apus	AVES	CAPRIMULGIFORMES	APODIDAE	Apus	apus	Least Concern
Aquila nipalensis	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Aquila	nipalensis	Endangered
Aquila rapax	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Aquila	rapax	Vulnerable
Aquila spilogaster	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Aquila	spilogaster	Least Concern
Ardea alba	AVES	PELECANIFORMES	ARDEIDAE	Ardea	alba	Least Concern
Ardea brachyrhyncha	AVES	PELECANIFORMES	ARDEIDAE	Ardea	brachyrhyncha	Least Concern
Ardea cinerea	AVES	PELECANIFORMES	ARDEIDAE	Ardea	cinerea	Least Concern
Ardea goliath	AVES	PELECANIFORMES	ARDEIDAE	Ardea	goliath	Least Concern
Ardea melanocephala	AVES	PELECANIFORMES	ARDEIDAE	Ardea	melanocephala	Least Concern
Ardea purpurea	AVES	PELECANIFORMES	ARDEIDAE	Ardea	purpurea	Least Concern
Ardeola ralloides	AVES	PELECANIFORMES	ARDEIDAE	Ardeola	ralloides	Least Concern
Ardeola rufiventris	AVES	PELECANIFORMES	ARDEIDAE	Ardeola	rufiventris	Least Concern
Asio capensis	AVES	STRIGIFORMES	STRIGIDAE	Asio	capensis	Least Concern
Atimastillas flavigula	AVES	PASSERIFORMES	PYCNONOTIDAE	Atimastillas	flavigula	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Aviceda cuculoides	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Aviceda	cuculoides	Least Concern
Batis molitor	AVES	PASSERIFORMES	PLATYSTEIRIDAE	Batis	molitor	Least Concern
Bocagia minuta	AVES	PASSERIFORMES	MALACONOTIDAE	Bocagia	minuta	Least Concern
Bostrychia hagedash	AVES	PELECANIFORMES	THRESKIORNITHIDAE	Bostrychia	hagedash	Least Concern
Bubo africanus	AVES	STRIGIFORMES	STRIGIDAE	Bubo	africanus	Least Concern
Bubo lacteus	AVES	STRIGIFORMES	STRIGIDAE	Bubo	lacteus	Least Concern
Bubulcus ibis	AVES	PELECANIFORMES	ARDEIDAE	Bubulcus	ibis	Least Concern
Bucorvus leadbeateri	AVES	BUCEROTIFORMES	BUCEROTIDAE	Bucorvus	leadbeateri	Vulnerable
Bugeranus carunculatus	AVES	GRUIFORMES	GRUIDAE	Bugeranus	carunculatus	Vulnerable
Burhinus capensis	AVES	CHARADRIIFORMES	BURHINIDAE	Burhinus	capensis	Least Concern
Burhinus vermiculatus	AVES	CHARADRIIFORMES	BURHINIDAE	Burhinus	vermiculatus	Least Concern
Buteo buteo	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Buteo	buteo	Least Concern
Butorides striata	AVES	PELECANIFORMES	ARDEIDAE	Butorides	striata	Least Concern
Bycanistes bucinator	AVES	BUCEROTIFORMES	BUCEROTIDAE	Bycanistes	bucinator	Least Concern
Calamonastes undosus	AVES	PASSERIFORMES	CISTICOLIDAE	Calamonastes	undosus	Least Concern
Calandrella cinerea	AVES	PASSERIFORMES	ALAUDIDAE	Calandrella	cinerea	Least Concern
Calendulauda africanoides	AVES	PASSERIFORMES	ALAUDIDAE	Calendulauda	africanoides	Least Concern
Calidris minuta	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Calidris	minuta	Least Concern
Calidris pugnax	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Calidris	pugnax	Least Concern
Camaroptera brachyura	AVES	PASSERIFORMES	CISTICOLIDAE	Camaroptera	brachyura	Least Concern
Campethera abingoni	AVES	PICIFORMES	PICIDAE	Campethera	abingoni	Least Concern
Campethera bennettii	AVES	PICIFORMES	PICIDAE	Campethera	bennettii	Least Concern
Campethera cailliautii	AVES	PICIFORMES	PICIDAE	Campethera	cailliautii	Least Concern
Campethera maculosa	AVES	PICIFORMES	PICIDAE	Campethera	maculosa	Least Concern
Campocolinus albogularis	AVES	GALLIFORMES	PHASIANIDAE	Campocolinus	albogularis	Least Concern
Campocolinus coqui	AVES	GALLIFORMES	PHASIANIDAE	Campocolinus	coqui	Least Concern
Caprimulgus fossii	AVES	CAPRIMULGIFORMES	CAPRIMULGIDAE	Caprimulgus	fossii	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Caprimulgus natalensis	AVES	CAPRIMULGIFORMES	CAPRIMULGIDAE	Caprimulgus	natalensis	Least Concern
Caprimulgus pectoralis	AVES	CAPRIMULGIFORMES	CAPRIMULGIDAE	Caprimulgus	pectoralis	Least Concern
Caprimulgus vexillarius	AVES	CAPRIMULGIFORMES	CAPRIMULGIDAE	Caprimulgus	vexillarius	Least Concern
Catriscus brevirostris	AVES	PASSERIFORMES	LOCUSTELLIDAE	Catriscus	brevirostris	Least Concern
Ceblepyris pectoralis	AVES	PASSERIFORMES	CAMPEPHAGIDAE	Ceblepyris	pectoralis	Least Concern
Cecropis abyssinica	AVES	PASSERIFORMES	HIRUNDINIDAE	Cecropis	abyssinica	Least Concern
Cecropis cucullata	AVES	PASSERIFORMES	HIRUNDINIDAE	Cecropis	cucullata	Least Concern
Cecropis semirufa	AVES	PASSERIFORMES	HIRUNDINIDAE	Cecropis	semirufa	Least Concern
Cecropis senegalensis	AVES	PASSERIFORMES	HIRUNDINIDAE	Cecropis	senegalensis	Least Concern
Centropus cupreicaudus	AVES	CUCULIFORMES	CUCULIDAE	Centropus	cupreicaudus	Least Concern
Centropus grillii	AVES	CUCULIFORMES	CUCULIDAE	Centropus	grillii	Least Concern
Centropus superciliosus	AVES	CUCULIFORMES	CUCULIDAE	Centropus	superciliosus	Least Concern
Cercotrichas leucophrys	AVES	PASSERIFORMES	MUSCICAPIDAE	Cercotrichas	leucophrys	Least Concern
Ceryle rudis	AVES	CORACIIFORMES	ALCEDINIDAE	Ceryle	rudis	Least Concern
Chalcomitra amethystina	AVES	PASSERIFORMES	NECTARINIIDAE	Chalcomitra	amethystina	Least Concern
Chalcomitra rubescens	AVES	PASSERIFORMES	NECTARINIIDAE	Chalcomitra	rubescens	Least Concern
Chalcomitra senegalensis	AVES	PASSERIFORMES	NECTARINIIDAE	Chalcomitra	senegalensis	Least Concern
Charadrius asiaticus	AVES	CHARADRIIFORMES	CHARADRIIDAE	Charadrius	asiaticus	Least Concern
Charadrius forbesi	AVES	CHARADRIIFORMES	CHARADRIIDAE	Charadrius	forbesi	Least Concern
Charadrius hiaticula	AVES	CHARADRIIFORMES	CHARADRIIDAE	Charadrius	hiaticula	Least Concern
Charadrius marginatus	AVES	CHARADRIIFORMES	CHARADRIIDAE	Charadrius	marginatus	Least Concern
Charadrius pecuarius	AVES	CHARADRIIFORMES	CHARADRIIDAE	Charadrius	pecuarius	Least Concern
Charadrius tricollaris	AVES	CHARADRIIFORMES	CHARADRIIDAE	Charadrius	tricollaris	Least Concern
Chlidonias hybrida	AVES	CHARADRIIFORMES	LARIDAE	Chlidonias	hybrida	Least Concern
Chlidonias leucopterus	AVES	CHARADRIIFORMES	LARIDAE	Chlidonias	leucopterus	Least Concern
Chlorocichla flaviventris	AVES	PASSERIFORMES	PYCNONOTIDAE	Chlorocichla	flaviventris	Least Concern
Chlorophoneus nigrifrons	AVES	PASSERIFORMES	MALACONOTIDAE	Chlorophoneus	nigrifrons	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Chlorophoneus sulfureopectus	AVES	PASSERIFORMES	MALACONOTIDAE	Chlorophoneus	sulfureopectus	Least Concern
Chrysococcyx caprius	AVES	CUCULIFORMES	CUCULIDAE	Chrysococcyx	caprius	Least Concern
Chrysococcyx cupreus	AVES	CUCULIFORMES	CUCULIDAE	Chrysococcyx	cupreus	Least Concern
Chrysococcyx klaas	AVES	CUCULIFORMES	CUCULIDAE	Chrysococcyx	klaas	Least Concern
Ciconia abdimii	AVES	CICONIIFORMES	CICONIIDAE	Ciconia	abdimii	Least Concern
Ciconia ciconia	AVES	CICONIIFORMES	CICONIIDAE	Ciconia	ciconia	Least Concern
Ciconia microscelis	AVES	CICONIIFORMES	CICONIIDAE	Ciconia	microscelis	Least Concern
Cinnyricinclus leucogaster	AVES	PASSERIFORMES	STURNIDAE	Cinnyricinclus	leucogaster	Least Concern
Cinnyris bifasciatus	AVES	PASSERIFORMES	NECTARINIIDAE	Cinnyris	bifasciatus	Least Concern
Cinnyris cupreus	AVES	PASSERIFORMES	NECTARINIIDAE	Cinnyris	cupreus	Least Concern
Cinnyris gertrudis	AVES	PASSERIFORMES	NECTARINIIDAE	Cinnyris	gertrudis	Least Concern
Cinnyris venustus	AVES	PASSERIFORMES	NECTARINIIDAE	Cinnyris	venustus	Least Concern
Circaetus cinerascens	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Circaetus	cinerascens	Least Concern
Circaetus cinereus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Circaetus	cinereus	Least Concern
Circaetus pectoralis	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Circaetus	pectoralis	Least Concern
Circus aeruginosus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Circus	aeruginosus	Least Concern
Circus ranivorus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Circus	ranivorus	Least Concern
Cisticola aridulus	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	aridulus	Least Concern
Cisticola brachypterus	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	brachypterus	Least Concern
Cisticola chiniana	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	chiniana	Least Concern
Cisticola cinnamomeus	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	cinnamomeus	Least Concern
Cisticola dambo	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	dambo	Least Concern
Cisticola fulvicapilla	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	fulvicapilla	Least Concern
Cisticola lateralis	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	lateralis	Least Concern
Cisticola luapula	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	luapula	Least Concern
Cisticola natalensis	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	natalensis	Least Concern
Cisticola pipiens	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	pipiens	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Cisticola robustus	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	robustus	Least Concern
Cisticola rufilatus	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	rufilatus	Least Concern
Cisticola textrix	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	textrix	Least Concern
Cisticola tinniens	AVES	PASSERIFORMES	CISTICOLIDAE	Cisticola	tinniens	Least Concern
Clamator jacobinus	AVES	CUCULIFORMES	CUCULIDAE	Clamator	jacobinus	Least Concern
Clamator levaillantii	AVES	CUCULIFORMES	CUCULIDAE	Clamator	levaillantii	Least Concern
Clanga pomarina	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Clanga	pomarina	Least Concern
Colius striatus	AVES	COLIIFORMES	COLIIDAE	Colius	striatus	Least Concern
Coracias caudatus	AVES	CORACIIFORMES	CORACIIDAE	Coracias	caudatus	Least Concern
Coracias garrulus	AVES	CORACIIFORMES	CORACIIDAE	Coracias	garrulus	Least Concern
Coracias naevius	AVES	CORACIIFORMES	CORACIIDAE	Coracias	naevius	Least Concern
Coracias spatulatus	AVES	CORACIIFORMES	CORACIIDAE	Coracias	spatulatus	Least Concern
Corvus albus	AVES	PASSERIFORMES	CORVIDAE	Corvus	albus	Least Concern
Corvus capensis	AVES	PASSERIFORMES	CORVIDAE	Corvus	capensis	Least Concern
Corythornis cristatus	AVES	CORACIIFORMES	ALCEDINIDAE	Corythornis	cristatus	Least Concern
Cossypha heuglini	AVES	PASSERIFORMES	MUSCICAPIDAE	Cossypha	heuglini	Least Concern
Cossypha natalensis	AVES	PASSERIFORMES	MUSCICAPIDAE	Cossypha	natalensis	Least Concern
Coturnix coturnix	AVES	GALLIFORMES	PHASIANIDAE	Coturnix	coturnix	Least Concern
Coturnix delegorguei	AVES	GALLIFORMES	PHASIANIDAE	Coturnix	delegorguei	Least Concern
Creatophora cinerea	AVES	PASSERIFORMES	STURNIDAE	Creatophora	cinerea	Least Concern
Crex crex	AVES	GRUIFORMES	RALLIDAE	Crex	crex	Least Concern
Crex egregia	AVES	GRUIFORMES	RALLIDAE	Crex	egregia	Least Concern
Crithagra atrogularis	AVES	PASSERIFORMES	FRINGILLIDAE	Crithagra	atrogularis	Least Concern
Crithagra capistrata	AVES	PASSERIFORMES	FRINGILLIDAE	Crithagra	capistrata	Least Concern
Crithagra mennelli	AVES	PASSERIFORMES	FRINGILLIDAE	Crithagra	mennelli	Least Concern
Crithagra mozambica	AVES	PASSERIFORMES	FRINGILLIDAE	Crithagra	mozambica	Least Concern
Crithagra sulphurata	AVES	PASSERIFORMES	FRINGILLIDAE	Crithagra	sulphurata	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Cuculus canorus	AVES	CUCULIFORMES	CUCULIDAE	Cuculus	canorus	Least Concern
Cuculus clamosus	AVES	CUCULIFORMES	CUCULIDAE	Cuculus	clamosus	Least Concern
Cuculus gularis	AVES	CUCULIFORMES	CUCULIDAE	Cuculus	gularis	Least Concern
Cuculus solitarius	AVES	CUCULIFORMES	CUCULIDAE	Cuculus	solitarius	Least Concern
Cursorius temminckii	AVES	CHARADRIIFORMES	GLAREOLIDAE	Cursorius	temminckii	Least Concern
Cyanomitra bannermani	AVES	PASSERIFORMES	NECTARINIIDAE	Cyanomitra	bannermani	Least Concern
Cyanomitra olivacea	AVES	PASSERIFORMES	NECTARINIIDAE	Cyanomitra	olivacea	Least Concern
Cypsiurus parvus	AVES	CAPRIMULGIFORMES	APODIDAE	Cypsiurus	parvus	Least Concern
Delichon urbicum	AVES	PASSERIFORMES	HIRUNDINIDAE	Delichon	urbicum	Least Concern
Dendrocygna bicolor	AVES	ANSERIFORMES	ANATIDAE	Dendrocygna	bicolor	Least Concern
Dendrocygna viduata	AVES	ANSERIFORMES	ANATIDAE	Dendrocygna	viduata	Least Concern
Dendropicos fuscescens	AVES	PICIFORMES	PICIDAE	Dendropicos	fuscescens	Least Concern
Dendropicos griseocephalus	AVES	PICIFORMES	PICIDAE	Dendropicos	griseocephalus	Least Concern
Dendropicos namaquus	AVES	PICIFORMES	PICIDAE	Dendropicos	namaquus	Least Concern
Dicrurus adsimilis	AVES	PASSERIFORMES	DICRURIDAE	Dicrurus	adsimilis	Least Concern
Dicrurus ludwigii	AVES	PASSERIFORMES	DICRURIDAE	Dicrurus	ludwigii	Least Concern
Dryoscopus cubla	AVES	PASSERIFORMES	MALACONOTIDAE	Dryoscopus	cubla	Least Concern
Egretta ardesiaca	AVES	PELECANIFORMES	ARDEIDAE	Egretta	ardesiaca	Least Concern
Egretta garzetta	AVES	PELECANIFORMES	ARDEIDAE	Egretta	garzetta	Least Concern
Elanus caeruleus	AVES	ACCIPITRIFORMES	ELANIDAE	Elanus	caeruleus	Least Concern
Elminia albicauda	AVES	PASSERIFORMES	STENOSTIRIDAE	Elminia	albicauda	Least Concern
Emberiza cabanisi	AVES	PASSERIFORMES	EMBERIZIDAE	Emberiza	cabanisi	Least Concern
Emberiza flaviventris	AVES	PASSERIFORMES	EMBERIZIDAE	Emberiza	flaviventris	Least Concern
Ephippiorhynchus senegalensis	AVES	CICONIIFORMES	CICONIIDAE	Ephippiorhynchus	senegalensis	Least Concern
Eremomela atricollis	AVES	PASSERIFORMES	CISTICOLIDAE	Eremomela	atricollis	Least Concern
Eremomela icteropygialis	AVES	PASSERIFORMES	CISTICOLIDAE	Eremomela	icteropygialis	Least Concern
Eremomela scotops	AVES	PASSERIFORMES	CISTICOLIDAE	Eremomela	scotops	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Estrilda paludicola	AVES	PASSERIFORMES	ESTRILDIDAE	Estrilda	paludicola	Least Concern
Euplectes axillaris	AVES	PASSERIFORMES	PLOCEIDAE	Euplectes	axillaris	Least Concern
Euplectes capensis	AVES	PASSERIFORMES	PLOCEIDAE	Euplectes	capensis	Least Concern
Euplectes hartlaubi	AVES	PASSERIFORMES	PLOCEIDAE	Euplectes	hartlaubi	Least Concern
Euplectes macroura	AVES	PASSERIFORMES	PLOCEIDAE	Euplectes	macroura	Least Concern
Euplectes progne	AVES	PASSERIFORMES	PLOCEIDAE	Euplectes	progne	Least Concern
Eupodotis senegalensis	AVES	OTIDIFORMES	OTIDIDAE	Eupodotis	senegalensis	Least Concern
Eurillas virens	AVES	PASSERIFORMES	PYCNONOTIDAE	Eurillas	virens	Least Concern
Eurystomus glaucurus	AVES	CORACIIFORMES	CORACIIDAE	Eurystomus	glaucurus	Least Concern
Falco biarmicus	AVES	FALCONIFORMES	FALCONIDAE	Falco	biarmicus	Least Concern
Falco dickinsoni	AVES	FALCONIFORMES	FALCONIDAE	Falco	dickinsoni	Least Concern
Falco naumanni	AVES	FALCONIFORMES	FALCONIDAE	Falco	naumanni	Least Concern
Falco peregrinus	AVES	FALCONIFORMES	FALCONIDAE	Falco	peregrinus	Least Concern
Falco ruficollis	AVES	FALCONIFORMES	FALCONIDAE	Falco	ruficollis	Least Concern
Falco rupicoloides	AVES	FALCONIFORMES	FALCONIDAE	Falco	rupicoloides	Least Concern
Falco subbuteo	AVES	FALCONIFORMES	FALCONIDAE	Falco	subbuteo	Least Concern
Falco tinnunculus	AVES	FALCONIFORMES	FALCONIDAE	Falco	tinnunculus	Least Concern
Falco vespertinus	AVES	FALCONIFORMES	FALCONIDAE	Falco	vespertinus	Vulnerable
Fraseria caerulescens	AVES	PASSERIFORMES	MUSCICAPIDAE	Fraseria	caerulescens	Least Concern
Fraseria plumbea	AVES	PASSERIFORMES	MUSCICAPIDAE	Fraseria	plumbea	Least Concern
Gallinago media	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Gallinago	media	Near Threatened
Gallinago nigripennis	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Gallinago	nigripennis	Least Concern
Gallinula chloropus	AVES	GRUIFORMES	RALLIDAE	Gallinula	chloropus	Least Concern
Glareola nordmanni	AVES	CHARADRIIFORMES	GLAREOLIDAE	Glareola	nordmanni	Near Threatened
Glareola nuchalis	AVES	CHARADRIIFORMES	GLAREOLIDAE	Glareola	nuchalis	Least Concern
Glaucidium capense	AVES	STRIGIFORMES	STRIGIDAE	Glaucidium	capense	Least Concern
Guttera verreauxi	AVES	GALLIFORMES	NUMIDIDAE	Guttera	verreauxi	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Gymnoris superciliaris	AVES	PASSERIFORMES	PASSERIDAE	Gymnoris	superciliaris	Least Concern
Gypohierax angolensis	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Gypohierax	angolensis	Least Concern
Gyps africanus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Gyps	africanus	Critically Endangered
Halcyon albiventris	AVES	CORACIIFORMES	ALCEDINIDAE	Halcyon	albiventris	Least Concern
Halcyon chelicuti	AVES	CORACIIFORMES	ALCEDINIDAE	Halcyon	chelicuti	Least Concern
Halcyon leucocephala	AVES	CORACIIFORMES	ALCEDINIDAE	Halcyon	leucocephala	Least Concern
Halcyon malimbica	AVES	CORACIIFORMES	ALCEDINIDAE	Halcyon	malimbica	Least Concern
Halcyon senegalensis	AVES	CORACIIFORMES	ALCEDINIDAE	Halcyon	senegalensis	Least Concern
Haliaeetus vocifer	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Haliaeetus	vocifer	Least Concern
Hedydipna collaris	AVES	PASSERIFORMES	NECTARINIIDAE	Hedydipna	collaris	Least Concern
Hieraaetus ayresii	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Hieraaetus	ayresii	Least Concern
Hieraaetus pennatus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Hieraaetus	pennatus	Least Concern
Hieraaetus wahlbergi	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Hieraaetus	wahlbergi	Least Concern
Himantopus himantopus	AVES	CHARADRIIFORMES	RECURVIROSTRIDAE	Himantopus	himantopus	Least Concern
Hippolais icterina	AVES	PASSERIFORMES	ACROCEPHALIDAE	Hippolais	icterina	Least Concern
Hirundo albigularis	AVES	PASSERIFORMES	HIRUNDINIDAE	Hirundo	albigularis	Least Concern
Hirundo dimidiata	AVES	PASSERIFORMES	HIRUNDINIDAE	Hirundo	dimidiata	Least Concern
Hirundo nigrita	AVES	PASSERIFORMES	HIRUNDINIDAE	Hirundo	nigrita	Least Concern
Hirundo nigrorufa	AVES	PASSERIFORMES	HIRUNDINIDAE	Hirundo	nigrorufa	Least Concern
Hirundo rustica	AVES	PASSERIFORMES	HIRUNDINIDAE	Hirundo	rustica	Least Concern
Hirundo smithii	AVES	PASSERIFORMES	HIRUNDINIDAE	Hirundo	smithii	Least Concern
Hyliota australis	AVES	PASSERIFORMES	HYLIOTIDAE	Hyliota	australis	Least Concern
Hyliota flavigaster	AVES	PASSERIFORMES	HYLIOTIDAE	Hyliota	flavigaster	Least Concern
Iduna natalensis	AVES	PASSERIFORMES	ACROCEPHALIDAE	Iduna	natalensis	Least Concern
Indicator exilis	AVES	PICIFORMES	INDICATORIDAE	Indicator	exilis	Least Concern
Indicator indicator	AVES	PICIFORMES	INDICATORIDAE	Indicator	indicator	Least Concern
Indicator meliphilus	AVES	PICIFORMES	INDICATORIDAE	Indicator	meliphilus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Indicator minor	AVES	PICIFORMES	INDICATORIDAE	Indicator	minor	Least Concern
Indicator variegatus	AVES	PICIFORMES	INDICATORIDAE	Indicator	variegatus	Least Concern
Ispidina picta	AVES	CORACIIFORMES	ALCEDINIDAE	Ispidina	picta	Least Concern
Ixobrychus minutus	AVES	PELECANIFORMES	ARDEIDAE	Ixobrychus	minutus	Least Concern
Jynx ruficollis	AVES	PICIFORMES	PICIDAE	Jynx	ruficollis	Least Concern
Kaupifalco monogrammicus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Kaupifalco	monogrammicus	Least Concern
Lagonosticta nitidula	AVES	PASSERIFORMES	ESTRILDIDAE	Lagonosticta	nitidula	Least Concern
Lagonosticta rhodopareia	AVES	PASSERIFORMES	ESTRILDIDAE	Lagonosticta	rhodopareia	Least Concern
Lagonosticta rubricata	AVES	PASSERIFORMES	ESTRILDIDAE	Lagonosticta	rubricata	Least Concern
Lamprotornis acuticaudus	AVES	PASSERIFORMES	STURNIDAE	Lamprotornis	acuticaudus	Least Concern
Lamprotornis chalybaeus	AVES	PASSERIFORMES	STURNIDAE	Lamprotornis	chalybaeus	Least Concern
Lamprotornis splendidus	AVES	PASSERIFORMES	STURNIDAE	Lamprotornis	splendidus	Least Concern
Laniarius aethiopicus	AVES	PASSERIFORMES	MALACONOTIDAE	Laniarius	aethiopicus	Least Concern
Laniarius bicolor	AVES	PASSERIFORMES	MALACONOTIDAE	Laniarius	bicolor	Least Concern
Lanius collaris	AVES	PASSERIFORMES	LANIIDAE	Lanius	collaris	Least Concern
Lanius collurio	AVES	PASSERIFORMES	LANIIDAE	Lanius	collurio	Least Concern
Lanius souzae	AVES	PASSERIFORMES	LANIIDAE	Lanius	souzae	Least Concern
Larus cirrocephalus	AVES	CHARADRIIFORMES	LARIDAE	Larus	cirrocephalus	Least Concern
Leptoptilos crumenifer	AVES	CICONIIFORMES	CICONIIDAE	Leptoptilos	crumenifer	Least Concern
Lissotis melanogaster	AVES	OTIDIFORMES	OTIDIDAE	Lissotis	melanogaster	Least Concern
Locustella fluviatilis	AVES	PASSERIFORMES	LOCUSTELLIDAE	Locustella	fluviatilis	Least Concern
Lophaetus occipitalis	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Lophaetus	occipitalis	Least Concern
Lophoceros alboterminatus	AVES	BUCEROTIFORMES	BUCEROTIDAE	Lophoceros	alboterminatus	Least Concern
Lophoceros pallidirostris	AVES	BUCEROTIFORMES	BUCEROTIDAE	Lophoceros	pallidirostris	Least Concern
Lybius torquatus	AVES	PICIFORMES	LYBIIDAE	Lybius	torquatus	Least Concern
Macheiramphus alcinus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Macheiramphus	alcinus	Least Concern
Macronyx ameliae	AVES	PASSERIFORMES	MOTACILLIDAE	Macronyx	ameliae	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Macronyx fuelleborni	AVES	PASSERIFORMES	MOTACILLIDAE	Macronyx	fuelleborni	Least Concern
Macronyx grimwoodi	AVES	PASSERIFORMES	MOTACILLIDAE	Macronyx	grimwoodi	Least Concern
Malaconotus blanchoti	AVES	PASSERIFORMES	MALACONOTIDAE	Malaconotus	blanchoti	Least Concern
Megaceryle maxima	AVES	CORACIIFORMES	ALCEDINIDAE	Megaceryle	maxima	Least Concern
Melaenornis pammelaina	AVES	PASSERIFORMES	MUSCICAPIDAE	Melaenornis	pammelaina	Least Concern
Melaniparus griseiventris	AVES	PASSERIFORMES	PARIDAE	Melaniparus	griseiventris	Least Concern
Melaniparus leucomelas	AVES	PASSERIFORMES	PARIDAE	Melaniparus	leucomelas	Least Concern
Melaniparus rufiventris	AVES	PASSERIFORMES	PARIDAE	Melaniparus	rufiventris	Least Concern
Melierax metabates	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Melierax	metabates	Least Concern
Melocichla mentalis	AVES	PASSERIFORMES	MACROSPHENIDAE	Melocichla	mentalis	Least Concern
Merops apiaster	AVES	CORACIIFORMES	MEROPIDAE	Merops	apiaster	Least Concern
Merops bullockoides	AVES	CORACIIFORMES	MEROPIDAE	Merops	bullockoides	Least Concern
Merops hirundineus	AVES	CORACIIFORMES	MEROPIDAE	Merops	hirundineus	Least Concern
Merops nubicoides	AVES	CORACIIFORMES	MEROPIDAE	Merops	nubicoides	Least Concern
Merops persicus	AVES	CORACIIFORMES	MEROPIDAE	Merops	persicus	Least Concern
Merops pusillus	AVES	CORACIIFORMES	MEROPIDAE	Merops	pusillus	Least Concern
Merops variegatus	AVES	CORACIIFORMES	MEROPIDAE	Merops	variegatus	Least Concern
Microcarbo africanus	AVES	SULIFORMES	PHALACROCORACIDAE	Microcarbo	africanus	Least Concern
Micronisus gabar	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Micronisus	gabar	Least Concern
Microparra capensis	AVES	CHARADRIIFORMES	JACANIDAE	Microparra	capensis	Least Concern
Milvus aegyptius	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Milvus	aegyptius	Least Concern
Milvus migrans	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Milvus	migrans	Least Concern
Mirafra africana	AVES	PASSERIFORMES	ALAUDIDAE	Mirafra	africana	Least Concern
Mirafra angolensis	AVES	PASSERIFORMES	ALAUDIDAE	Mirafra	angolensis	Least Concern
Mirafra rufocinnamomea	AVES	PASSERIFORMES	ALAUDIDAE	Mirafra	rufocinnamomea	Least Concern
Monticola angolensis	AVES	PASSERIFORMES	MUSCICAPIDAE	Monticola	angolensis	Least Concern
Motacilla aguimp	AVES	PASSERIFORMES	MOTACILLIDAE	Motacilla	aguimp	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Motacilla capensis	AVES	PASSERIFORMES	MOTACILLIDAE	Motacilla	capensis	Least Concern
Motacilla flava	AVES	PASSERIFORMES	MOTACILLIDAE	Motacilla	flava	Least Concern
Muscicapa adusta	AVES	PASSERIFORMES	MUSCICAPIDAE	Muscicapa	adusta	Least Concern
Muscicapa striata	AVES	PASSERIFORMES	MUSCICAPIDAE	Muscicapa	striata	Least Concern
Musophaga rossae	AVES	MUSOPHAGIFORMES	MUSOPHAGIDAE	Musophaga	rossae	Least Concern
Mycteria ibis	AVES	CICONIIFORMES	CICONIIDAE	Mycteria	ibis	Least Concern
Myrmecocichla arnotti	AVES	PASSERIFORMES	MUSCICAPIDAE	Myrmecocichla	arnotti	Least Concern
Myrmecocichla nigra	AVES	PASSERIFORMES	MUSCICAPIDAE	Myrmecocichla	nigra	Least Concern
Necrosyrtes monachus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Necrosyrtes	monachus	Critically Endangered
Neolestes torquatus	AVES	PASSERIFORMES	PYCNONOTIDAE	Neolestes	torquatus	Least Concern
Neophedina cincta	AVES	PASSERIFORMES	HIRUNDINIDAE	Neophedina	cincta	Least Concern
Neotis denhami	AVES	OTIDIFORMES	OTIDIDAE	Neotis	denhami	Near Threatened
Netta erythrophthalma	AVES	ANSERIFORMES	ANATIDAE	Netta	erythrophthalma	Least Concern
Nettapus auritus	AVES	ANSERIFORMES	ANATIDAE	Nettapus	auritus	Least Concern
Nilaus afer	AVES	PASSERIFORMES	MALACONOTIDAE	Nilaus	afer	Least Concern
Numida meleagris	AVES	GALLIFORMES	NUMIDIDAE	Numida	meleagris	Least Concern
Oena capensis	AVES	COLUMBIFORMES	COLUMBIDAE	Oena	capensis	Least Concern
Oenanthe familiaris	AVES	PASSERIFORMES	MUSCICAPIDAE	Oenanthe	familiaris	Least Concern
Oenanthe pileata	AVES	PASSERIFORMES	MUSCICAPIDAE	Oenanthe	pileata	Least Concern
Oriolus auratus	AVES	PASSERIFORMES	ORIOLIDAE	Oriolus	auratus	Least Concern
Oriolus larvatus	AVES	PASSERIFORMES	ORIOLIDAE	Oriolus	larvatus	Least Concern
Oriolus oriolus	AVES	PASSERIFORMES	ORIOLIDAE	Oriolus	oriolus	Least Concern
Ortygospiza atricollis	AVES	PASSERIFORMES	ESTRILDIDAE	Ortygospiza	atricollis	Least Concern
Otus senegalensis	AVES	STRIGIFORMES	STRIGIDAE	Otus	senegalensis	Least Concern
Pachycoccyx audeberti	AVES	CUCULIFORMES	CUCULIDAE	Pachycoccyx	audeberti	Least Concern
Paludipasser locustella	AVES	PASSERIFORMES	ESTRILDIDAE	Paludipasser	locustella	Least Concern
Pandion haliaetus	AVES	ACCIPITRIFORMES	PANDIONIDAE	Pandion	haliaetus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Paragallinula angulata	AVES	GRUIFORMES	RALLIDAE	Paragallinula	angulata	Least Concern
Pelecanus onocrotalus	AVES	PELECANIFORMES	PELECANIDAE	Pelecanus	onocrotalus	Least Concern
Pelecanus rufescens	AVES	PELECANIFORMES	PELECANIDAE	Pelecanus	rufescens	Least Concern
Pernis apivorus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Pernis	apivorus	Least Concern
Petrochelidon rufigula	AVES	PASSERIFORMES	HIRUNDINIDAE	Petrochelidon	rufigula	Least Concern
Petrochelidon spilodera	AVES	PASSERIFORMES	HIRUNDINIDAE	Petrochelidon	spilodera	Least Concern
Phoeniculus purpureus	AVES	BUCEROTIFORMES	PHOENICULIDAE	Phoeniculus	purpureus	Least Concern
Phyllastrephus cabanisi	AVES	PASSERIFORMES	PYCNONOTIDAE	Phyllastrephus	cabanisi	Least Concern
Phyllastrephus cerviniventris	AVES	PASSERIFORMES	PYCNONOTIDAE	Phyllastrephus	cerviniventris	Least Concern
Phylloscopus trochilus	AVES	PASSERIFORMES	PHYLLOSCOPIDAE	Phylloscopus	trochilus	Least Concern
Pinarocorys nigricans	AVES	PASSERIFORMES	ALAUDIDAE	Pinarocorys	nigricans	Least Concern
Platysteira peltata	AVES	PASSERIFORMES	PLATYSTEIRIDAE	Platysteira	peltata	Least Concern
Plectropterus gambensis	AVES	ANSERIFORMES	ANATIDAE	Plectropterus	gambensis	Least Concern
Plegadis falcinellus	AVES	PELECANIFORMES	THRESKIORNITHIDAE	Plegadis	falcinellus	Least Concern
Ploceus cucullatus	AVES	PASSERIFORMES	PLOCEIDAE	Ploceus	cucullatus	Least Concern
Ploceus superciliosus	AVES	PASSERIFORMES	PLOCEIDAE	Ploceus	superciliosus	Least Concern
Ploceus velatus	AVES	PASSERIFORMES	PLOCEIDAE	Ploceus	velatus	Least Concern
Ploceus xanthops	AVES	PASSERIFORMES	PLOCEIDAE	Ploceus	xanthops	Least Concern
Podica senegalensis	AVES	GRUIFORMES	HELIORNITHIDAE	Podica	senegalensis	Least Concern
Pogoniulus bilineatus	AVES	PICIFORMES	LYBIIDAE	Pogoniulus	bilineatus	Least Concern
Pogoniulus chrysoconus	AVES	PICIFORMES	LYBIIDAE	Pogoniulus	chrysoconus	Least Concern
Pogonornis macclounii	AVES	PICIFORMES	LYBIIDAE	Pogonornis	macclounii	Least Concern
Poicephalus meyeri	AVES	PSITTACIFORMES	PSITTACIDAE	Poicephalus	meyeri	Least Concern
Polemaetus bellicosus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Polemaetus	bellicosus	Endangered
Polyboroides typus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Polyboroides	typus	Least Concern
Porphyrio alleni	AVES	GRUIFORMES	RALLIDAE	Porphyrio	alleni	Least Concern
Porphyrio porphyrio	AVES	GRUIFORMES	RALLIDAE	Porphyrio	porphyrio	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Prinia subflava	AVES	PASSERIFORMES	CISTICOLIDAE	Prinia	subflava	Least Concern
Prionops plumatus	AVES	PASSERIFORMES	VANGIDAE	Prionops	plumatus	Least Concern
Prionops retzii	AVES	PASSERIFORMES	VANGIDAE	Prionops	retzii	Least Concern
Prodotiscus regulus	AVES	PICIFORMES	INDICATORIDAE	Prodotiscus	regulus	Least Concern
Prodotiscus zambesiae	AVES	PICIFORMES	INDICATORIDAE	Prodotiscus	zambesiae	Least Concern
Psalidoprocne pristoptera	AVES	PASSERIFORMES	HIRUNDINIDAE	Psalidoprocne	pristoptera	Least Concern
Pseudhirundo griseopyga	AVES	PASSERIFORMES	HIRUNDINIDAE	Pseudhirundo	griseopyga	Least Concern
Psophocichla litsitsirupa	AVES	PASSERIFORMES	TURDIDAE	Psophocichla	litsitsirupa	Least Concern
Pternistis afer	AVES	GALLIFORMES	PHASIANIDAE	Pternistis	afer	Least Concern
Ptilopsis granti	AVES	STRIGIFORMES	STRIGIDAE	Ptilopsis	granti	Least Concern
Pycnonotus barbatus	AVES	PASSERIFORMES	PYCNONOTIDAE	Pycnonotus	barbatus	Least Concern
Pytilia afra	AVES	PASSERIFORMES	ESTRILDIDAE	Pytilia	afra	Least Concern
Quelea quelea	AVES	PASSERIFORMES	PLOCEIDAE	Quelea	quelea	Least Concern
Rallus caerulescens	AVES	GRUIFORMES	RALLIDAE	Rallus	caerulescens	Least Concern
Rhinopomastus aterrimus	AVES	BUCEROTIFORMES	PHOENICULIDAE	Rhinopomastus	aterrimus	Least Concern
Rhinopomastus cyanomelas	AVES	BUCEROTIFORMES	PHOENICULIDAE	Rhinopomastus	cyanomelas	Least Concern
Rhinoptilus chalcopterus	AVES	CHARADRIIFORMES	GLAREOLIDAE	Rhinoptilus	chalcopterus	Least Concern
Riparia riparia	AVES	PASSERIFORMES	HIRUNDINIDAE	Riparia	riparia	Least Concern
Rostratula benghalensis	AVES	CHARADRIIFORMES	ROSTRATULIDAE	Rostratula	benghalensis	Least Concern
Rynchops flavirostris	AVES	CHARADRIIFORMES	LARIDAE	Rynchops	flavirostris	Least Concern
Sagittarius serpentarius	AVES	ACCIPITRIFORMES	SAGITTARIIDAE	Sagittarius	serpentarius	Endangered
Sarkidiornis melanotos	AVES	ANSERIFORMES	ANATIDAE	Sarkidiornis	melanotos	Least Concern
Sarothrura boehmi	AVES	GRUIFORMES	RALLIDAE	Sarothrura	boehmi	Least Concern
Sarothrura elegans	AVES	GRUIFORMES	RALLIDAE	Sarothrura	elegans	Least Concern
Sarothrura rufa	AVES	GRUIFORMES	RALLIDAE	Sarothrura	rufa	Least Concern
Saxicola torquatus	AVES	PASSERIFORMES	MUSCICAPIDAE	Saxicola	torquatus	Least Concern
Scopus umbretta	AVES	PELECANIFORMES	SCOPIDAE	Scopus	umbretta	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Scotopelia peli	AVES	STRIGIFORMES	STRIGIDAE	Scotopelia	peli	Least Concern
Sheppardia polioptera	AVES	PASSERIFORMES	MUSCICAPIDAE	Sheppardia	polioptera	Least Concern
Smithornis capensis	AVES	PASSERIFORMES	CALYPTOMENIDAE	Smithornis	capensis	Least Concern
Spermestes bicolor	AVES	PASSERIFORMES	ESTRILDIDAE	Spermestes	bicolor	Least Concern
Spermestes cucullata	AVES	PASSERIFORMES	ESTRILDIDAE	Spermestes	cucullata	Least Concern
Spilopelia senegalensis	AVES	COLUMBIFORMES	COLUMBIDAE	Spilopelia	senegalensis	Least Concern
Stactolaema anchietae	AVES	PICIFORMES	LYBIIDAE	Stactolaema	anchietae	Least Concern
Streptopelia capicola	AVES	COLUMBIFORMES	COLUMBIDAE	Streptopelia	capicola	Least Concern
Streptopelia decipiens	AVES	COLUMBIFORMES	COLUMBIDAE	Streptopelia	decipiens	Least Concern
Streptopelia semitorquata	AVES	COLUMBIFORMES	COLUMBIDAE	Streptopelia	semitorquata	Least Concern
Strix woodfordii	AVES	STRIGIFORMES	STRIGIDAE	Strix	woodfordii	Least Concern
Sylvia borin	AVES	PASSERIFORMES	SYLVIIDAE	Sylvia	borin	Least Concern
Sylvietta ruficapilla	AVES	PASSERIFORMES	MACROSPHENIDAE	Sylvietta	ruficapilla	Least Concern
Synoicus adansonii	AVES	GALLIFORMES	PHASIANIDAE	Synoicus	adansonii	Least Concern
Tachybaptus ruficollis	AVES	PODICIPEDIFORMES	PODICIPEDIDAE	Tachybaptus	ruficollis	Least Concern
Tauraco schalowi	AVES	MUSOPHAGIFORMES	MUSOPHAGIDAE	Tauraco	schalowi	Least Concern
Tchagra australis	AVES	PASSERIFORMES	MALACONOTIDAE	Tchagra	australis	Least Concern
Tchagra senegalus	AVES	PASSERIFORMES	MALACONOTIDAE	Tchagra	senegalus	Least Concern
Telophorus viridis	AVES	PASSERIFORMES	MALACONOTIDAE	Telophorus	viridis	Least Concern
Terathopius ecaudatus	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Terathopius	ecaudatus	Endangered
Terpsiphone viridis	AVES	PASSERIFORMES	MONARCHIDAE	Terpsiphone	viridis	Least Concern
Thalassornis leuconotus	AVES	ANSERIFORMES	ANATIDAE	Thalassornis	leuconotus	Least Concern
Threskiornis aethiopicus	AVES	PELECANIFORMES	THRESKIORNITHIDAE	Threskiornis	aethiopicus	Least Concern
Trachyphonus vaillantii	AVES	PICIFORMES	LYBIIDAE	Trachyphonus	vaillantii	Least Concern
Treron calvus	AVES	COLUMBIFORMES	COLUMBIDAE	Treron	calvus	Least Concern
Tricholaema frontata	AVES	PICIFORMES	LYBIIDAE	Tricholaema	frontata	Least Concern
Trigonoceps occipitalis	AVES	ACCIPITRIFORMES	ACCIPITRIDAE	Trigonoceps	occipitalis	Critically Endangered

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Tringa glareola	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Tringa	glareola	Least Concern
Tringa nebularia	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Tringa	nebularia	Least Concern
Tringa ochropus	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Tringa	ochropus	Least Concern
Tringa stagnatilis	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Tringa	stagnatilis	Least Concern
Turdoides hartlaubii	AVES	PASSERIFORMES	LEIOTRICHIDAE	Turdoides	hartlaubii	Least Concern
Turdoides jardineii	AVES	PASSERIFORMES	LEIOTRICHIDAE	Turdoides	jardineii	Least Concern
Turdus libonyana	AVES	PASSERIFORMES	TURDIDAE	Turdus	libonyana	Least Concern
Turdus pelios	AVES	PASSERIFORMES	TURDIDAE	Turdus	pelios	Least Concern
Turnix nanus	AVES	CHARADRIIFORMES	TURNICIDAE	Turnix	nanus	Least Concern
Turnix sylvaticus	AVES	CHARADRIIFORMES	TURNICIDAE	Turnix	sylvaticus	Least Concern
Turtur afer	AVES	COLUMBIFORMES	COLUMBIDAE	Turtur	afer	Least Concern
Turtur chalcospilos	AVES	COLUMBIFORMES	COLUMBIDAE	Turtur	chalcospilos	Least Concern
Tychaedon barbata	AVES	PASSERIFORMES	MUSCICAPIDAE	Tychaedon	barbata	Least Concern
Tyto alba	AVES	STRIGIFORMES	TYTONIDAE	Tyto	alba	Least Concern
Tyto capensis	AVES	STRIGIFORMES	TYTONIDAE	Tyto	capensis	Least Concern
Upupa epops	AVES	BUCEROTIFORMES	UPUPIDAE	Upupa	epops	Least Concern
Uraeginthus bengalus	AVES	PASSERIFORMES	ESTRILDIDAE	Uraeginthus	bengalus	Least Concern
Urocolius indicus	AVES	COLIIFORMES	COLIIDAE	Urocolius	indicus	Least Concern
Vanellus armatus	AVES	CHARADRIIFORMES	CHARADRIIDAE	Vanellus	armatus	Least Concern
Vanellus coronatus	AVES	CHARADRIIFORMES	CHARADRIIDAE	Vanellus	coronatus	Least Concern
Vanellus crassirostris	AVES	CHARADRIIFORMES	CHARADRIIDAE	Vanellus	crassirostris	Least Concern
Vanellus senegallus	AVES	CHARADRIIFORMES	CHARADRIIDAE	Vanellus	senegallus	Least Concern
Vidua macroura	AVES	PASSERIFORMES	VIDUIDAE	Vidua	macroura	Least Concern
Vidua obtusa	AVES	PASSERIFORMES	VIDUIDAE	Vidua	obtusa	Least Concern
Zapornia flavirostra	AVES	GRUIFORMES	RALLIDAE	Zapornia	flavirostra	Least Concern
Zapornia pusilla	AVES	GRUIFORMES	RALLIDAE	Zapornia	pusilla	Least Concern
Zosterops senegalensis	AVES	PASSERIFORMES	ZOSTEROPIDAE	Zosterops	senegalensis	Least Concern

Table 8 – Potential species of terrestrial mammals by family in the project's area of influence (IUCN, 2022)

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Anomalurus derbianus	MAMMALIA	RODENTIA	ANOMALURIDAE	Anomalurus	derbianus	Least Concern
Fukomys bocagei	MAMMALIA	RODENTIA	BATHYERGIDAE	Fukomys	bocagei	Least Concern
Fukomys mechowii	MAMMALIA	RODENTIA	BATHYERGIDAE	Fukomys	mechowii	Least Concern
Alcelaphus buselaphus	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Alcelaphus	buselaphus	Least Concern
Cephalophus silvicultor	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Cephalophus	silvicultor	Near Threatened
Damaliscus lunatus	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Damaliscus	lunatus	Least Concern
Hippotragus equinus	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Hippotragus	equinus	Least Concern
Hippotragus niger	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Hippotragus	niger	Least Concern
Kobus leche	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Kobus	leche	Near Threatened
Ourebia ourebi	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Ourebia	ourebi	Least Concern
Philantomba monticola	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Philantomba	monticola	Least Concern
Redunca arundinum	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Redunca	arundinum	Least Concern
Sylvicapra grimmia	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Sylvicapra	grimmia	Least Concern
Tragelaphus oryx	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Tragelaphus	oryx	Least Concern
Tragelaphus scriptus	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Tragelaphus	scriptus	Least Concern
Tragelaphus spekii	MAMMALIA	CETARTIODACTYLA	BOVIDAE	Tragelaphus	spekii	Least Concern
Canis adustus	MAMMALIA	CARNIVORA	CANIDAE	Canis	adustus	Least Concern
Cercopithecus mitis	MAMMALIA	PRIMATES	CERCOPITHECIDAE	Cercopithecus	mitis	Least Concern
Chlorocebus cynosuros	MAMMALIA	PRIMATES	CERCOPITHECIDAE	Chlorocebus	cynosuros	Least Concern
Colobus angolensis	MAMMALIA	PRIMATES	CERCOPITHECIDAE	Colobus	angolensis	Vulnerable
Papio kindae	MAMMALIA	PRIMATES	CERCOPITHECIDAE	Papio	kindae	Least Concern
Loxodonta africana	MAMMALIA	PROBOSCIDEA	ELEPHANTIDAE	Loxodonta	africana	Endangered
Loxodonta africana	MAMMALIA	PROBOSCIDEA	ELEPHANTIDAE	Loxodonta	africana	Endangered
Taphozous mauritianus	MAMMALIA	CHIROPTERA	EMBALLONURIDAE	Taphozous	mauritianus	Least Concern
Acinonyx jubatus	MAMMALIA	CARNIVORA	FELIDAE	Acinonyx	jubatus	Vulnerable
Caracal caracal	MAMMALIA	CARNIVORA	FELIDAE	Caracal	caracal	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Felis lybica	MAMMALIA	CARNIVORA	FELIDAE	Felis	lybica	Least Concern
Leptailurus serval	MAMMALIA	CARNIVORA	FELIDAE	Leptailurus	serval	Least Concern
Panthera leo	MAMMALIA	CARNIVORA	FELIDAE	Panthera	leo	Vulnerable
Panthera pardus	MAMMALIA	CARNIVORA	FELIDAE	Panthera	pardus	Vulnerable
Galago moholi	MAMMALIA	PRIMATES	GALAGIDAE	Galago	moholi	Least Concern
Galagoides demidoff	MAMMALIA	PRIMATES	GALAGIDAE	Galagoides	demidoff	Least Concern
Otolemur crassicaudatus	MAMMALIA	PRIMATES	GALAGIDAE	Otolemur	crassicaudatus	Least Concern
Graphiurus kelleni	MAMMALIA	RODENTIA	GLIRIDAE	Graphiurus	kelleni	Least Concern
Atilax paludinosus	MAMMALIA	CARNIVORA	HERPESTIDAE	Atilax	paludinosus	Least Concern
Helogale parvula	MAMMALIA	CARNIVORA	HERPESTIDAE	Helogale	parvula	Least Concern
Herpestes ichneumon	MAMMALIA	CARNIVORA	HERPESTIDAE	Herpestes	ichneumon	Least Concern
Herpestes sanguineus	MAMMALIA	CARNIVORA	HERPESTIDAE	Herpestes	sanguineus	Least Concern
Ichneumia albicauda	MAMMALIA	CARNIVORA	HERPESTIDAE	Ichneumia	albicauda	Least Concern
Mungos mungo	MAMMALIA	CARNIVORA	HERPESTIDAE	Mungos	mungo	Least Concern
Hippopotamus amphibius	MAMMALIA	CETARTIODACTYLA	HIPPOPOTAMIDAE	Hippopotamus	amphibius	Vulnerable
Hipposideros ruber	MAMMALIA	CHIROPTERA	HIPPOSIDERIDAE	Hipposideros	ruber	Least Concern
Crocuta crocuta	MAMMALIA	CARNIVORA	HYAENIDAE	Crocuta	crocuta	Least Concern
Hystrix africaeaustralis	MAMMALIA	RODENTIA	HYSTRICIDAE	Hystrix	africaeaustralis	Least Concern
Lepus victoriae	MAMMALIA	LAGOMORPHA	LEPORIDAE	Lepus	victoriae	Least Concern
Elephantulus brachyrhynchus	MAMMALIA	MACROSCELIDEA	MACROSCELIDIDAE	Elephantulus	brachyrhynchus	Least Concern
Petrodromus tetradactylus	MAMMALIA	MACROSCELIDEA	MACROSCELIDIDAE	Petrodromus	tetradactylus	Least Concern
Phataginus tricuspis	MAMMALIA	PHOLIDOTA	MANIDAE	Phataginus	tricuspis	Endangered
Chaerephon ansorgei	MAMMALIA	CHIROPTERA	MOLOSSIDAE	Chaerephon	ansorgei	Least Concern
Chaerephon chapini	MAMMALIA	CHIROPTERA	MOLOSSIDAE	Chaerephon	chapini	Least Concern
Chaerephon nigeriae	MAMMALIA	CHIROPTERA	MOLOSSIDAE	Chaerephon	nigeriae	Least Concern
Mops condylurus	MAMMALIA	CHIROPTERA	MOLOSSIDAE	Mops	condylurus	Least Concern
Mops niveiventer	MAMMALIA	CHIROPTERA	MOLOSSIDAE	Mops	niveiventer	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Aethomys kaiseri	MAMMALIA	RODENTIA	MURIDAE	Aethomys	kaiseri	Least Concern
Aethomys nyikae	MAMMALIA	RODENTIA	MURIDAE	Aethomys	nyikae	Least Concern
Dasymys incomtus	MAMMALIA	RODENTIA	MURIDAE	Dasymys	incomtus	Least Concern
Gerbilliscus boehmi	MAMMALIA	RODENTIA	MURIDAE	Gerbilliscus	boehmi	Least Concern
Gerbilliscus leucogaster	MAMMALIA	RODENTIA	MURIDAE	Gerbilliscus	leucogaster	Least Concern
Gerbilliscus validus	MAMMALIA	RODENTIA	MURIDAE	Gerbilliscus	validus	Least Concern
Grammomys dolichurus	MAMMALIA	RODENTIA	MURIDAE	Grammomys	dolichurus	Least Concern
Lemniscomys griselda	MAMMALIA	RODENTIA	MURIDAE	Lemniscomys	griselda	Least Concern
Mastomys natalensis	MAMMALIA	RODENTIA	MURIDAE	Mastomys	natalensis	Least Concern
Mus triton	MAMMALIA	RODENTIA	MURIDAE	Mus	triton	Least Concern
Pelomys fallax	MAMMALIA	RODENTIA	MURIDAE	Pelomys	fallax	Least Concern
Pelomys minor	MAMMALIA	RODENTIA	MURIDAE	Pelomys	minor	Least Concern
Thallomys paedulcus	MAMMALIA	RODENTIA	MURIDAE	Thallomys	paedulcus	Least Concern
Zelotomys hildegardeae	MAMMALIA	RODENTIA	MURIDAE	Zelotomys	hildegardeae	Least Concern
Aonyx capensis	MAMMALIA	CARNIVORA	MUSTELIDAE	Aonyx	capensis	Near Threatened
Hydrictis maculicollis	MAMMALIA	CARNIVORA	MUSTELIDAE	Hydrictis	maculicollis	Near Threatened
Ictonyx striatus	MAMMALIA	CARNIVORA	MUSTELIDAE	Ictonyx	striatus	Least Concern
Mellivora capensis	MAMMALIA	CARNIVORA	MUSTELIDAE	Mellivora	capensis	Least Concern
Poecilogale albinucha	MAMMALIA	CARNIVORA	MUSTELIDAE	Poecilogale	albinucha	Least Concern
Cricetomys ansorgei	MAMMALIA	RODENTIA	NESOMYIDAE	Cricetomys	ansorgei	Least Concern
Dendromus melanotis	MAMMALIA	RODENTIA	NESOMYIDAE	Dendromus	melanotis	Least Concern
Dendromus mystacalis	MAMMALIA	RODENTIA	NESOMYIDAE	Dendromus	mystacalis	Least Concern
Dendromus nyikae	MAMMALIA	RODENTIA	NESOMYIDAE	Dendromus	nyikae	Least Concern
Saccostomus campestris	MAMMALIA	RODENTIA	NESOMYIDAE	Saccostomus	campestris	Least Concern
Steatomys krebsii	MAMMALIA	RODENTIA	NESOMYIDAE	Steatomys	krebsii	Least Concern
Steatomys pratensis	MAMMALIA	RODENTIA	NESOMYIDAE	Steatomys	pratensis	Least Concern
Nycteris hispida	MAMMALIA	CHIROPTERA	NYCTERIDAE	Nycteris	hispida	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Nycteris intermedia	MAMMALIA	CHIROPTERA	NYCTERIDAE	Nycteris	intermedia	Least Concern
Nycteris macrotis	MAMMALIA	CHIROPTERA	NYCTERIDAE	Nycteris	macrotis	Least Concern
Nycteris thebaica	MAMMALIA	CHIROPTERA	NYCTERIDAE	Nycteris	thebaica	Least Concern
Orycteropus afer	MAMMALIA	TUBULIDENTATA	ORYCTEROPODIDAE	Orycteropus	afer	Least Concern
Pedetes capensis	MAMMALIA	RODENTIA	PEDETIDAE	Pedetes	capensis	Least Concern
Dendrohyrax arboreus	MAMMALIA	HYRACOIDEA	PROCAVIIDAE	Dendrohyrax	arboreus	Least Concern
Eidolon helvum	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Eidolon	helvum	Near Threatened
Epomophorus crypturus	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Epomophorus	crypturus	Least Concern
Epomophorus wahlbergi	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Epomophorus	wahlbergi	Least Concern
Epomops dobsonii	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Epomops	dobsonii	Least Concern
Lissonycteris angolensis	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Lissonycteris	angolensis	Least Concern
Micropteropus pusillus	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Micropteropus	pusillus	Least Concern
Myonycteris torquata	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Myonycteris	torquata	Least Concern
Plerotes anchietae	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Plerotes	anchietae	Least Concern
Scotonycteris bergmansi	MAMMALIA	CHIROPTERA	PTEROPODIDAE	Scotonycteris	bergmansi	Least Concern
Ceratotherium simum	MAMMALIA	PERISSODACTYLA	RHINOCEROTIDAE	Ceratotherium	simum	Near Threatened
Diceros bicornis	MAMMALIA	PERISSODACTYLA	RHINOCEROTIDAE	Diceros	bicornis	Critically Endangered
Rhinolophus fumigatus	MAMMALIA	CHIROPTERA	RHINOLOPHIDAE	Rhinolophus	fumigatus	Least Concern
Rhinolophus landeri	MAMMALIA	CHIROPTERA	RHINOLOPHIDAE	Rhinolophus	landeri	Least Concern
Heliosciurus gambianus	MAMMALIA	RODENTIA	SCIURIDAE	Heliosciurus	gambianus	Least Concern
Crocidura hirta	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Crocidura	hirta	Least Concern
Crocidura mariquensis	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Crocidura	mariquensis	Least Concern
Crocidura nigrofusca	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Crocidura	nigrofusca	Least Concern
Crocidura olivieri	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Crocidura	olivieri	Least Concern
Crocidura parvipes	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Crocidura	parvipes	Least Concern
Crocidura turba	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Crocidura	turba	Least Concern
Suncus lixus	MAMMALIA	EULIPOTYPHLA	SORICIDAE	Suncus	lixus	Least Concern

scientificName	className	orderName	familyName	genusName	speciesName	redlistCategory – IUCN, 2022
Phacochoerus africanus	MAMMALIA	CETARTIODACTYLA	SUIDAE	Phacochoerus	africanus	Least Concern
Potamochoerus larvatus	MAMMALIA	CETARTIODACTYLA	SUIDAE	Potamochoerus	larvatus	Least Concern
Glauconycteris variegata	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Glauconycteris	variegata	Least Concern
Kerivoula argentata	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Kerivoula	argentata	Least Concern
Kerivoula lanosa	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Kerivoula	lanosa	Least Concern
Laephotis angolensis	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Laephotis	angolensis	Data Deficient
Mimetillus moloneyi	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Mimetillus	moloneyi	Least Concern
Myotis tricolor	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Myotis	tricolor	Least Concern
Myotis welwitschii	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Myotis	welwitschii	Least Concern
Neoromicia capensis	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Neoromicia	capensis	Least Concern
Neoromicia nana	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Neoromicia	nana	Least Concern
Neoromicia rendalli	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Neoromicia	rendalli	Least Concern
Pipistrellus anchietae	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Pipistrellus	anchietae	Least Concern
Scotoecus hirundo	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Scotoecus	hirundo	Least Concern
Scotophilus dinganii	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	Scotophilus	dinganii	Least Concern
Civettictis civetta	MAMMALIA	CARNIVORA	VIVERRIDAE	Civettictis	civetta	Least Concern
Genetta angolensis	MAMMALIA	CARNIVORA	VIVERRIDAE	Genetta	angolensis	Least Concern
Genetta maculata	MAMMALIA	CARNIVORA	VIVERRIDAE	Genetta	maculata	Least Concern

Annex XII – Photographic record of flora species identified in the Project's area of influence

PHOTOGRAPHIC REGISTRATION - FLORISTIC SPECIES

	
Photography 1. *Rafia textilis*	Photography 2. *Burkea africana*
	
Photography 3. *Hellichrisum sp*.	Photography 4. *Uapaca pulchra*, in the foreground. Tree without leaves.
	
Photography 5. *Opuntia ficus-india*	Photography 6. *Bignoniaceae*

	
Photography 7. *Harungana madagascariensis*	Photography 8. *Erythrophleum africanum*
	
Photography 9. *Hallea stipulosa*	Photography 10. *Englerophytum sp*.
	
Photography 11. *Vitex madiensis*	Photography 12. *Gloriosa superba*
	
Photography 13. *Eulophia sp.*	Photography 14. *Brachystegia Tamarindoides*

	
Photography 15. *Senna siemae*	Photography 16. *Vernonia conferta*

Annex XIII – Environmental and Social Impact Assessment Matrix

Resurb

IDENTIFICATION AND EVALUATION OF ENVIRONMENTAL ASPECTS

Proponent: OG Konstruktion GmbH

Project: CONTRACT FOR REHABILITATION OF ROAD EC 102 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

Weight = S + F + Q + S

Score ≥ 12 - Significant Impact

Situation (N,A,E) - Normal, Abnormal and Emergency

Aspect Classification (D,I) - Direct and Indirect

Sig. - Significance

Criteria (S, F, Q, S) - Severity, Frequency, Quantity, Scale

Project Phase	Activity/ Equipment / Service	Descriptor	Environmental Aspect		Associated Potential Impact	Nature	Status (N,A,E)	Classif. Aspecto (D,I)	Criteria S	F	Q	S	Severity index		CC/IC	Impact Significance		Operational Control Measures
Construction/Deactivation	Preparatory work - Deforestation, stripping and earthmoving of land and signage	Climate	Loss of vegetation cover		Increase in air temperature close to the ground and decrease in relative humidity, associated with loss of thermal regulation capacity	-	N	D	1	2	2	1	4	N	1	4	Reduced	
		Soil	Loss of vegetation cover		Potentiation of the risk of erosion	-	N	D	1	2	2	1	4	N	1	4	Reduced	
		Water Resources	Dragging of solids to surface water resources		Water Quality Change	-	N	I	1	2	2	1	4	N	1	4	Reduced	
		Noise	Noise Production		Increased sound levels (continuous and punctual) incident on the surrounding sensitive receptors, which may cause uncomfortable situations	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Noise	Noise Production		Exclusion effect on fauna	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Waste and Effluents	Waste Production	Green waste	Visual Impact	-	N	D	1	2	2	1	4	N	2	2	Reduced	
		Air Quality/Climate	Atmospheric emissions	Combustion gases and particles	Alteration/degradation of Air Quality	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Biodiversity and Ecological Factors	Soil and Vegetation Cover Removal	Habitat Change	Disturbance of biotopes/natural habitats Mortality/Loss of Fauna and Flora	-	N	D	1	2	2	1	4	N	1	4	Reduced	
			Deforestation and pickling actions		Mortality by crushing/run over Physical destruction of individuals or populations of floristic species Disturbance of resting, feeding and breeding sites	-	N	D	1	2	2	1	4	N	1	4	Reduced	
		Geology and Geomorphology	Earthworks		Allocation of rocky outcrops Affect of the local terrain morphology	-	N	D	1	2	2	2	8	N	1	8	Moderate	
		Soils	Earthworks		Degradation of natural soil layers Soil erosion	-	N	D	1	2	2	1	4	N	1	4	Reduced	
		Cultural Heritage	Land clearing activities; Earthworks and excavation; Soil removal; Trenching and excavation		Possible allocation of Built Heritage and/or Archaeological Heritage underground	-	N	D	2	2	2	2	16	N	2	8	Moderate	MM124; MM125
		Landscape	Deforestation and stripping actions	Destruction of natural landscape elements	Visual Impact	-	N	D	1	2	2	1	4	N	1	4	Reduced	
	Assembly and operation of the Jobsite, Offices and Social Facilities	Waste and Effluents	Waste Production	Undifferentiated Waste	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Waste and Effluents		Paper and Cardboard	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Waste and Effluents		Metallic and Plastic Packaging	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Waste and Effluents		Ink Cartridges and Toners	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Waste and Effluents		Electrical and Electronic Equipment	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Waste and Effluents		Domestics	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Energy	Energy consumption	Diesel	Depletion of natural resources	-	N	D	4	2	1	1	8	N	1	8	Moderate	
		Resources	Consumption of chemicals	Chemicals, paints, lubricating oils, etc.	Contamination of soil and groundwater in case of accidental spillage	-	N	D	4	2	1	1	8	N	1	8	Moderate	
		Natural Resources/Water Resources	Water consumption	Supply network water	Depletion of natural resources	-	N	D	2	2	1	1	4	N	2	2	Reduced	
		Natural Resources/Water Resources		Bottled water	Depletion of natural resources	-	N	D	2	2	1	1	4	N	1	4	Reduced	
		Natural resources	Consumption of Materials	Office Equipment and Supplies	Depletion of natural resources	-	N	D	1	1	1	1	1	N	2	1	Reduced	
		Natural resources		Paper and Cardboard	Depletion of natural resources	-	N	D	1	1	1	1	1	N	2	1	Reduced	
		Natural resources		IT Consumables	Depletion of natural resources	-	N	D	2	1	1	1	2	N	2	1	Reduced	
		Natural resources		Detergents and Soaps	Depletion of natural resources	-	N	D	2	1	1	1	2	N	2	1	Reduced	
		Natural resources		Toilet and Cleaning Paper	Depletion of natural resources	-	N	D	1	1	1	1	1	N	1	1	Reduced	
		Air/Climate Quality	Use of refrigerant fluids in air conditioners and other refrigeration equipment	Regulated fluorinated gases	Depletion of the ozone layer	-	N	I	4	1	1	2	8	N	2	4	Reduced	
		Waste and Effluents	Production/Discharge of Wastewater	Domestic wastewater	Contamination of soil and water resources	-	N	D	1	3	1	1	3	N	1	3	Reduced	
					Bad smell	-	N	D	1	3	1	1	3	N	1	3	Reduced	
		Landscape	Implementation of the jobsite and respective infrastructures	Presence of the jobsite and infrastructures	Modification of the original terrain morphology leading to the appearance of visual discontinuity zones	-	N	D	1	4	1	1	4	N	2	2	Reduced	
				Presence of the jobsite and infrastructures	Introduction of foreign elements into the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area	-	N	D	1	4	1	1	4	N	2	2	Reduced	
		Geology and Geomorphology		Presence of the jobsite and infrastructures	Allocation of rocky outcrops Affect of the local terrain morphology	-	N	D	2	4	1	1	8	N	1	8	Moderate	
		Waste and Effluents	Waste Production	Paper and Cardboard	Contamination of soil and water resources. Visual Impact	-	N	D	1	1	1	1	1	N	2	1	Reduced	
		Waste and Effluents		Metallic and Plastic Packaging	Contamination of soil and water resources. Visual Impact	-	N	D	1	1	1	1	1	N	2	1	Reduced	
		Waste and Effluents		Undifferentiated Waste	Contamination of soil and water resources. Visual Impact	-	N	D	2	1	1	1	2	N	2	1	Reduced	
		Waste and Effluents		Woods	Contamination of soil and water resources. Visual Impact	-	N	D	2	1	1	1	2	N	2	1	Reduced	
		Waste and Effluents		Used PPE's	Contamination of soil and water resources. Visual Impact	-	N	D	2	1	1	1	2	N	2	1	Reduced	
		Air Quality/Climate	Atmospheric emissions	Combustion Gases	Atmospheric contamination	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Noise and Vibrations	Noise Production		Annoyance of the population	-	N	D	2	2	2	1	8	N	2	4	Reduced	
			Vibration Production		Annoyance of the population. Degradation of Buildings	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Energy	Energy consumption	Diesel	Depleção de recursos naturais	-	N	D	4	2	1	1	8	N	1	8	Moderate	
		Natural Resources/Water Resources	Consumption of Natural Resources/Water Resources	Water	Depletion of natural resources	-	N	D	2	2	1	1	4	N	2	2	Reduced	
		Natural resources	Consumption of Materials	Paper and Cardboard	Depletion of natural resources	-	N	D	1	1	1	1	1	N	2	1	Reduced	
	Temporary Waste Storage	Waste and Effluents	Waste Production	Contaminated packaging	Contamination of soil and water resources. Visual Impact	-	N	D	4	2	2	1	16	N	1	16	High	
		Waste and Effluents		Contaminated absorbents	Contamination of soil and water resources. Visual Impact	-	N	D	4	2	2	1	16	N	2	8	Moderate	MM44; MM45; MM46; MM48; MM100
		Waste and Effluents		Oil and diesel spill	Contamination of soil and water resources	-	N/E	D	4	2	3	2	48	S	2	24	High	MM15; MM48; MM49; MM100
		Waste and Effluents		Contaminated soil from spill	Contamination of soil and water resources	-	N/E	D	4	2	2	1	16	N	2	8	Moderate	MM49; MM100
	Transport of Materials and Supply and transfer/storage of fuel	Waste and Effluents	Waste Production/Wastewater Discharge	Contaminated Absorbents / Contaminated Soils	Contamination of soil and water resources. Visual Impact	-	N/E	D	4	4	2	1	32	S	2	16	High	MM43; MM44; MM45; MM46; MM48; MM100
				Contaminated Packaging	Contamination of soil and water resources. Visual Impact	-	N	D	4	1	1	1	4	N	2	2	Reduced	
		Soil/Water Resources		Oil and diesel spill	Contamination of soil and water resources	-	N/E	D	4	3	3	1	36	S	2	18	High	MM11; MM15; MM28; MM49;MM66;MM69; M100
		Air Quality/Climate	Atmospheric emissions	Combustion Gases	Change in Air Quality	-	N	D	4	2	1	1	8	N	2	4	Reduced	
		Noise and Vibrations	Noise Production		Annoyance of the population	-	N	D	2	2	2	1	8	N	2	4	Reduced	
			Vibrations Production		Annoyance of the population. Degradation of Buildings	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Energy	Energy consumption	Diesel	Depletion of natural resources	-	N	D	4	2	1	1	8	N	1	8	Moderate	
	Concrete and bituminous plant and stationary crusher	Waste and Effluents	Waste Production	Remains of concrete/bituminous	Contamination of soil and water resources	-	N	D	1	4	1	1	4	N	2	2	Reduced	
				Contaminated PPE's	Contamination of soil and water resources	-	N	D	4	1	1	1	4	N	2	2	Reduced	
				Oil and diesel spill	Contamination of soil and water resources	-	N/E	D	4	2	3	1	24	N	2	12	Moderate	MM11; MM15; MM28; MM49; MM69; MM100
				Absorbents and contaminated soils from soills	Contamination of soil and water resources	-	N/E	D	4	2	2	1	16	N	2	8	Moderate	MM49; MM100
		Waste and Effluents	Waste Production/Wastewater Discharge	Wastewater resulting from production processes	Contamination of soil and water resources	-	N	D	3	3	2	2	36	S	3	12	Moderate	MM17; MM19; MM44, MM45; MM46 MM50; MM74; MM100
		Air Quality/Climate	Atmospheric emissions	Exhaust gases	Change in Air Quality	-	N	D	3	2	1	1	6	N	2	3	Reduced	
		Air Quality/Climate		GHG and particulate matter	Change in Air Quality	-	N	D	4	4	4	3	192	S	3	64	High	MM1; MM2; MM55; MM56; MM57; MM58; MM59; MM60; MM62; MM100
		Noise and Vibrations	Production of noise and vibrations		Discomfort of working populations / Disturbance of fauna and potential effect of exclusion of fauna	-	N	D	2	4	4	2	64	S	3	21	High	MM29; MM30; MM31; MM32; MM33; MM34; MM36, MM37; MM38; MM126; MM127; MM100; MM101
		Energy	Energy consumption	Diesel	Resource depletion	-	N	D	4	2	2	1	16	N	2	8	Moderate	MM100
		Natural Resources/Water Resources	Water consumption	Water	Resource depletion	-	N	D	1	3	3	1	9	N	2	5	Reduced	MM12; MM100
		Natural Resources	Consumption of materials	Concrete	Resource depletion	-	N	D	2	3	3	1	18	N	2	9	Moderate	MM42; MM50; MM100
		Geology and Geomorphology	Implementation of plants and respective infrastructures	Presence of the Plants and respective infrastructure and equipment	Allocation of rocky outcrops Affect of the local terrain morphology	-	N	D	3	2	2	1	12	N	2	6	Moderate	MM6; MM77; MM100
		Soils	Implementation of plants and respective infrastructures	Presence of the Plants and respective infrastructure and equipment	Soil waterproofing and compaction	-	N	D	2	4	1	1	8	N	1	8	Moderate	
		Landscape	Implementation of plants and respective infrastructures	Presence of the Plants and respective infrastructure and equipment	Modification of the original terrain morphology leading to the appearance of visual discontinuity zones	-	N	D	2	4	1	1	8	N	1	8	Moderate	
		Landscape	Implementation of plants and respective infrastructures	Presence of the Plants and respective infrastructure and equipment	Introduction of foreign elements into the landscape, creating a visual discontinuity and promoting a degradation of the scenic value of the area	-	N	D	1	4	1	1	4	N	2	2	Reduced	
	Circulation in the project area	Waste and Effluents	Waste Production	Contaminated PPE's	Contamination of soil and water resources. Visual Impact	-	N	D	4	2	2	1	16	N	2	8	Moderate	MM44; MM45; MM46; MM48; MM100
				Urban solid waste	Contamination of soil and water resources. Visual Impact	-	N	D	2	1	1	1	2	N	2	1	Reduced	
				Oil and diesel spill	Contamination of soil and water resources. Visual Impact	-	N/E	D	4	3	3	1	36	S	2	18	High	MM15; MM48; MM49; MM100
		Water Resources	Circulation of vehicles, machines, equipment and transportation of diverse materials		Contamination of the water resources	-	N/E	D	4	3	3	1	36	S	2	18	High	MM15; MM48; MM49; MM100
		Air Quality/Climate	Circulation of vehicles, machines, equipment	Exhaust gases	Change in air quality	-	N	D	4	2	1	1	8	N	2	4	Reduced	
				Dust/particle emission	Change in air quality Disturbance of populations/disruption of fauna	-	N	D	2	2	1	1	4	N	2	2	Reduced	
		Biodiversity and Ecological Factors	Running over animals		Direct crash fatality	-	N	D	1	2	2	1	4	N	1	4	Reduced	
		Noise and Vibrations	Production of noise and vibrations		Annoyance of populations Wildlife disturbance Degradation of Buildings	-	N	D	2	2	2	1	8	N	2	4	Reduced	

Operation Phase		Energy	Energy consumption	Diesel	Resource depletion	-	N	D	4	3	2	1	24	N	2	12	Moderate	MM100
	Pavement Removal	Waste and Effluents	Consumption of natural resources	Tar-free bituminous mixes	Contamination of soil and water resources. visual impact	-	N	D	2	3	3	1	18	N	2	9	Moderate	MM42; MM44; MM45; MM46; MM100
		Air Quality/Climate	Atmospheric emissions	Dust	Change in air quality	-	N	D	2	2	1	1	4	N	2	2	Reduced	
				Combustion Gases	Change in air quality	-	N	D	4	2	1	1	8	N	2	4	Reduced	
		Noise and Vibrations	Noise Production		Annoyance of the population	-	N	D	2	2	2	1	8	N	2	4	Reduced	
			Vibration Production		Annoyance of the population. Degradation of Buildings	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Energy	Energy consumption	Diesel	Depletion of natural resources	-	N	D	4	1	2	1	8	N	1	8	Moderate	
		Natural Resources/Water Resources	Consumption of natural resources/Water Resources	Water	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
	Excavation, placement of pipes/manholes and backfilling of ditches/ Execution of transverse and longitudinal drainage organs/ Execution of hydraulic crossings and concrete pontoons Bridge rehabilitation and construction	Natural Resources	Consumption of natural resources	Remaining Soils and Rocks	Visual Impact	-	N	D	2	4	1	1	8	N	3	3	Reduced	
		Waste and Effluents	Waste Production	HDPE/PVC pipes/accessories	Contamination of soil and water resources. Visual Impact	-	N	D	1	2	2	1	4	N	3	1	Reduced	
		Air Quality/Climate	Atmospheric emissions	Combustion Gases	Change in air quality	-	N	D	2	2	1	1	4	N	2	2	Reduced	
				Dust/Particle	Change in air quality	-	N	D	4	2	1	1	8	N	2	4	Reduced	
		Noise and Vibrations	Noise Production		Annoyance of the population	-	N	D	2	2	2	1	8	N	2	4	Reduced	
			Vibration Production		Annoyance of the population. Degradation of Buildings	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Natural Resources	Consumption of natural resources	Diesel/gasoline	Depletion of natural resources	-	N	D	4	1	2	1	8	N	1	8	Moderate	
				Aggregates	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				Water	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				HDPE/PP pipes	Depletion of natural resources	-	N	D	2	2	1	1	4	N	2	2	Reduced	
				Cement	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				Prefabricated Concrete	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				Wood	Depletion of natural resources	-	N	D	2	2	1	1	4	N	2	2	Reduced	
	Pavement	Waste and Effluents	Consumption of materials	Tar-free bituminous mixes	Contaminação do solo e recursos hídricos. Impacte visual	-	N	D	2	3	3	1	18	N	2	9	Moderate	MM42; MM44; MM45; MM46; MM100
			Waste Production	Contaminated Packaging	Contamination of soil and water resources. Visual Impact	-	N	D	4	1	1	1	4	N	3	1	Reduced	
		Air Quality/Climate	Atmospheric emissions	Combustion Gases	Change in air quality	-	N	I	2	2	1	1	4	N	2	2	Reduced	
				Volatile Organic Compounds	Change in air quality	-	N	I	4	2	1	1	8	N	2	4	Reduced	
		Noise and Vibrations	Noise Production		Annoyance of populations Exclusion effect on fauna	-	N	D	2	2	2	1	8	N	2	4	Reduced	
			Vibration Production		Annoyance of populations Exclusion effect on fauna	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Energy	Energy consumption	Diesel	Depletion of natural resources	-	N	D	4	1	2	1	8	N	1	8	Moderate	
		Natural Resources/Water Resources	Consumption of Natural Resources/Materials	Water	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Natural Resources		Extensive Granolometry Crushed Aggregate	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				Other Aggregates	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				Bituminous	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
				Cement	Depletion of natural resources	-	N	D	2	2	2	1	8	N	2	4	Reduced	
	Aspersion of Work Fronts, Jobsites, Plants and Accesses	Air Quality/Climate	Atmospheric emissions	Combustion Gases	Atmospheric contamination	-	N	I	2	2	2	1	8	N	2	4	Reduced	
		Noise and Vibrations	Noise Production		Annoyance of populations	-	N	D	2	2	2	1	8	N	2	4	Reduced	
			Vibration Production		Annoyance of populations	-	N	D	2	2	2	1	8	N	2	4	Reduced	
		Energy	Energy consumption	Diesel	Depletion of natural resources	-	N	D	4	2	1	1	8	N	1	8	Moderate	
		Natural Resources/Water Resources	Consumption of Natural Resources	Water	Depletion of natural resources	-	N	D	2	2	1	1	4	N	2	2	Reduced	
	Emergency - Disruption of supply networks/ drainage	Waste and Effluents	Waste Production	Domestic Wastewater	Contamination of soil and water resources	-	E	D	4	2	1	1	8	N	1	8	Moderate	
		Natural Resources/Water Resources	Water consumption	Water (Waste Caused by Rupture)	Depletion of natural resources	-	E	D	2	1	1	1	2	N	2	1	Reduced	
	Emergency - Spill	Waste and Effluents	Waste Production	Contaminated spill absorbents	Contamination of soil and water resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
				Contaminated Soils	Contamination of soil and water resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
				Absorbent	Depletion of natural resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
			Waste water production	Discharge of Wastewater	Contamination of soil and water resources	-	E	D	2	3	1	1	6	N	2	3	Reduced	
	Emergency - Flood	Waste and Effluents	Waste Production and wastewater	Undifferentiated Waste	Contamination of soil and water resources. Visual Impact	-	E	D	2	1	1	1	2	N	3	1	Reduced	
				Industrial Wastewater (Contaminated)	Contamination of soil and water resources	-	E	D	4	3	2	2	48	S	2	24	High	MM15; MM100
				Equivalent to Domestic	Contamination of soil and water resources	-	E	D	4	3	1	2	24	N	2	12	Moderate	MM15; MM100
		Natural Resources	Consumption of Natural Resources	Water (Waste Caused by Flooding)	Depletion of natural resources	-	E	D	2	1	1	1	2	N	2	1	Reduced	
	Emergency - Fire	Waste and Effluents	Waste Production	Undifferentiated Waste	Contamination of soil and water resources	-	E	D	2	1	1	1	2	N	3	1	Reduced	
			Discharge of Wastewater	Industrial Wastewater (Contaminated)	Contamination of soil and water resources	-	E	D	4	3	2	2	48	S	2	24	High	MM15; MM100
		Air Quality/Climate	Atmospheric emissions	Combustion Gases	Atmospheric contamination	-	E	I	3	2	2	1	12	N	2	6	Moderate	MM62; MM100
		Natural Resources	Consumption of Natural Resources	Sand	Depletion of natural resources	-	E	D	2	1	1	1	2	N	2	1	Reduced	
		Natural Resources/Water Resources	Water consumption	Water	Depletion of natural resources	-	E	D	2	1	1	1	2	N	2	1	Reduced	
		Natural Resources	Consumption of materials	Extinguisher Chemical Powder	Depletion of natural resources	-	E	D	4	1	1	1	4	N	2	2	Reduced	
	Emergency - Gas Leaks	Air Quality/Climate	Atmospheric emissions	Refrigerant Harmful to the Ozone Layer (Air Conditioning in offices and vehicles)	Change in air quality. Depletion of the Ozone Layer	-	E	D	4	1	1	3	12	N	2	6	Moderate	MM15; MM52; MM100
				Refrigerant Not Harmful to the Ozone Layer (Air Conditioning in offices and vehicles)	Change in air quality	-	E	D	3	1	1	3	9	N	2	5	Reduced	
				Propane/Butane	Change in air quality	-	E	D	4	1	1	3	12	N	2	6	Moderate	MM15; MM100
	Extinguisher Maintenance	Fire extinguisher maintenance	Consumption of material resources	Fire extinguisher refill chemical	Contamination of soil and water resources	-	E	D	4	1	1	1	4	N	2	2	Reduced	
	Repair/maintenance activities on site/jobsite	Waste and Effluents	Waste Production and wastewater	Contaminated absorbents	Contamination of soil and water resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
				Electrical waste	Contamination of soil and water resources	-	N	D	1	2	2	1	4	N	3	1	Reduced	
				Used oils	Contamination of soil and water resources	-	N	D	3	2	2	1	12	N	3	4	Reduced	
				Contaminated packaging	Contamination of soil and water resources	-	N	D	4	2	2	1	16	N	3	5	Reduced	
				Contaminated PPE's	Contamination of soil and water resources	-	N	D	4	2	2	1	16	N	3	5	Reduced	
				Oil and diesel spill	Contamination of soil and water resources	-	N	D	4	2	2	1	16	N	3	5	Reduced	
				Absorbents and soil contaminated from soills	Contamination of soil and water resources	-	N	D	4	2	2	1	16	N	3	5	Reduced	
		Air Quality/Climate	Atmospheric emissions	Exhaust gases	Change in air quality	-	N	D	3	2	2	1	12	N	2	6	Moderate	MM100
		Energy	Energy consumption	Diesel	Depletion of natural resources	-	N	D	4	2	1	1	8	N	1	8	Moderate	
		Natural Resources	Consumption of materials	Oils	Resource depletion	-	N	D	4	2	1	1	8	N	2	4	Reduced	
				Greases	Resource depletion	-	N	D	4	2	1	1	8	N	2	4	Reduced	
	Dismantling of jobsites, infrastructure and equipment to support the contract	Waste and Effluents	Waste Production	Undifferentiated Waste	Contamination of soil and water resources Visual impact	-	N	D	2	1	1	1	2	N	3	1	Reduced	
				Mixture of construction and demolition waste		-	N	D	2	1	1	1	2	N	3	1	Reduced	
				Concrete		-	N	D	2	1	1	1	2	N	3	1	Reduced	
				Plastic		-	N	D	2	1	1	1	2	N	3	1	Reduced	
				Scraps		-	N	D	2	1	1	1	2	N	3	1	Reduced	
				Wood		-	N	D	2	1	1	1	2	N	3	1	Reduced	
		Cultural Heritage	Demolition, dismantling and removal of existing/supporting infrastructure Landscape restoration activities		Possible allocation of Built Heritage and/or Archaeological Heritage underground	-	N	D	2	2	2	2	16	N	2	8	Moderate	MM124; MM125
		Landscape	Dismantling and decommissioning of support infrastructures	Replacement of initial conditions/Landscape recovery	Visual impact	+	N	D	2	2	2	2	16	N	1	16	High	
		Noise and Vibrations	Production of noise and vibrations		Annoyance of populations Exclusion effect on fauna	-	N	D	2	2	2	1	8	N	2	4	Reduced	
	Road section rehabilitation activities	Socioeconomy	Investment value		Benefit of the economy as a whole with reflections at all levels Increased tax revenue for the state Social inclusion and community participation	+	N	D	1	1	2	4	8	N	1	8	Moderate	
		Socioeconomy	Road infrastructure construction activities		Creation of indefinite-term employment for new employees and maintenance of jobs for existing employees	+	N	D	2	2	2	3	24	N	1	24	High	
		Socioeconomy			Demand for goods and services by workers in the project implementation area	+	N	D	1	3	2	3	18	N	1	18	High	
		Socioeconomy			Dinamização do comércio associado a diversas áreas, desde produção de materiais e equipamentos, aluguer de maquinaria, contratação de operadores de resíduos, entre outrosPromotion of trade associated with various areas, from the production of materials and equipment, rental of machinery, hiring of waste operators, among others	+	N	D	1	3	2	3	18	N	1	18	High	
Use Phase	Circulation of vehicles on the rehabilitated road infrastructure	Noise and Vibrations	Production of noise and vibrations		Annoyance of populations and effect of exclusion on fauna. Degradation of Buildings	-	N	D	2	3	2	2	24	N	2	12	Moderate	
		Air/Climate Quality	Atmospheric emissions	Exhaust gases/GHG	Change in air quality	-	N	D	3	4	4	3	144	S	1	144	High	
		Biodiversity and Ecological Factors	Running over animals		Direct crash fatality	-	N	D	2	2	2	1	8	N	1	8	Moderate	
		Socioeconomy	Presence of rehabilitated road infrastructure		Improvement of the living conditions of the population	+	N	D	4	4	4	3	192	S	1	192	High	
		Socioeconomy	Presence of rehabilitated road infrastructure		Increased employment opportunities due to the attractiveness of investments and reduction of transport costs	+	N	D	3	3	2	3	54	S	1	54	High	
		Socioeconomy	Presence of rehabilitated road infrastructure		Increase in jobs due to new road users	+	N	D	2	2	2	3	24	N	1	24	High	
		Socioeconomy	Presence of rehabilitated road infrastructure		Better access to social services (education, health and security)	+	N	D	3	3	2	3	54	S	1	54	High	
		Socioeconomy	Presence of rehabilitated road infrastructure		Decrease in road accidents	+	N	D	3	4	2	1	24	N	1	24	High	

Exploration Ph	Road maintenance/repair activities	Geology and Geomorphology	Maintenance interventions (paving, signage, cleaning, etc.)		Allocation of rocky outcrops Affect of the local terrain morphology	-	N	D	2	1	1	1	2	N	1	2	Reduced	
		Soils/Water Resources			Contamination of soil and water resources	-	N	D	1	1	2	1	2	N	2	1	Reduced	
		Socioeconomy			Increased job opportunities	+	N	D	1	1	1	1	1	N	1	1	Reduced	
		Cultural Heritage	Movement of people and vehicles Infrastructure maintenance activities		Possible allocation of Built Heritage and/or Archaeological Heritage underground	-	N	D	2	2	2	2	16	N	2	8	Moderate	MM124; MM125
		Noise and Vibrations	Production of noise and vibrations		Annoyance of populations and effect of exclusion on fauna	-	N	D	2	3	2	2	24	N	2	12	Moderate	
	Emergency - Spill	Waste and Effluents	Waste Production	Contaminated spill absorbents	Contamination of soil and water resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
				Contaminated Soils	Contamination of soil and water resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
				Absorbent	Depletion of natural resources	-	E	D	4	2	2	1	16	N	3	5	Reduced	
			Waste water production	Discharge of Wastewater	Contamination of soil and water resources	-	E	D	2	3	1	1	6	N	2	3	Reduced	

Annex XIV – Record of the presence of the people auscultated in the scope of the Public Consultation process

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
Francisco Chi	01	05.01.23.6H40	A-Zambeze	Cavungo	Cacuvu	Francisco Chi
Alexandre Kahi	02	05/01/2023 6H4	A.Zambeze	Cavungo	NHAKATOLO Sede	Alexandre Kahi
DAVID Muhinhi	03	05/01/23 6H44	Luau		Popular	David Muhinhi
Mucuma Kahilo	04	05/01/23/6H45	Alto Zambezi	Cavungo	Kapanco	Mucuma Kahilo
Eduardo F. Lufuka	5	05/01/23 6H45	Alto - Zambeze	Cavungo	Sede NHACatolo	Eduardo F. Lufuka
Alberto Levi Jano	6	05/01/23/6H45	Alto-Zambeze	Cavungo	Cacuelleca	Alberto Levi Jano
Mateus A Kalonda	07	05/01/2023/6H45	Alto - Zambeze	Cavungo	Cacuelleca	Mateus A. Kalonda
Gosiva Justo	8	05/01/2023/6H45	Alto-Zambeze	Cavungo	Sede NHACatolo	Gosiva Justo
Mucaza Chimvuama	8	05/01/2023/6H45	Alto-Zambeze	Cavungo	Sede Comunal	Mucaza Chimvuama
Domingos K. Kahuma	09	05.01.2023/7:20	Alto-Zambeze	Cavungo	Sede comunal	Domingos K. Kahuma
Domingos Gonji	10	05/01/2023/7:20	Alto-Zambeze	Cavungo	Cacuelleca	Domingos Gonji
Bili Antonio	15 11	05/01/2023/7:23	Alto-Zambeze	Cavungo	Sede NHACatolo	Bili Antonio
Fernando Nhamtuge	12 12	05/01/23. 6H40	Alto-Zambeze	Cavungo	Sede Nhacatolo	Fernando Nhamtuge
Domingos Mario	12 13	05/01/23. 6H40	Alto-Zambeze	Cavungo	Sede Nhacatolo	Domingos Mario
Paulo Simão	014	05/01/23.8H04	Alto. Zambezi	Cavungo	Sede Comunali	Paulo Simão
ERNESTO NDONGI	015	05/01/23.8H04	ALTO ZAMBEZI	CAVUNGO	sede comunal	ERNESTO NDONGI
Augusto Rapaldo	016	05/01/23.8H10	Alto Zambezi	Cavungo	Sede Comunali	Augusto Rapaldo
Tomas Canito	017	05/01/23.8H12	Alto Zambezi	Cavungo	Sede Comunali	Tomas Canito
Bunza Ezequiel	018	05/01/23.8H20	Alto Zambezi	Cavungo	sede Nhacatolo	Bunza Ezequiel
Dunahia Tchidhuma	019	05/01/23.8H25	Alto Zambezi	Cavungo	Sede Comunal	Dunahia Tchidhuma
Jorge Simão	20	05/01/23.8H30	Alto Zambezi	Cavungo	Sede Comunali	Jorge Simão
David Gracioso	21	05/01/23.8H31	Alto Zambezi	Cavungo	Sede Comunali	David Gracioso
Job Caumba	22	05/01/2023/8H48	Alto Zambeze	Cavungo	Sede NhaCatolo	Job Caumba
Chinhemba	23	05/01/023	Alto Zambe	Cavungo	Cavevo	Chinhemba
Tomás Catota	24	05/01/2023/8H50	Alto Zambeze	Cavungo	Sede Comunal	Tomás Catota
MARCEL	25	05/01/23	Alto Zambe	CAVUNGO	CAVEVO	MARCEL
JOÃO - KAHILU	26	05/01/23	ALTO ZAMBE	CAVUNGO	CAVEVU	JOÃO - KAHILU - CHIKUMA

PROCESSO DE AUSCULTAÇÃO/CONSULTA PÚBLICA - INDIVIDUAL | REABILITAÇÃO/CONSTRUÇÃO DO TROÇO DA ESTRADA ENTRE LUAU-CAZOMBO-LUMBALA (CERCA DE 260KM), NA PROVÍNCIA DO MOXICO

Resurb Ambiente, Lda

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
Oliveira Mucuma	26	05/01/23/8H55	Alto Zambezi	Cóvungo	Sede Comunal	Oliveira Mucuma
Quivene Patrício	27	05/01/23.8H56	Alto Zambezi	Cavungo	Sede Nhacatolo	Quivene Patrício
Domingo Yova	28	05/01/23.8H58	Alto Zambezi	Cavungo	Sede Comunal	Domingo Yova
Francisco Kacanga	29	05/01/23.8H57	Alto Zambezi	Cavungo	Kacuelenca	Francisco Kacanga
Jaime	30	05/01/23	Alto Zambeze	Cavungo	Cende Nhacatolo	Jaime CHINHAMA
Azevedo-Kapenda	31	05/01/23	Alto ZAMBEZE	CAVUNGO	Sede NYATOLO	Azevedo-KAPENDA
Valdevino S.	32	05/01/23	Alto Zambeze	Cavungo	Sede Comunal	Valdevino S.
Domingos Rafael	33	05/01/2310H02	Alto Zambezi	Cavungo	Sede Nhacatolo	Domingos Rafael
Oliveira Mayanda	34	05/01/23/9H01	Alto Zambezi	Cavungo	Sede Comunal	Oliveira Mayanda
Domba Cassoma	35	05/01/23/9H05	Alto Zambezi	Cavungo	Sede Comunal	Domba Cassoma
Bernardo C. Calua	36	05/01/23 9H07	Alto-Zambeze	Cavungo	Sede Comunal	Bernardo C. Calua
Justina Alfonso	37	05/01/23/ 9H09	Alto Zambezi	Cavungo	Agostinho Neto	Justina Alfonso
Francisco Penzo	38	05/01/23/9H11	Alto Zambezi	Cavungo	Sede Nhacatolo	Francisco Penzo
Alince Chilombo	39	05/01/23.9H12	Alto Zambezi	Cavungo	Sede Nhacatolo	Alice Chilombo
Mateus Mutombo	40	05/01/23.9H15	Alto Zambezi	Cavungo	Agostinho Neto	Mateus Mutombo
Alince Chinhama	41	05/01/23: 9H17	Alto Zambezi	Cavungo	Sede Nhacatolo	Alince Chinhama
Noe Gossal	42	05/01/23	Alto Zambeze	Cavungo	Capango	Noe Gossal
Samuel Chilombo	43	05/01/23	Alto Zambeze	Cavungo	Agostinho Neto	Samuel Chilombo
Joaquim Waiti	44	05/01/23	Alto Zambeze	Cavungo	Capango	Joaquim Waiti
Augusto Chinyama	45	05/01/23	Alto Zambeze	Cavungo	Capango	Augusto Chinyama
Luis Braz	46	05/01/23	Alto Zambeze	Cavungo	Capango	Luis Braz
Domingas	47	05/01/23	Alto Zambeze	Cavungo	Agostinho Neto	Domingas
Angeleta	48	05/01/23	Alto Zambeze	Cavungo	Sede Comunal	Angeleta
Elias Vasco	49	05/01/23	Alto Zambeze	Cavungo	Sede Comunal	Elias Vasco
Esperança	50	05/01/2023	Alto-Zambeze	Cavungo	Caculeca	Esperança
Evaristo Kayamba	51	05/01/23.9H20	Alto Zambeze	Cavungo	Sede Comunal	Evaristo Kayamba
Flora Simão	52	05/01/23.9H22	Alto Zambezi	Cavungo	Sede Comunal	Flora Simão
Jane Sombo	53	05/01/23.9H23	Alto Zambezi	Cavungo	Sede Comunal	Jane Sombo

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
Arminda M. Muzala	001	05/01/2023	Alto Zambezi	Cavungo	Sede Comunal	Arminda M. Muzala
João Segunda	55	05/01/23. 9H	alto Zambeze	cavungo	cavuvu	João segunda
José João Caiombo	56	06/01/23	alto Zambeze	Cavungo	Cauevue	José João Caiombo
Elenza. Rutembo	57	05/01/23: 9H25	Alto Zambezi	Cavungo	Sede Comunal	Elinza. Rutembo
Saulo. Quinta	58	05/01/23: 9H30	Alto Zambezi	Cavungo	Sede Nhacatolo	Saulo. Quinta
Lindica. Zamba	59	05/01/23: 9H54	Alto Zambezi	Cavungo	Sede Nhucoado	Lindica. Zamba
Domingos Calomba	60	05/01/23: 10	Alto Zambezi	Cavungo	Sede Nhucoado	Domingos Calomba
Katherina	61	05/01/23	Alto Zambeze	Cavungo	Sede Nhabitolo	Katherina Mujinga
Manis Caiombo	62	05/01/23	Alto Zambezi	Cavungo	Rapenca	Manis. Rapenca
Ernesto. Racoma	63	05/01/23/ 10H02	Alto Zambezi	Cavungo	Sede Nhucotolo	Ernesto. Racoma
Madalena. Tchimba	64	05/01/23/ 10H05	Alto Zambezi	Cavungo	Sede Nhacatolo	Madalena Ntemba
Alice. Mahoco	65	05/01/23/10H07	Alto Zambezi	Cavungo	Agustino Neto	Alice. Mahoco
Baptista. Tchingo	66	05/01/23/ 10H09	Alto Zambeze	Cavungo	Rapoola	Baptista. Tchingo
Terreza. Mujinga	67	05/01/23/10H11	Alto Zambezi	Cavungo	Sede Comunal	Terreza. Mujinga
Dialinda. Sombo	68	05/01/23/10H13	Alto Zambezi	Cavungo	Rapoola	Dialinda Sombo
Maura. Iren	69	05/01/23/10H14	Alto Zambezi	Cavungo	Sede Nhacatolo	Maura. Iren
Mucazo. Kahinga	70	05/01/23/10H16	Alto Zambezi	Cavungo	Agustino. Neto	Mucazo. Kahinga
Jonas Mujinga	71	05/01/23/10H18	Alto Zambeze	Cavungo	Cassulo	Jonas Mujinga
Mario Nego	72	05/01/23	Alto Zambeze	Cavungo	Agostinho	Mario Nego
Angelita Kahinga	73	05/01/23/10H22	Alto Zambezi	Cavungo	Rapoola	Angelita. Kahinga
Domingos Mujinga	74	05/01/23/10H23	Alto Zambeze	Cavungo	Sede Comunal	Domingos. Mujinga
José Nzenga	75	05/01/23	Alto Zambeze	Cavungo	Cauevue	José Nzenga
Isaias Chissola	76	05/01/23	Alto Zambeze	Cavungo	Sede Nhucotolo	Isaias Chissola
Atanasio Tchinhe	77	05/01/23. 10H29	Alto Zambezi	Cavungo	Sede Nhucotolo	Atanasio Tchinhe
Wilson. Moises	78	05/01/23/10H31	Alto Zambezi	Cavungo	Rapoola	Wilson. Moises
Duze. Eduardo	79	05/01/23/10H34	Alto Zambezi	Cavungo	Agustino Neto	Duze. Eduardo
Ernesto. Mateus	80	05/01/23/10H37	Alto Zambezi	Cavungo	Agustino Neto	Ernesto. Mateus
Nove. Guerra	81	05/01/23/10H39	Alto Zambezi	Cavungo	Sede Nhacatolo	Nove. Guerra

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
MARIO KASSA	82	05/01/23	ALTO ZAMBEZE	CAVUNGO	SEDE COMUNAL	MARIO KASSA
Francisco	83	05/01/23	Alto Zambeze	cavungo	Agostinho Neto	Francisco
Eduardo	84	05/01/23	Alto Zambeze	Cavungo	Nyakatolo	Eduardo Mundala
Mario	85	05/01/23	Alto Zambeze	Cavungo	Nyakatolo	Mario Kassala
Fernando Kauma	86	05/01/23: 10H45	Alto Zambezi	Cavungo	Rapondola	Fernando Kauma
Remiji Kapala	87	05/01/23: 10H46	Alto Zambezi	Cavungo	Rapondola	Remiji Kapala
Fernando Kauma	88	05/01/23: 10H46	Alto Zambezi	Cavungo	sede Nyacatolo	Fernando Kauma
David Silva	89	05/01/23: 10H50	Alto Zambezi	Cavungo	Sede Nyacatola	DAVID SILVA
Gorgias Kambo	90	05/01/23/10H51	Alto Zambezi	Cavungo	Sede Cavungo	Gorgias Kambo
Luca Tonji	91	05/01/23/10H53	Alto Zambezi	Cavungo	Rapondola	Luca Tonji
Baltazar Mazau	92	05/01/23	Alto Zambeze	Cavungo	Agostinho Neto	Baltazar Mazau
António Jotaca	93	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	António Jotaca
Graça João	94	05/01/23	Alto Zambeze	Cavungo	Agostinho Neto	Graça João
Cristina Kacumba	95	05/01/23	Alto Zambeze	Cavungo	Sede Comunal	Cristina Kacumba
Helena Sambo	96	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Helena Sambo
Maria Chisola	97	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Maria Chisola
Adelia Hilda	98	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Adelia Hilda
Eugenia Kalenga	99	05/01/23	Alto Zambeze	Cavungo	Kapodola	Eugenia Kalenga
Katemba Mujingo	100	05/01/23	Alto Zambeze	Cavungo	Sede Nyatolo	Katemba Mujingo
Gertrudes Chipanga	101	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Gertrudes Chipanga
Duwa Kasochi	102	05/01/23	Alto Zambeze	Cavungo	Kapango	Duwa Kasochi
Frida Lewu	103	05/01/23	Alto Zambeze	Cavungo	Sede	Frida Lewu
Oscar Ndala	103	05/01/23	Alto Zambeze	Cavungo	Sede	Oscar Ndala
Quinta Kamanga	104	05/01/23	Alto Zambeze	Cavungo	Kapango	Quinta Kamanga
Fanti Mukatoji	105	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Fatema Katoji
Luiza Mahongo	106	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Luiza Mahongo
Jeofreka Kamanga	107	05/01/23	Alto Zambeze	Cavungo	Sede Nyakatolo	Joofre Kamanga
Mabela Costa	108	05/01/23	Alto Zambe	Cavungo	Kapodola	Mabela Costa

PROCESSO DE AUSCULTAÇÃO/CONSULTA PÚBLICA - INDIVIDUAL | REABILITAÇÃO/CONSTRUÇÃO DO TROÇO DA ESTRADA ENTRE LUAU-CAZOMBO-LUMBALA (CERCA DE 260KM), NA PROVÍNCIA DO MOXICO

Resurb Ambiente, Lda

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
Diogo K.	109	05/01/2023	Alto Zambeze	Cavungo	Kapondola	Diogo Kapondola
Olga Muyongo	110	05/01/23	Alto Zambeze	Cavungo	Kapondola	Olga Muyongo
Linda Chitombo	111	05/01/23	Alto Zambeze	Cavungo	Cavungo	Linda Chitombo
Secilia. K.	112	05/01/23	Alto Zambeze	Cavungo	Gelo Nhaca Velho	Secilia. K
Izeludo. D.	113	05/01/23/11H32	Alto Zambeze	Cavungo	Agostinho Neto	Izeludo. Domingos
Estevao. K	114	06/01/23	Alto Zambeze	Lumbala	Cassombo	Estevao Kaumba
Graca S	115	06/01/23	Alto zambeze	Lumbala	Cassombo	Graca Sakowaya
Florência CH.	116	06/01/23.	Alto zambeze	Cazombo	Maguxe	Florência CH.
Alexandre	117	06/01/023	Alto Zambeze	Cazombo	Maguxe	Alexandre
Tomasco K.	118	06/01/023	Alto Zambeze	Cazombo	Chipoia	Kazueza
João Sebastião	119	06/01/23	Alto Zambeze	Cazombo	Chipoia	

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
MANUEL CHINHAMA	01	05/01/2023 7H29	ALTO ZAMBEZI	NANA CANDUNDO K.	CAPANGO	MANUEL CHINHAMA
JANUARIO NDO-	02	05/01/023 7H50	ALTO Z.	NANA KANDUNDO K.	CAPANGO	Januario Ndonji
ATANASE BERNA	03	05/01/2023 8H29	ALTO ZAMBEZI	KANA KANDUNDO K.	CAPANGO	Atanase Bernardo
AALINDA PAULO	04	05/01/2023 8H59	ALTO ZAMBEZI	NANA KANDUNDU K	CAPANGO	AALINDA PAULO
AUGUSTO SAMAHU	05	05/01/2023, 9 H20	ALTO ZAMBEZI	NANA KANDUNDU	CAPANGO	Augusto SAMAHUNG
Crispim Caiombo	06	05/01/2023	Alto-Zambeze	Nana Kanduondu	Fazenda	Crispim Caiombo
FRANCISCO	07	05/01/2023	Alto-Zambeze	NANA KANDUNDU	KAPANGO	FRANCISCO KAIOMBO
Jorge Cacumba	08	05/01/2023.	Alto Zambeze	NANA KANDUNDA	Kakhelekha.	Jorge Kacumba.
Atanásio Cacuma	09	05/01/2023 9h37	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
José Tchembo	0010	05/01/2023 9h39	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Gertrudes Tchiama	011	05/01/2023 9h40	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Charlote Maria	012	05/01/2023 9h45	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Ermelinda Naemia	013	05/01/2023 9h50	Alto Zambeze	Nana Candundo	Kakhelekha	Ermelinda Naémia
Felicia Ngoma	014	05/01/2023 9h52	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Beatriz Silva	015	05/01/2023 9h53	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Artur Pedro	016	05/01/2023 9h55	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Levi Chikomba	017	05/01/2023 9h57	Alto Zambeze	Nana Candundo	Capango	Levi Chikomba
Zeca Cacumbo	018	05/01/2023 9h59	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
Avina Cacuma	019	05/01/2023 10H1	Alto Zambeze	Nana Candundo	Capango	Não Sabe assinar
DEOLINDA CHITENGUI	020	05/07/2023 10H13	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	DEOLINDA CHITENGUI
JANETE MUNGAJI	021	05/07/2023 10H15	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	JANETE MUNGAJI
FERNANDO MUTUNDA	022	05/07/2023 10H16	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	FERNANDO MUTUNDA
CRISTINA CHISENGO	023	05/07/2023 10H20	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	CRISTINA CHISENGO
MARIA CHINHAMA	024	05/07/2023 10H30	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	MARIA CHINHAMA
BARROS AUGUSTO	025	05/07/2023 10H40	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	BARROS AUGUSTO
TUMBA DIOLINDA	026	05/07/2023 10H47	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	TUMBA DIOLINDA
DIOLINDA MUTUKA	027	05/07/2023 10H49	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	DIOLINDA MUTUKA

Nome	Referência do Inquérito	Data e Hora	Local			Assinatura
			Município	Comuna	Bairro	
Caiombo	028	05/01/2023	ALTO ZAMBEZI	NANA CANDUNDU	KAKWELEKA	CAIOMBO Joaqui
SAMBA MUSOLE	029	05/01/2023/11 H16	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	SAMBA MUSOLE
JANETE KAKOMA	030	05/01/2023/11 H16	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	JANETE KAKOMA
LAVINA KASONGO	031	05/01/2023/11 H15	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	LAVINA KASONGO
CUSTODIA JOÃO	032	05/01/2023/11 H16	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	CUSTODIA JOÃO
LUCIA KAHILO	033	05/01/2023/11 H17	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	LUCIA KAHILO
ASTAZIA CHIPANGO	034	05/01/2023/11 H18	ALTO ZAMBEZI	NANA CANDUNDU	CAPANGO	ASTAZIA CHIPANGO
EGRIDIA CHIPANGO	035	05/01/2023/11 H19	ALTO ZAMBEZI	NANANDUNDU	CAPANGO	EGRIDIA CHIPANGO
JAIME DALA	036	05/01/2023/11 H20	ALTO ZAMBEZI	NANANDUNDU	CAPANGO	JAIME DALA
KHORBETO MUHANGO	037	05/01/2023/11 H21	ALTO ZAMBEZI	NANANDUNDU	KAKWELEKA	JORBERTO MUHANGO
AUGOSTO MUKAZO	038	05/01/2023/11 H22	ALTO ZAMBEZI	NANANDUNDU	LUVUA NHAMUSHILI	AUGOSTO MUKAZO
ENOQUE	039	06/01/2023 13H	ALTO ZAMBEZE	LUMBALA	KAQUENGE	ENOQUE KALA
NELSON SAMA	040	06/01/2023	ALTO ZAMBEZE	Lumbala	Kaquenge	NELSON SAMAKAYI
Anacleto Munguji	041	06-01-023	Alto Zambeze	Lumachi	Lumachi	Anacleto
Não Sabe						
Salvador	042	06-04-023	Alto Zambeze	Cazombo	Manguxi	Salvador.
Josia Kaka	043	06.01-023	Alto Zambe	Cazombo	Manguxi	Josia Kacoma
João Domin	044	06.01-023	Alto Zambe	Cazombo	manguxi	João
Lourenço	045	06,04-023	Alto Zambe	Cazombo	Manguxi	Lourenço
Domingos Liahu	046	06, 023	Alto Zam	Cazombo	manguxi	Joukenço
Não Sabe						

Annex XV – Brochure prepared for the presentation of the project in the scope of the process of auscultation, participation and public consultation of the project

PARTICIPAÇÃO E AUSCULTAÇÃO

SERÁ ASSEGURADA A PROTECÇÃO DOS DADOS SEMPRE QUE SOLICITADO ANONIMATO

SERÃO INFORMADOS SOBRE O DESENVOLVIMENTO DO DESEMPENHO AMBIENTAL E SOCIAL DO PROJECTO E PLANO DE ENVOLVIMENTO DAS PARTES INTERESSADAS (PI)

SABIA QUE ?

O PROJECTO IRÁ ORIGINAR MAIORITARIAMENTE IMPACTES POSITIVOS:

- DIMINUIÇÃO DO NÚMERO DE ACIDENTES RODOVIÁRIOS
- MELHORIA DA QUALIDADE DE VIDA
- OPORTUNIDADES DE EMPREGO
- DINAMIZAÇÃO DAS ACTIVIDADES ECONÓMICAS
- INCLUSÃO SOCIAL E PARTICIPAÇÃO COMUNITÁRIA

SABIA QUE ?

A AVALIAÇÃO DE IMPACTE AMBIENTAL E SOCIAL É UM INSTRUMENTO PREVENTIVO PARA MITIGAR AS CONSEQUÊNCIAS DE UM PROJECTO SOBRE O AMBIENTE E A SOCIEDADE

SABIA QUE ?

PODE APRESENTAR AS SUAS RECOMENDAÇÕES, QUESTÕES E/OU DÚVIDAS SOBRE O PROJECTO SEMPRE QUE ENTENDER:

- NAS CONSULTAS PÚBLICAS PRESENCIAIS INDIVIDUAIS OU DE GRUPO
- REDES SOCIAIS DO PROJECTO
- TELEFONE
- E-MAIL

ELABORADO POR Resurb Ambiente, Lda

CONSULTA PÚBLICA

PROJECTO DE REABILITAÇÃO/ CONSTRUÇÃO DO TROÇO DA ESTRADA ENTRE LUAU-CAZOMBO-LUMBALA (CERCA DE 260 KM), NA PROVÍNCIA DO MOXICO

GOVERNO DE ANGOLA

QGMI Resurb Ambiente, Lda

CONSULTA PÚBLICA

OBJECTIVO

OBTER CONTRIBUIÇÕES A CONSIDERAR NA CONCEPÇÃO DO PROJETO POR FORMA A GARANTIR O BOM DESEMPENHO AMBIENTAL E SOCIAL

OBJECTIVOS DO PROJETO

- MELHORIA DA INFRA-ESTRUTURA, PERMITINDO UMA MAIOR MOBILIDADE E ACESSO AOS SERVIÇOS DE SAÚDE, EDUCAÇÃO E COMÉRCIO
- REDUÇÃO A NECESSIDADE DE MANUTENÇÃO DAS VIATURAS QUE USUFRUEM DA VIA
- IMPULSIONAR O CRESCIMENTO DAS ACTIVIDADES ECONÓMICAS DA REGIÃO
- MELHORAR A ACTIVIDADE NOUTROS SECTORES, COMO A EDUCAÇÃO, SAÚDE, AGRICULTURA, TURISMO, ETC.
- CRIAÇÃO DE NOVOS EMPREGOS NAS ZONAS RURAIS A FIM DE REDUZIR A POBREZA

DURAÇÃO DA EMPREITADA - 4 ANOS

LOCALIZAÇÃO DO PROJECTO

PROVÍNCIA DO MOXICO ENTRE LUAU - CAZOMBO - LUMBALA

POLÍTICAS DE GESTÃO DO PROJECTO

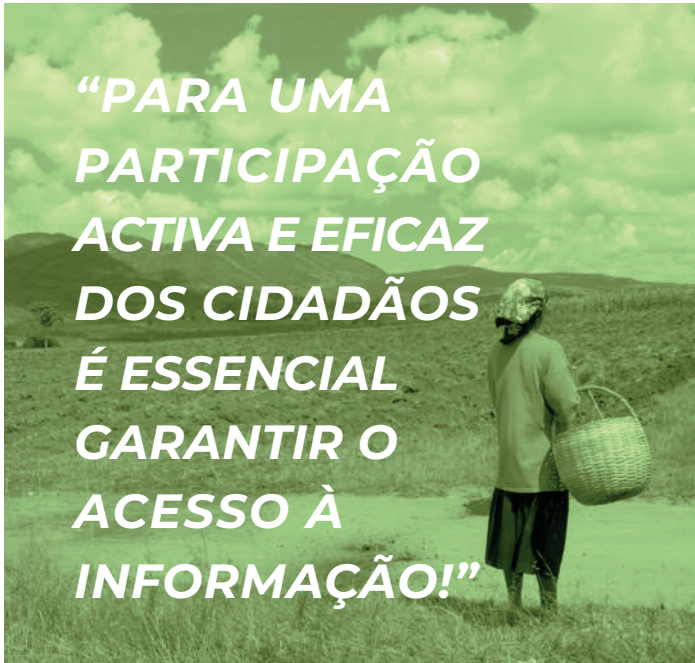
- Código Ético e de Cumprimento Legal
- Sigilo e Confidencialidade
- Protecção de Dados
- Programa de Prevenção do Sistema de Gestão de Riscos Laborais
- Protecção do Meio Ambiente
- Protecção, Participação e Inclusão Social
- Protecção dos Trabalhadores
- Prevenção do Assédio Sexual
- Compromisso de Respeito dos Direitos Humanos
- Mecanismo de Gestão de Queixas e Reclamações
- Cumprimento da legislação, requisitos do Banco Mundial, IFC e Princípios do Equador

PLANO DE ENVOLVIMENTO DAS PARTES INTERESSADAS

A Consulta Pública é parte integrante da Avaliação de Impacte Ambiental e Social

Pretende assegurar o Compromisso Efectivo

Será acompanhado e monitorizado ao longo da Fase de Preparação e Implementação do Projecto



Annex XVI – Project Management Policies

POLÍTICA DO **SISTEMA DE GESTÃO INTEGRADO**

Na **QGMI** orientamos nossas ações estratégicas para alcançar os objetivos empresariais, baseados na gestão: da **Qualidade**, da **Segurança**, da **Saúde Ocupacional** e **Socioambiental**, comprometida com o contínuo aperfeiçoamento de processos, produtos e serviços, para consolidar os objetivos corporativos, considerando:

- Confiabilidade, Lealdade, Qualidade e Trabalho como valores inegociáveis;
- Manter um ambiente de negócios ético e transparente, sendo um agente social catalisador para o desenvolvimento sustentável nos países onde atuamos;
- Cumprimento da legislação e das normas aplicáveis como base primordial do compromisso com a qualidade, na busca contínua das melhores práticas de mercado do nosso segmento;
- Eliminação de perigos e redução de riscos na realização das atividades para prevenção de lesões e doenças ocupacionais, com o engajamento de todos, visando alcançar os mais altos padrões de segurança e de integridade praticados em nossos projetos;
- Consulta e participação dos trabalhadores nos temas pertinentes ao sistema de saúde e segurança do trabalho;
- Contribuir para melhorar a qualidade de vida das pessoas como forma de ampliar o aporte positivo para a sociedade;
- Gerenciamento dos resíduos gerados e a prevenção da poluição, promovendo o uso racional dos recursos naturais, garantindo assim a proteção da biodiversidade e dos ecossistemas; e
- Satisfação das partes interessadas e atendimento as suas necessidades assegurando o engajamento com uma gestão de excelência, custos e com o aprimoramento social devido.

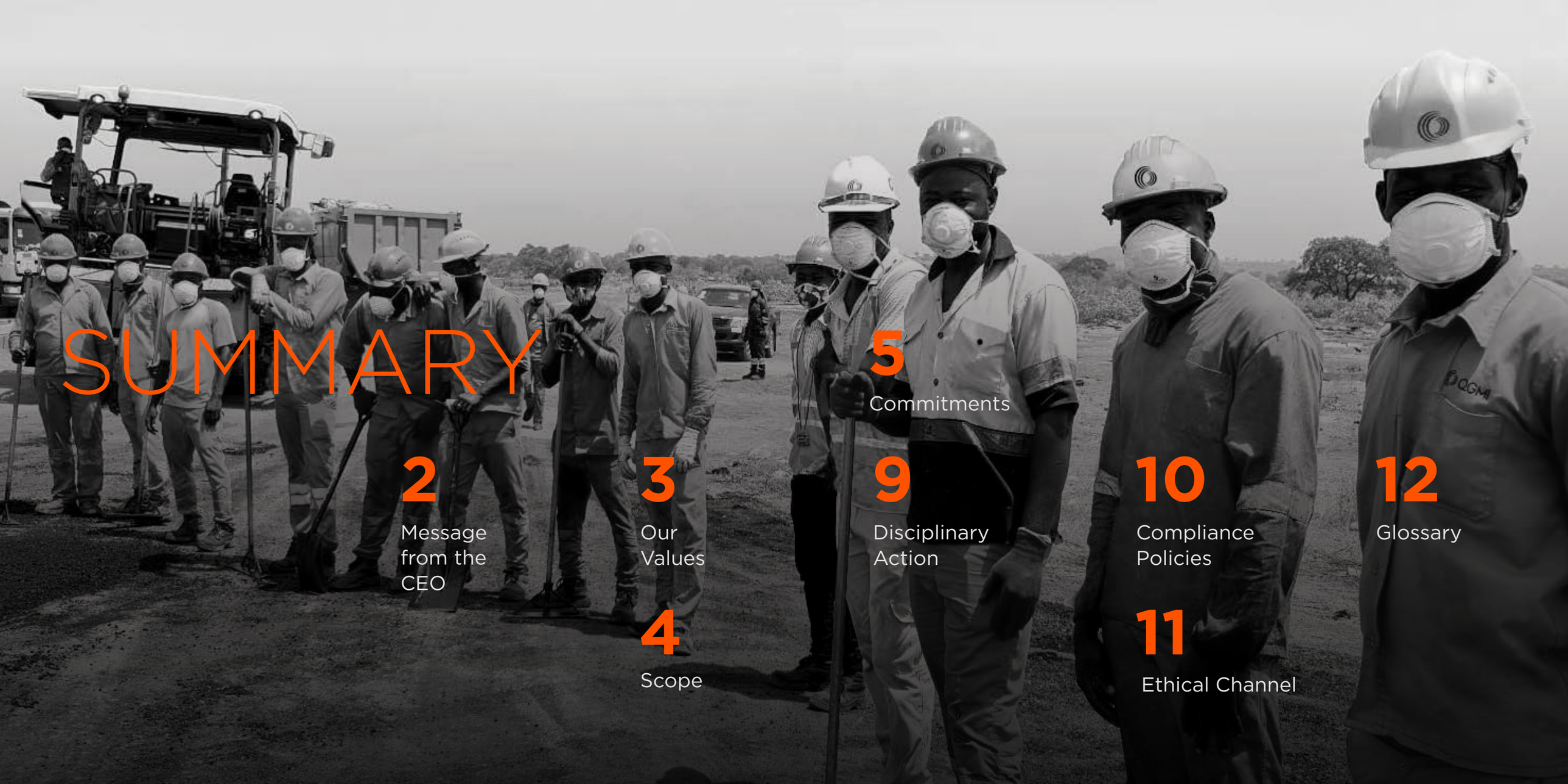
Gustavo Dantas Guerra
CEO

Rev 02

QGMI

QGMI

CODE OF ETHICS



SUMMARY

MESSAGE FROM THE CEO

QGMI's mission as a global company is to bring development wherever we go, always guided by our Values.

It is our Values that make us overcome the challenges imposed by an increasingly competitive and demanding world, not only with quality, but also with image, reputation, and transparency in business.

In a world in which business develops at great speed, at companies like QGMI, which is marked by diversity and multiculturalism and where all Employees play a key role, absolute commitment to ethics and transparency is an essential factor for us to be recognised and respected in the markets in which we operate.

As the QGMI Chairman, I have a duty not only to promote business development, but also to ensure that it is based on pillars that lead to sustainable growth.

But this duty is not exclusive to the management, but to all employees who, based on an ethical culture, are the true vectors for the creation of a safe environment that promotes the generation of business opportunities, employment, and trust of our partners.

Furthermore, it is important to ensure that not only we, as Partners, act ethically, but also the whole chain of our business relationships whether as business partners, customers, suppliers or third parties, who in synergy with QGMI pursue and promote a common goal.

Today, a company's image and reputation are some of its most important assets, in addition to its people and its ability to generate results.

Therefore, at QGMI we encourage the dissemination of good practices inside and outside the company, and we do not tolerate illegal or improper conduct that violates or is at odds with our Values.

This attitude has led us to act in accordance with the precepts, values, and mission of QGMI. It is essential to take an active role by reading, observing, and disseminating our values and the conduct set out in this Code of Ethics. Only in this way, united by the same purposes, will we contribute to the growth of QGMI and feel proud to be part of it.

Gustavo Dantas Guerra
CEO

OUR VALUES

WORK
VALUE THAT ENNOBLES AND DIGNIFIES

Working with passion and synergy in order to build a lasting company and dignified people.

RELIABILITY
HONOURING OUR COMMITMENTS

Complying with integrity and efficiency our commitments and thus transmitting reliability and respect to all our Clients, Employees, and Society.

QUALITY
MAKING THE BEST AND WELL DONE

Ensuring continuous improvement of our products and services, satisfying our clients and recipients, with engineering solutions.

LOYALTY
INTERACTING WITH TRANSPARENCY AND COMMITMENT

Company-Employee relationship is based upon the same objectives, aiming for mutual cooperation for sustainable growth.

SCOPE

For QGMI, complying or doing the right thing is not limited to complying with laws, standards, and regulations.

That is why we have developed a rigorous Compliance Programme that seeks to identify, prevent, and deal with the image and reputation risks that the organisation may endure in carrying out its business activity.

Our Code of Ethics is the basis of this Compliance Programme, in which we find a guide to the behaviour and conduct expected of our Employees, as well as of all those who act on behalf of QGMI, directly or indirectly, such as suppliers, subcontractors, representatives, consultants, agents or third parties, which we call 'Business Parties'.

Because we operate in many countries and regions, this Code of Ethics is international in scope and must be complied with by all our Business Units, wherever they may be. It is everyone's duty to protect the name and reputation of our company.

Below you will find a list of behaviours that we expect everyone to commit to.

COMMITMENTS

Work environment

At QGMI we are multicultural and are committed to a respectful, inclusive, and dignified work environment.

Therefore, all employees must treat others with respect, dignity, and equality. Any abuse of power, discrimination, threats, intimidation, violence, moral or sexual abuse will not be tolerated. Furthermore, we do not tolerate individuals or companies that permit child or forced labour, sexual exploitation, and human trafficking.

We make it our priority to maintain a safe working environment and to this end we provide the appropriate facilities and protective equipment for each activity, considering the legislation on the prevention of occupational hazards. Thus, all QGMI employees must follow the recommendations, protocols, and procedures, as well as the health and safety regulations in force.

It is strictly forbidden to go to work while carrying or under the influence of drugs, alcohol, or narcotics. This applies to both internal work and any external activities where employees are representing or carrying out work on behalf of QGMI.

QGMI Assets and Resources

QGMI places at the disposal of its Employees the appropriate goods and resources for the development of its activities. It is the duty of all employees to use such goods or resources only for the development of their professional activities, and they must also ensure their conservation, avoiding their inappropriate use.

Environment

At QGMI we have a strong commitment to the environment and biodiversity, which is why we rigorously comply with all the applicable laws, standards, and regulations. The preservation and responsible use of natural resources is an essential requirement for us. We are committed to protecting and remedying any specific impacts that may occur as a result of our activities.

QGMI guarantees that its activities, and those of our suppliers, will always be covered by the necessary licences and authorisations.

> The preservation and responsible use of natural resources is an essential requirement for us.

Interaction with Public and Private Stakeholders

QGMI is a company with a presence in many countries and therefore our Partners interact with a wide range of groups such as: Customers, Suppliers, Public Authorities and Agents, Public and Private Banks and Media (Business Parties). The image of the company is reflected in the conduct of our employees; therefore, we promote our values and train our employees to act positively, creating an ethical and sustainable business network, in which we can support our activities.

For our business to be sustainable, it is essential to operate in an environment of responsible competition. As such, we strictly comply with all standards and precepts of competition practice and our Employees are prohibited from engaging in any illegal or improper practices.

Although specific laws exist in each country for the protection of the public interest and the definition of illegal and improper practices, in general, these laws prohibit conduct in which an undue advantage or benefit is offered to Public Authorities or Public Officials. For this reason, QGMI requires its Employees to act with integrity and ethics and to deal with authorities in accordance with best market practice, in strict compliance with the law as far as meetings, business dealings and negotiations are concerned.

Thus, it is strictly forbidden for QGMI, its Employees and Third Parties to promise, offer or grant any undue advantage, monetary or otherwise, to public or private agents and third parties related to them. Furthermore, it is also forbidden to make payments to accelerate administrative procedures (facilitation payments), to carry out any act that may, directly or indirectly, affect the competition of a public or private bidding procedure, as well as those actions aimed at corrupting representatives of the Public Administration or the private market in order to obtain undue advantages by executing, altering, extending, or terminating a public or private contract.

Gifts and Entertainment

Accepting gifts and entertainment from Business Parties or offering them to the same in exchange for gaining an advantage or influence is conduct that decreases QGMI's credibility and ability to generate business. Such conduct can lead to the perception that the company's business is not earned on its own merit, which damages the company's reputation and image.

Thus, our Employees must not offer gifts, payments and/or entertainment invitations to third parties or potential business partners nor accept them if this offer or acceptance could be construed as influencing the transaction. Gifts, payments, or entertainment may be accepted when they are within the limits set by applicable law and QGMI Policies.

Our Employees must be aware of and comply with the law, as well as our Policies, and claiming lack of knowledge will not be accepted as an excuse for non-compliance.

Contributions to political parties

Donations to a campaign, political party, or candidate on behalf of QGMI are strictly prohibited, whether financial or otherwise.

Donations to entities or organisations, whose objectives are aligned with the social and cultural activities supported by QGMI, may be made provided they comply with internal procedures and are approved by the Compliance Body.

All donations must be recorded and documented in accordance with applicable legislation and our Policies.

Conflict of Interest

All activities carried out by QGMI Employees must be based on the company's Values, always following best practices, and not seeking to prioritise personal interests over organisational interests.

In the event that personal and/or family interests are not aligned with those of QGMI, all Employees must actively work to prevent these, as well as outside activities, financial interests or conflicts in working relationships, from influencing the way business is conducted on behalf of the company.

The most common examples of conflicts of interest are:

- Employee, or family member, who has previously worked for competitors, suppliers or customers;
- Suggesting family members and/or friends as new hires;
- Investing in company assets or assets potentially linked to its activity (insider trading);
- Performing services for another company or organisation within a role that is incompatible or may conflict with your former role at QGMI;
- Engaging the services of a company owned by an employee and/or family member to provide services to QGMI; Etc.

In the event that an Employee may be in a situation of conflict of interest, they must inform their hierarchical superior and/or the Compliance Area of the situation so that they can advise them on the most appropriate conduct in each case, always in accordance with the Code of Ethics and the Policies in force at QGMI.

Accounting Records

The accuracy, clarity, and timeliness of QGMI's accounting and financial records are an essential requirement for the legitimacy of our business. Therefore, all transactions must be properly recorded in accordance with the applicable laws of the countries in which we operate and our Policies.

At QGMI, information is also an essential asset for the development of its activities and therefore must always be treated with care and responsibility.

Information Stealth

Nowadays, information is an asset that circulates with great speed and can cause a lot of damage to organisations.

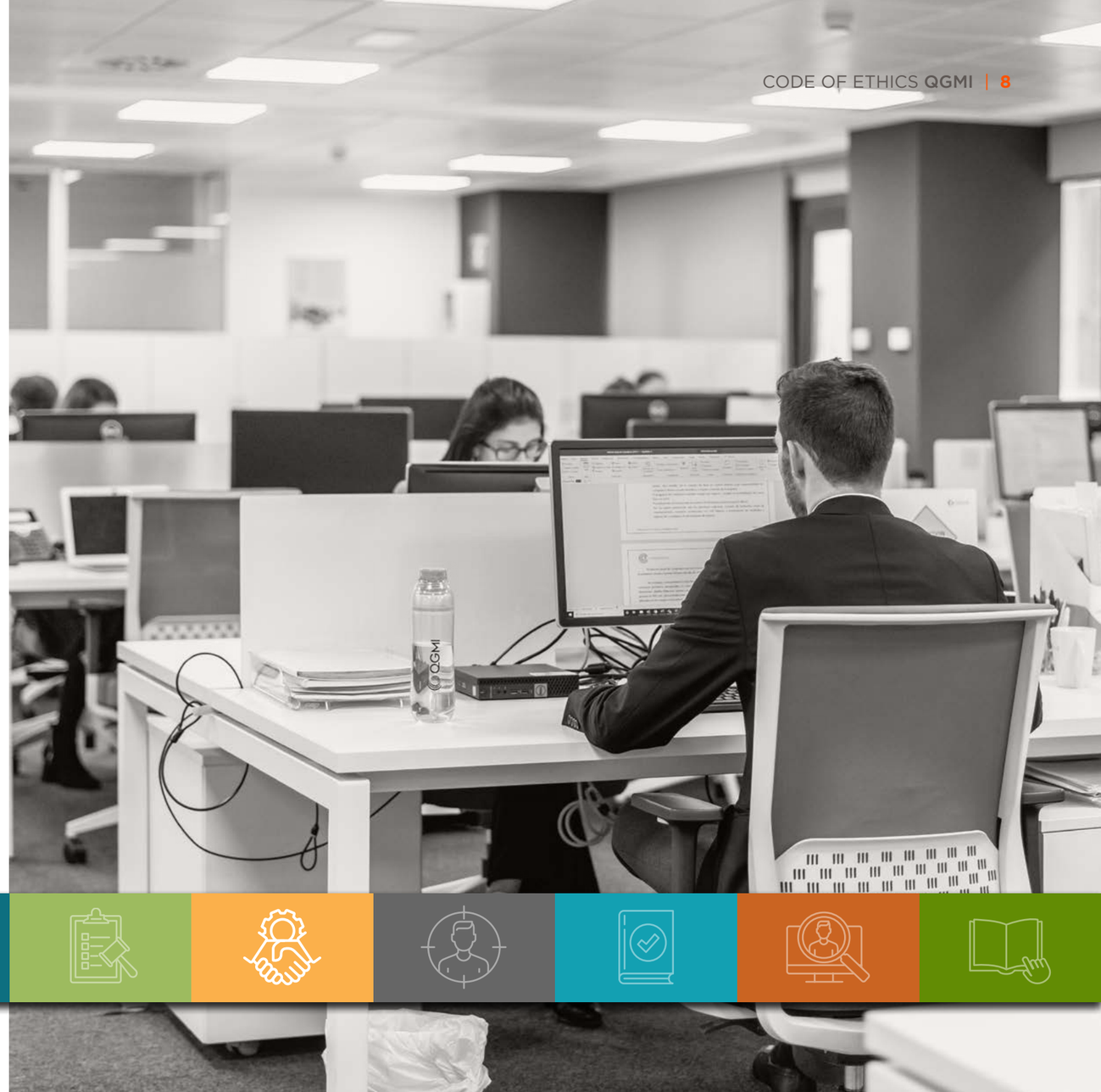
At QGMI, information is also an essential asset for the development of its activities and therefore must always be treated with care and responsibility.

We routinely disclose information to various audiences, both internal and external. Some of this information is confidential and must be treated as such, especially that which is disclosed within the company, whether in communications, reports, audits, IT systems, etc.

All data produced and handled by employees in the course of their work is also the property of and accessible to QGMI, and each employee must keep this information confidential, as well as any other information they may receive during the performance of their duties, keeping the files in secure places with limited access.

Furthermore, great care must be taken to avoid talking about confidential matters in public spaces (airports, restaurants, lifts, toilets, etc.) and common sense must be used when disclosing this type of information on the Internet and social media, as the image and reputation of QGMI is at play.

If you identify information security issues, whether concerning the company or third parties, you should seek help from the IT or Compliance Area.



DISCIPLINARY ACTION

We expect all our Employees to act in line with our Code of Ethics and Company Policies.

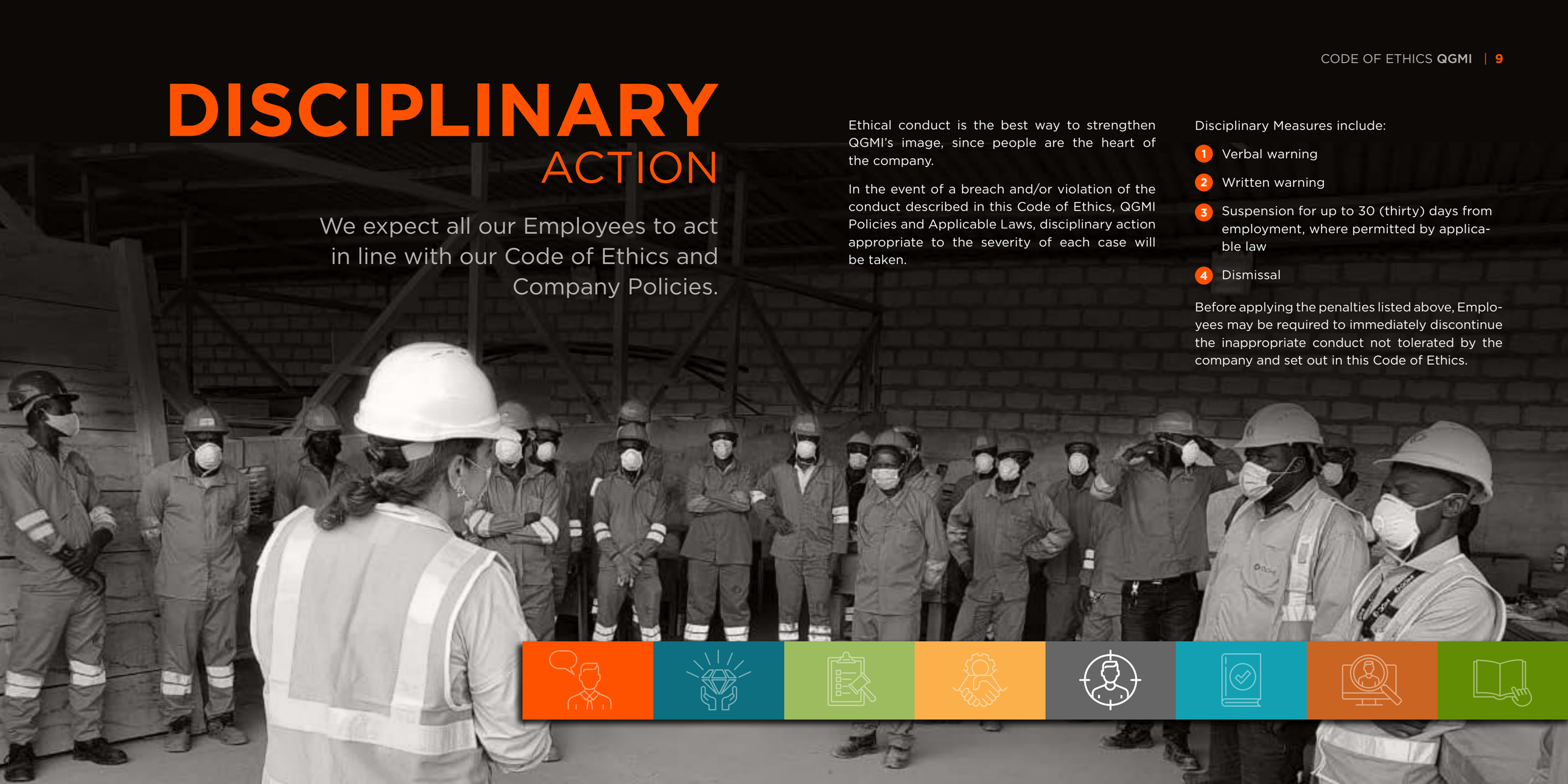
Ethical conduct is the best way to strengthen QGMI's image, since people are the heart of the company.

In the event of a breach and/or violation of the conduct described in this Code of Ethics, QGMI Policies and Applicable Laws, disciplinary action appropriate to the severity of each case will be taken.

Disciplinary Measures include:

1. Verbal warning
2. Written warning
3. Suspension for up to 30 (thirty) days from employment, where permitted by applicable law
4. Dismissal

Before applying the penalties listed above, Employees may be required to immediately discontinue the inappropriate conduct not tolerated by the company and set out in this Code of Ethics.



COMPLIANCE POLICIES

QGMI's Compliance Programme consists of a Code of Ethics and a set of Internal Policies. They can be found on our website and Intranet.

They are as follows:

- **Criminal Compliance** Policy
- **Anti-Corruption** Policy
- **Partnerships** and **Associations** Policy
- **Know Your Supplier** Policy
- **Gifts** and **Entertainment** Policy
- **Conflict of Interest** Policy
- **Ethical Channel** and **Disciplinary Measures** Policy
- **Donations and Sponsorship** Policy
- **Personal Data Protection** Policy
- **Know Your Client** Policy
- **Antitrust** Policy

ETHICAL CHANNEL

At QGMI we believe that communication is key to achieving continuous improvement.

For this reason, we encourage our Employees and Third Parties to report any suspicious behaviour and/or violations of expected behaviour that they may have observed, and to make their reports through our Ethical Channel.

All reports received will be treated securely, anonymously, and confidentially and action will be taken to avoid retaliation against those who use it.

To ensure that the investigation is as efficient as possible and to enable its correct outcome, it is important that the whistleblower provides as much information as possible and always in a responsible manner.

LINK TO ETHICAL CHANNEL

GLOSSARY

› Public Administration

All bodies, services and agents instituted, directly or indirectly, by the public authorities with the aim of carrying out administrative management in the public interest.

› Business Party (Parties)

Third parties with whom QGMI interacts in the different countries, environments, and markets in which it operates, including: customers, competitors, business partners, governmental and regulatory authorities, public and private banks, shareholders, suppliers, consultants, agents and/or third parties in general.

› Employee

Anyone who holds a position or function at QGMI or its subsidiaries, affiliates, and branches.

› Common Values

Pillars that guide the conduct of the company and its Employees, forming a set of common concepts.

› Company

Institutional representation of QGMI, including its subsidiaries and affiliates.

› Private Market

Refers to non-governmental or public companies, banks, associations, etc.

www.qgmi.eu

ANTI-CORRUPTION POLICY

QGMI Compliance Policy N° 01 (PC-QGMI-01)	
Revision: 01	**Approval: Jan/2016**

SUMMARY

1. Objective

1.1. In order to reaffirm the values and principles that base QGMI activities and to adjust to the risk-control system and new regulatory frameworks, QGMI's Anti-Corruption Policy aims at ensuring that all Employees and Third Parties comply with the requirements of Anticorruption, reflected in this Policy, as well as in the guidelines of QGMI's Code of Ethics, in order to ensure that its businesses are conducted in accordance with the law and based on the highest standards of integrity and transparency.

1.2. QGMI will not tolerate any form of bribery or corruption in its business relations and, therefore, is willing to fight and prevent situations of conflict and violation to the legislation and to the conduct guidelines established in its Code of Ethics.

1.3. It is the responsibility of everyone who acts in behalf of QGMI to be aware of its Code of Ethics and its Compliance Policies, and the Compliance Area must be contacted in case of doubt regarding the applicability of those guidelines.

1.4. **No Employee or anyone who acts in behalf of QGMI shall be punished due to delays or losses of business that may result from the compliance with the guidelines of this Policy.**

2. Applicability

2.1. This policy covers all QGMI Employees, as well as Third Parties, who act in behalf and/or represent QGMI in its activities developed abroad.

3. Definitions

Public Official: Any individual, servant or otherwise, even if temporarily or without pay, who acts officially or holds public office, employment or service in or for a Government Authority; any individual who works for a service provider Company contracted or associated for the conduction of typical activity of the Public Administration; or any leader of political party, their Employees or other people who act for or in behalf of a political party or candidate to a public office.

Governmental Authority: Every agency, department or entity of the direct, indirect or foundations-related administration of any of the Branches of Federal Power, of the States, the Federal District, the Municipalities, of Territory, legal entity incorporated to the public property or entity for whose creation or costing the public treasury has contributed or contributes with more than fifty percent of the property or annual revenue; of all bodies, state entities or diplomatic representations of foreign country, as well as legal entities, directly or

indirectly controlled by the public authority of foreign country or public international organizations, including sovereign wealth funds or an entity whose property is a sovereign wealth fund.

Giveaways: Items of non-commercial value or of market value inferior to 30,00€ EUR (or equivalent in the respective country), given as hospitality, publicity or usual advertising and that must show the logo of QGMI or the legal entity that provided the giveaway to the QGMI Employee, such as organizers, calendars, key chains, pen drives, pens, among others.

Chief Compliance Officer (CCO): is the Employee responsible for deploying, managing and supervising the Compliance Area, working as an independent and objective body that analyzes and assesses the compliance issues within the Company.

Employee(s): interns, staff of all operational and managerial levels, stockholders, advisors, directors and officers of QGMI, of all its national and international units. The expression also covers, for the purposes of this policy, the staff of outsourced companies.

Ethics Committee: is the non-statutory permanent body aiming at advising the CEO of QGMI in the performance of their duties regarding the promotion of the organizational culture based on ethics and the transparency of their business relations, in the rendering of accounts of their acts, as well as in the equal treatment given to all stakeholders, promoting, for this purpose, the dissemination of and the compliance with the Code of Ethics and the adoption and improvement of non-compliance risks management mechanisms.

Compliance: is the systematic and continuous process that aims at: i) ensuring the compliance with current legislation, policies and guidelines established for the business, aiming at preventing, detecting and addressing any misconduct identified, and promoting an organizational culture based on ethics and transparency; and ii) facilitating the elaboration and development of businesses and the search for creative and innovative solutions for regulatory issues and internal discussions.

Corruption: is the misuse of power or authority with the intention of obtaining improper advantages for themselves or others. The most usual form of corruption is bribery, which means giving or receiving money, gift or any asset in exchange of favorable treatment by the Public Official or Government Authority, in order to: i) influence any act or decision by the Public Official; ii) lead them to practice an act that violates their legal duties; iii) ensure Improper Advantage; and/or iv) lead them to use their influence on a Government Authority to help them obtain, keep or refer businesses.

Entertainment: Activities or events whose main goal is to provide leisure to their participants, such as parties, concerts or sports events.

Intermediary: Every individual or legal entity that is not the final recipient of a given Facilitation Payment or Improper Advantage or that acts in order to conceal its final destiny.

Local Compliance Officer (LCO): is the QGMI Employee who shall perform the Compliance duties in the operation place of a specific international unit of QGMI, reporting to the CCO.

Facilitation Payment: Undue or illegal payments to an individual, Public Official or otherwise, even if through an Intermediary, for them to expedite or ensure the execution of an act under their responsibility, which QGMI is legally entitled to. This does not include payments made by official means and permitted by Law, as long as they do not conflict with the provisions of the applicable Anti-Corruption Laws.

Politically Exposed Person[1]: Public Official who holds or individual who have held, in the past five years, in any country, territory and foreign premises, relevant offices, employments or public services, as well as their representatives, relatives and close associates.

Gifts: Items of commercial value that do not fall into the definition of Giveaways.

Third Parties: service providers, suppliers, business partners, companies in consortium, representatives, temporary advisors or any other person or company that act in behalf of QGMI, directly or indirectly.

Improper Advantage: Any tangible or intangible asset, including money and valuables, offered, promised or delivered with the goal of improperly influencing or compensating any act, decision or omission of a person, Public Official or otherwise. In this concept, gifts, entertainment, airline tickets, accommodation, donations, sponsorships or any other asset used for such purposes, which are, improperly influencing or compensating any act or decision.

[1] Such as people who hold political offices, state ministers, presidents, vice-presidents, or directors of agencies, state-run companies or joint-stock companies, governors, mayors, members of audit courts, among others.

4. Anti-Corruption Laws and Penalties

4.1. The international operations of QGMI requires the Company to strictly observe and comply with the Anti-Corruption Laws from other countries where it operates, as well as from their partners 'and suppliers' countries of origin, such as: Foreign Corrupt Practices Act (North-American Anti-Corruption Law) and UK Bribery Act (British Anti-Corruption Law).

4.2. Violations to Anti-Corruption Laws may result in administrative, civil and criminal penalties against the Company, including fines and prohibition of public procurement, in addition to civil and criminal penalties against the Employees, including arrest and civil fines.

4.3. QGMI shall cooperate fully with the authorities in the event of investigations and criminal actions suffered by its Employees due to violation of Anti-Corruption Laws. In addition to the possible criminal and civil penalties, the Employee shall also be subject to the sanctions set forth in this Policy.

5. Identifying an Illicit Conduct

5.1. Some situations should serve as a warning to the Employees of QGMI and Third Parties, such as those described below. In these cases, and whenever situations that lead to any suspicion regarding the integrity of the procedure being adopted arise, the CCO shall be contacted. For example:

- Payments to Public Official, their relatives, legal entities of which they are shareholders or to an individual or legal entity appointed by the Public Official;
- Requests for payments to be made in the bank account of a third person or in a bank account in another country not related to the contract;
- Requests for payments to be made in cash;
- Requests for commissions or "contingency fees" that stick out from customary market practices or are incompatible with the nature of the services provided;
- Requests for advanced payments or uncommon pressure for the processing of payments, that stick out from customary practices;
- Receipt or offer of extravagant and excessive gifts, potentially in violation to the Compliance Policies of QGMI;
- Individual who insist on interacting personally with a specific supplier or client;
- Decisions making for the approval of projects or contracts in unusual or detrimental conditions to the interests of QGMI;
- Preference or orientation for contracting a specific Third Party with no reasonable justification,

particularly of technical or financial nature;

- Attempt to avoid or prevent diligence processes required for the execution of the contract or its maintenance;
- The failure to comply with customary procedures for contracting Third Parties;
- Request or approval of payments of invoices that exceed the amount adjusted in the contract;
- Refusal to include Compliance and Anti-Corruption Clauses in the contract;
- Request of employment for relative of Public Official.

5.2. In addition to these signs involving Third Parties, the existence of the following internal practices must be observed: constant outflows in cash or check payable to bearer, repeated interactions involving specific Public Officials, contracting of Third Parties unrelated to the business, service fees, commissions or advances of high amounts, expenses without supporting documentation, donation or receipt of Gifts of high value, signs of irregular enrichment of Employees, etc.

5.3. The signs above do not make a full list. The indications of potential practices of Corruption may vary according to the nature of the operation or procedures inherent to each country. It is important that the Employees constantly assess and report the existence of other signs that may entail risk to QGMI.

5.4. Upon noticing any warning sign, the Employee must report their concern directly to the CCO, LCO or QGMI Hotline Reporting, so the due investigation may be conducted, confidentially, and, if proved, remedial actions are readily implemented. No Employee who, anonymously or otherwise, takes their concern to the competent authorities of QGMI shall suffer any sanction or retaliation, even if the suspicions are not confirmed.

6. General Considerations

6.1. Most Anti-Corruption Laws require, for the purposes of constituting a Corruption act, that a Public Official is the recipient of an Improper Advantage promised/offered/delivered by another individual who is interested in an action or omission by said Public Official. However, all forms of Corruption – even those that do not involve Public Officials – are improper and inconsistent with the values of QGMI, and therefore are completely forbidden.

Thus:

- The Improper Advantage must always be assessed under the perspective of those who shall potentially receive it. An item cannot have any value for those who offer it. However, it may be extremely valuable for those who receive it, and may influence their capacity to make decisions and act according to their responsibilities.
- It does not matter if the recipient of the Improper Advantage accepted it or not. The mere offer goes

against the values of QGMI, which is the reason why its Employees and Third Parties are not authorized to act in such way. It is worth noting that the mere offer or promise of advantage to a Public Official is considered illegal.

- The prohibitions of promise, offer, delivery, receipt and authorization of Improper Advantage, described in this policy, take into account the final recipient of the advantage. Thus, said prohibition also cover the use of Intermediaries for that purpose.

6.2. Likewise, the Employees of QGMI and Third Parties must strive for ethics and transparency in the conduction of their activities, performing them with professionalism and always concerned with the best interest of QGMI, regardless of any advantage offered by other individuals or even required by them.

6.3. The fair, respectful and professional treatment is a prerogative in all interactions of QGMI. Thus, even if requested by their superior or another Employee, the Employee and/or Third Party must never act against the provisions of this Policy and other internal standards of the Company. The CCO must be immediately informed if an Improper Advantage is requested by or even offered to any Employee of QGMI or Third Party, in the scope of the activities developed to the interest, benefit or representation of QGMI.

7. Rules and Prohibitions

Corruption

7.1. All those who act on behalf of QGMI are forbidden to:

- Offer, promise or give (directly or indirectly) any Improper Advantage to a Public Official or a person related to them;
- Finance, fund, sponsor or in any way subsidize or conceal the practice of Corruption acts; and
- Use Intermediaries (individual or legal entities) to conceal or disguise Corruption acts.

Giveaways, Gifts and Entertainment

7.2. No Giveaway, Gift or Entertainment may be offered in exchange for favorable treatment aiming at any improper business advantage for QGMI.

7.3. PC-QGMI-02 Policy (Gifts, Presents and Entertainment) presents specific guidelines that address value limits and approval required to offer or receive courtesies from Third Parties and Public Officials.

Facilitation Payments

7.4. No Employee of QGMI or Third Party is authorized to make Facilitation Payments. Conversely, we stress

that payments provided for in Law are allowed and do not conflict with the provisions of this policy.

7.5. In case of any request for a Facilitation Payment, the Employee and/or Third Party must refuse to make it, informing the requesting party about the prohibitions provided for by this Policy. Furthermore, the CCO of QGMI must be immediately informed.

Third Party Representatives

7.6. The contracting of Third Parties must be based on the business needs and on the merits of the Company or individual contracted, particularly for their undeniable technical expertise, experience in the field of action and good reputation.

7.7. Under no circumstance does QGMI authorize Third Parties contracted to act on its behalf, to exert improper influence over Public Officials, for the achievement of the services contracted.

7.8. QGMI adopts as policy doing business only with Third Parties that ensure the legality and credibility of their activities. For this purpose, it has specific procedures to conduct audits prior to the contracting of Third Parties, in order to assess potential Corruption risks, complying, for this purpose, with the guidelines of this Policy.

7.9. In the event that the audit prior to the contracting shows questionable results, QGMI may use the services of external advisors to research further or conduct another audit. Until we have the conclusion of the inspections to be performed, the execution of any activity with the Third Party shall me temporarily suspended.

7.10. Each and every contract signed with Third Parties shall contain specific clauses to ensure the compliance with the Anti-Corruption Laws and other correlated laws, as the case may be, thus aiming at mitigating risks of illicit conducts and ensuring the legal safety of the Company.

7.11. Regarding the compensation of Third Parties contracted, the following premises must be observed:

- Payments made to Third Parties must be compatible with the complexity of the services contracted;
- The services provided must be licit, and their object, value and conditions must be duly described in the corresponding contract, whose payments shall be attested by means of valid document; and
- Third Parties shall be paid according to Local Laws. Payments made abroad shall only be authorized if there is a commercial, just and legitimate reason that justifies them and provided that they have been previously approved by a person with local competence to do so. The exemption from taxes shall not be considered a just and legitimate reason.

7.12. Consortiums, joint-ventures or any other types of partnerships in which QGMI participates must adopt and implement Anti-Corruption Policies.

7.13. PC-QGMI-03 (Know your Supplier) and PC-QGMI-04 (Conflict of Interests) Policies must be observed as a complement to the provisions herein.

Employees

7.14. QGMI bases the contracting of Employees on the following principles and guidelines:

- Only Employees of established reputation and integrity shall be contracted for strategic offices, defined according to internal and exclusive criteria of QGMI; and
- Special attention shall be given to Employees who act in sensitive areas, defines according to internal and exclusive criteria of QGMI, such as, without limitation, purchases, contracting of services, bids, in countries where they might be more exposed to pressures of Corruption practices.

7.15. PC-QGMI-07 Policy (Know your Employee) must be observed as a complement to the provisions herein.

Donations and Sponsorships

7.16. No form of contribution shall be authorized, even if such contribution is intended for a legally organized charitable institution, as a way of enabling a business on behalf of QGMI before the Government Authorities, particularly if the Public Official involved, or any member of their family, has any kind of participation or involvement with the charitable institution.

7.17. Contributions to charitable causes shall be motivated by philanthropic, humanitarian, social, cultural, educational interests or others, at the sole discretion of QGMI.

7.18. All sponsorships must be based on contracts duly formalized and in accordance with the Policy and specific internal approval procedures of QGMI's international units.

7.19. The donations to political parties shall always be official and documented, addressed to the candidate or political party, observing the current legislation, as well as the policy established by QGMI, and the offer or provision of any service, granting of loan or even the assignment of assets, personnel or favor that may characterize electoral contribution not authorized by Law, in contradiction to the electoral regulations or the

policy established by QGMI, are strictly prohibited.

7.20. Contributions or donations to political parties, political campaigns, politicians and/or candidates to public offices may only be made if previously approved by the Ethics Committee.

7.21. It is strictly forbidden to any Employee or Third Parties the use of private funds to make donations to political parties, political campaigns or candidates to public offices on behalf of QGMI.

7.22. PC-QGMI-10 Policy (Donations and Sponsorships) addresses the matter specifically and must be used as complement to the provisions herein.

Purchases and Bids

7.23. The procedures of purchases, contracting of services and participation in bids shall strictly comply with the local Laws and regulations, as well as with the guidelines of this Policy and of the Code of Ethics of QGMI, in order to ensure that:

- The choosing of suppliers is based on quality and price, and never due to the influence they may exert before Public Officials and Government Authorities;

- No inside information regarding the bidding procedure is sought or used;

- There are no kind of relationship with Public Official involved with the bidding procedure; and Gifts and Giveaways are strictly forbidden in these situations.

7.24. QGMI prohibits any conduct that may, directly or indirectly, thwart or defraud bidding procedures.

7.25. The public bidding procedure has a competitive character by nature. The public interest is best met when several competitors compete fairly for the contract, for thus the best offer has a greater chance of being chosen. Thus, in order to ensure fair competition, QGMI, its Employees and Third Parties must not keep contact with tenders with the intention of defrauding, thwarting or preventing the competition of any bidding process.

Interactions with Government Authorities

7.26. QGMI requires its Employees and Third Parties to adopt certain conducts to avoid that undesirable acts are performed in the context of the relationship with Government Authorities or Public Officials, such as:

- Interacting on behalf, interest or benefit of QGMI with Public Officials or Politically Exposed People, who

may influence a decision-making process, strictly when necessary for the development of their professional activities;

- Avoid interactions with Public Official or Politically Exposed People who may influence a decision-making process without the presence of another Employee and/or Third Party;
- The making of any agreement or understanding with private officials or Public Officials to remove any bidder, defraud or thwart any act of a public bidding or contract arising from it, is forbidden;
- Influencing Public Official for the obtainment of Improper Advantage, including regarding the amendment or extension of public contract, is forbidden;
- The adulteration or fraud of any record or minutes of meetings referring to contracts made between Employees, Third Parties and Public Officials, is forbidden;
- The interactions with Public Official during bidding procedures shall observe the forms laid down in the bid books;
- Manipulating or defrauding the economic and financial balance of public contracts is forbidden;
- The obtainment of improper benefits, whether economic, commercial or personal, including by means of amendments or other contractual negotiations/modifications, is forbidden; and
- The maintenance of accounting record of any payments made by the Company is mandatory.

Mergers and Acquisitions

7.27. In the case of merger or acquisition of companies, QGMI shall proceed with the detailed prior audit (due diligence) of the target company, especially regarding the history of legal and regulatory non-compliance, and potential risks of illicit conducts inherent to the business in question.

7.28. In case of identification of liability due to non-compliance with the Anti-Corruption Laws that may mean considerable economic and reputation-related contingencies for the Company, said fact may constitute a deal breaker.

Accounting records and books

7.29. All QGMI international units must keep accounting records that reflect all their transactions in a precise and correct manner. They must also guarantee the accuracy of the records of expenses and payments to Third Parties, which must be accompanied by the corresponding receipts, invoices or bills of sale.

7.30. The making of inadequate, ambiguous or fraudulent accounting entries, and any other accounting procedure, technique or artifice that may conceal or in any other way cover up illegal payments, shall not be allowed.

7.31. The authorities of each Employee shall be respected and the transactions must only be made with the proper approvals.

Investigations and Inspections

7.32. The Employees of QGMI and Third Parties must not act in order to hamper or intervene in inspections and investigations conducted by Public Officials or private officials acting on behalf, interest or benefit of Government Authorities. Examples of authorities that may perform said activities are: Federal Revenue, IBAMA, Ministry of Labor and Employment, City Councils, among others.

7.33. The contacts with said officials in inspection situations must, whenever possible, be accompanied by at least two Employees or one Employee together with a Third Party.

7.34. The requests made by said officials and the documents presented by the Employees or Third Parties must be duly controlled and registered for QGMI to protect its interests in these situations.

7.35. QGMI Employees and Third Parties must provide access to the documents and information for the conduction of the investigations by the inspecting agents.

7.36. It is forbidden to perform acts to hamper or defraud investigation or inspection activities of Public Officials, agencies or entities, including, without limitation, the Corruption of controllers, managers or auditors for the performance of fraudulent measurements or for the acknowledgement of services poorly delivered or not delivered.

8. Communication

8.1. In the event that an Employee of QGMI is not sure about which is the correct conduct to take in a specific situation, they must consult the CCO or the Ethics Committee of QGMI.

8.2. In addition, if any Employee detects or suspects, in good faith, that there may be violation to the Compliance Program, especially the Code the Ethics or the Compliance Policies of QGMI, they must report the fact to the communication channel available for that purpose.

9. Supervision

9.1. Every Employee of QGMI must be familiar with the principles and rules present in the Code of Ethics, as well as in the Compliance Policies, observing them anywhere in the world.

9.2. The managers are required to ensure that their team observes said rules and principles, this ensuring

that, in the scope of their area of responsibility, there are no misconducts that could have been avoided with due supervision.

10. Sanctions

10.1. The Employee or Third Party who does not obey any of the determinations applicable to them provided for in the Code of Ethics or in the Compliance Policies, as the case may be, shall be subject to sanctions laid down in PC-QGMI-09 Policy (Ethical Channel and Disciplinary Measures), such as disciplinary measures, including contract termination.

10.2. The Employees and Third Parties must be aware that violation to the determinations of this Policy may constitute liability in the criminal, civil and administrative spheres.

11. Exceptions

11.1. Except if otherwise expressly provided for in this document, only the Ethics Committee, in the performance of its activities, may, in the face of an analysis of a concrete case and observing the specific procedure, authorize any exceptions to the provisions of any Compliance Policies.

12. Documents related to this Policy

- Code of Ethics
- FCPA - Foreign Corrupt Practices Act/1977
- UK Bribery Act/2010
- QGMI Compliance Policies

KNOW YOUR SUPPLIER POLICY

QGMI Compliance Policy N° 03 (PC-QGMI-03)	
Revision: 01	**Approval: Jan/2016**

SUMMARY

1. Objective

1.1. Establish the guidelines and procedures to assess potential suppliers, subcontractors, service providers and other Third Parties ("Suppliers"), in order to provide the Employees with the capacity of assessing the contracting and avoiding the exposure of QGMI ("Company") to risks that may be previously identified and mitigated.

1.2. The performance of the suppliers, in the context of QGMI, must be permanently supported in principles of transparency and trust in the acts performed and in full compliance with the Code of Ethics of QGMI.

2. Applicability

2.1. This policy covers all QGMI Employees, as well as Third Parties, who act in behalf and/or represent QGMI in its activities developed abroad. This policy must also be observed in the scope of consortiums and other associations with companies which QGMI comes to be a part of.

2.2. The Employees responsible for the contracting of Suppliers must apply this policy daily and critically analyze the information obtained.

3. Definitions

Chief Compliance Officer (CCO): is the Employee responsible for deploying, managing and supervising the Compliance Area, working as an independent and objective body that analyzes and assesses the compliance issues within the Company.

Compliance: is the systematic and continuous process that aims at: i) ensuring the compliance with current legislation, policies and guidelines established for the business, aiming at preventing, detecting and addressing any misconduct identified, and promoting an organizational culture based on ethics and transparency; and ii) ease the structuring of products, the development of business and the search for creative and innovative solutions for regulatory issues and internal discussions.

Corruption: is the misuse of power or authority with the intention of obtaining unfair advantages for themselves or others. The most usual form of corruption is bribery, which means giving or receiving money, gift or any asset in exchange of favorable treatment by the Public Official or Government Authority, in order to: i) influence any act or decision by the Public Official; ii) lead them to practice an act that violates their legal duties; iii) ensure Unfair Advantage; and iv) lead them to use their influence on a Government Authority to help them obtain, keep or refer businesses.

Employee(s): interns, staff of all operational and managerial levels, stockholders, advisors, directors and officers of QGMI, of all its national and international units. The expression also covers, for the purposes of this policy, the staff of outsourced companies.

Entertainment: Activities or events whose main goal is to provide leisure to their participants, such as parties, concerts or sports events.

Gifts: Items of commercial value that do not fall into the definition of Giveaways.

Governmental Authority: Every agency, department or entity of the direct, indirect or foundations-related administration of any of the Branches of Federal Power, of the States, the Federal District, the Municipalities, of Territory, legal entity incorporated to the public property or entity for whose creation or costing the public treasury has contributed or contributes with more than fifty percent of the property or annual revenue; of all bodies, state entities or diplomatic representations of foreign country, as well as legal entities, directly or indirectly controlled by the public authority of foreign country or public international organizations, including sovereign wealth funds or an entity whose property is a sovereign wealth fund.

Giveaways: Items of non-commercial value or of market value inferior to 30,00€ EUR (or equivalent in the respective country), given as hospitality, publicity or usual advertising and that must show the logo of QGMI or the legal entity that provided the giveaway to the QGMI Employee, such as organizers, calendars, key chains, pen drives, pens, among others.

Local Compliance Officer (LCO): is the QGMI Employee who shall perform the Compliance duties in the operation place of a specific international unit of QGMI, reporting to the CCO.

Politically Exposed Person[1]: Public Official who holds or individual who have held, in the past five years, in any country, territory and foreign premises, relevant offices, employments or public services, as well as their representatives, relatives and close associates.

Public Official: Any individual, servant or otherwise, even if temporarily or without pay, who acts officially or holds public office, employment or service in or for a Government Authority; any individual who works for a service provider Company contracted or associated for the conduction of typical activity of the Public Administration; or any leader of political party, their employees or other people who act for or on behalf of a political party or candidate to a public office.

Third Parties: service providers, suppliers, business partners, companies in consortium, representatives,

[1] Such as people who hold political offices, state ministers, presidents, vice-presidents, or directors of agencies, state-run companies or joint-stock companies, governors, mayors, members of audit courts, among others..

temporary advisors or any other person or company that act on behalf of QGMI, directly or indirectly.

Unfair Advantage: Any tangible or intangible asset, including money and valuable, offered, promised or delivered with the goal of improperly influencing or compensating any act, decision or omission of a person, Public Official or otherwise. In this concept, Gifts, Entertainment, airline tickets, accommodation, donations, sponsorships or any other asset used for such purposes, which are, improperly influencing or compensating any act or decision.

4. Exception

4.1. Suppliers of common products or services, those standardized in the market, or that use adhesion contracts as a standard for contracting, or that are regulated by Government Authorities, such as the Central Bank, Superintendence of Private Insurance, Electricity Regulatory Agency, National Telecommunications Agency, etc., may be excepted from the assessment procedure provided for by this policy. The CCO, in case of contracting made in the head office, or the LCO, in case of contracting made in other countries, must be consulted to check if a specific Supplier classifies in the exception provided herein.

5. Classification of the Suppliers

5.1. For the purposes of the application of this policy, the Suppliers have been divided in groups, according to the objects and activities to be performed for the fulfillment of the potential contract, as shown below.

High-Risk Group

5.2. This group consists of individuals or legal entities that QGMI intends to contract to provide services or act on its behalf, interest or benefit, whose execution of the contract may involve one of the following activities:

- The obtainment of permits or another type of authorization by a Government Authority, or the consulting in regulatory issue along with the Governmental Authority;
- The direct or indirect interaction with any Government Authority and/or Public Official and/or Politically Exposed Person; and
- The commissioning, brokerage, intermediation and every activity that require representation from QGMI before any third parties, whether individuals or legal entities, Public Officials, Politically Exposed People, Government Authorities or otherwise.
- Subcontracted companies for the execution of large-scale projects;

5.3. Examples of said suppliers are brokers, advisors, attorneys, representatives, managers, designers, agents, among others.

5.4. Additionally, individuals or companies of any nature under assessment to receive donations or sponsorships are part of this group. excepting contributions for political parties or electoral campaigns, due to specific regulations provided for in the applicable law regarding this matter.

Low Risk Group

5.5. This group consists of individuals or legal entities that may not be classified in the High-Risk Group.

6. Criteria for Contracting and Maintaining Suppliers

6.1. The Employee responsible for the contracting must request, as a minimum, offer to 03 (three) Suppliers of the same size, in order to disembody the process of contracting, avoid orientations and ensure the obtainment of the best price for the quality equivalent to the product or service to be contracted.

6.2. Upon requesting an offer, the Employees must review the manner of compensation of the potential Supplier, for the value must be legitimate and consistent with what is being contracted.

6.3. The information obtained and occasional risks identified must be reviewed.

6.4. The contracting, while observing the occasional need of prior approval from the CCO or LCO, as the case may be, must be formalized by contractual instrument that clearly defines the scope of the work, value, payment method and possibility of requirement, by QGMI, of a report of the activities performed by the Supplier.

6.5. Said contract shall also include clauses that protect QGMI from risks to which it may be exposed, with anti-corruption clauses and annexes, including the right to audit, in addition to others that may be required depending on the nature of the business.

6.6. The procedure is not fully described in this policy. Therefore, although there is a pattern to be followed to gather information about potential suppliers, the Employee must critically assess each situation, since it may be necessary to seek different information, depending on what is made available or is obtained in the actual case.

6.7. The Employees of QGMI must monitor and follow the risks during the entire execution of the contract. If any change in the situation of the Supplier is identified and may generate risks to QGMI, it must be immediately reported to the CCO or LCO, as the case may be.

6.8. Copies of all documents and information gathered during the contracting process must be kept in a file located in the managing area of the contract.

High-Risk Suppliers Assessment Method

6.9. The contracting area of a Supplier of the High-Risk Group must conduct the following procedure:

1. Present the Diligence Questionnaire (Annex I) to the Supplier, requesting the filling out and signing of the Statement contained therein, as well as the submission of the documents requested in the list present in Annex II and occasionally others deemed necessary to the assessment of the Supplier in question;

2. Assess the information and documents made available by the potential Supplier and, if necessary, contact them with the purpose of clearing possible doubts arisen or risks identified;

3. Conduct independent researches online, in the registers listed below and those correlated (if abroad), in the registers of the country where the contracting is made and in the registers of the Supplier's country of origin, to assess the reputation of the potential Supplier and their possible link to any discrediting act or fact;

    a. List of Disabled or Suspended Companies in the countries of its operation;
    b. List of Ineligible Companies (Disreputable) in the countries of its operation;
    c. "Sanctioned Firms and Individuals" List of the BID (Banco Interamericano de Desarollo);
    d. "Debarred & Cross-Debarred Firms & Individuals" List of the World Bank; and
    e. OFAC (Office of Foreign Assets Control) - USA.

4. Assess the information given, as well as those obtained through researches online, in order to identify potential risks or inconsistencies.

    a. If any risk is identified, the decision for the contracting must be made with the participation/opinion of the CCO, in the case of contracting made in the head office, or the LCO, in the case of contracting made in other countries; and
    b. If no risk is identified, the contracting must be approved, observing the internal governance of QGMI.

5. If the contracting is approved, the contractual instrument must be signed, including the corresponding Anti-Corruption clause therein;

6. Upon the completion of the contracting, the fact must be reported to the CCO or LCO, as the case may be; and

7. During the term of the contract, its fulfillment must be monitored and reported to the CCO or LCO, as the case may be, if any risk or misconduct is identified.

Low Risk Suppliers Assessment Method

6.10. For the contracting of Suppliers who fall under the Low Risk Group, the requesting are must conduct the following procedure:

1. Request the potential Supplier to present all documentation necessary to the contracting, such as copies of the incorporation documents and record of the company, as well as all permits and licenses required for the performance of the activities to be developed in the scope of the contract;

2. Assess the information and documents made available by the potential Supplier and, if necessary, contact them with the purpose of clearing possible doubts arisen or risks identified;

3. Conduct independent researches online, in the registers listed below and those correlated (if abroad), in the registers of the country where the contracting is made and in the registers of the Supplier's country of origin, to assess the reputation of the potential Supplier and their possible link to any discrediting act or fact;

    a. List of Disabled or Suspended Companies in the countries of its operation;
    b. List of Ineligible Companies (Disreputable) in the countries of its operation;
    c. “Sanctioned Firms and Individuals” List of the BID (Banco Interamericano de Desarollo);
    d. “Debarred & Cross-Debarred Firms & Individuals” List of the World Bank; and
    e. OFAC (Office of Foreign Assets Control) - USA.

4. Assess the information given, as well as those obtained through researches online, in order to identify potential risks or inconsistencies.

    a. If any risk is identified, the decision for the contracting must be made with the participation/opinion of the CCO, in the case of contracting made in the head office, or the LCO, in the case of contracting made in other countries; and
    b. If no risk is identified, the contracting must be approved, observing the internal governance of QGMI.

5. Upon approval, the contracting must be formalized and the corresponding anti-corruption clause must be included in the contract.

7. Risks and Points of Attention

7.1. There are some situations in the contracting of the Suppliers that must serve as a warning for the Employees of QGMI, which are:

- The Supplier lacks resources (manpower, physical premises, etc.) or capacity to provide the services;
- Requests for commissions or "contingency fees" in atypical situations or of high values incompatible with the service provided;
- Attempt to avoid or prevent any steps of this policy, like refusing or imposing unnecessary delays to

answer the questionnaire or to include the anti-corruption clause in the contract;

- Disregard to usual procedures for contracting suppliers;
- Request of payments in cash;
- The Supplier avoids communication in writing;
- There is reluctance to submit a report of the activities performed;
- The Supplier was appointed by Public Officials or a Politically Exposed Person;
- The Supplier has no references in the market; and
- The Supplier is, in any way, related to Public Officials or Politically Exposed Persons and is in conditions of influencing the decision-making of said individuals.

7.2. This list of risks is not complete and serves purely to illustrate critical situations. There are many others that will deserve the attention of the Employees of QGMI while performing the reputation analyses of potential Suppliers. When in doubt, report the points identified to the CCO or LCO, as the case may be.

8. Monitoring and Assessment

8.1. QGMI is committed to operational and institutional excellence. Therefore, the company will develop a tool to monitor and assess its suppliers, which will generate a Supplier's Performance Index (IDF).

9. Unsubscription of the Supplier

9.1. The non-compliance with the principles and commitments expressed in this Policy may cause the adoption of disciplinary measures, including the termination of the contracts established between the parties and the unsubscription of the supplier, as per rules of QGMI, notwithstanding the applicable legal and judicial measures that aim at protecting the interests of the company.

9.2. The full compliance with this Policy is a basic condition for the continuity of the supplier in the Suppliers List of QGMI.

10. Communication

10.1. In the event that an Employee of QGMI is not sure about which is the correct conduct to take in a specific situation, they must consult the CCO or the Ethics Committee of QGMI.

10.2. In addition, if any Employee detects or suspects, in good faith, that there may be violation to the

Compliance Program, especially the Code the Ethics or the Compliance Policies of QGMI, they must report the fact to the communication channel available for that purpose.

11. Supervision

11.1. Every Employee of QGMI must be familiar with the principles and rules present in the Code of Ethics, as well as in the Compliance Policies, observing them anywhere in the world.

11.2. The managers are required to ensure that their team observes said rules and principles, this ensuring that, in the scope of their area of responsibility, there are no misconducts that could have been avoided with due supervision.

12. Sanctions

12.1. The Employee or Third Party who does not obey any of the determinations applicable to them provided for in the Code of Ethics or in the Compliance Policies, as the case may be, shall be subject to sanctions laid down in the PC-QGMI-09 Policy (Ethical Channel and Disciplinary Measures), such as disciplinary measures, including contract termination.

12.2. The Employees and Third Parties must be aware that violation to the determinations of this Policy may constitute liability in the criminal, civil and administrative spheres.

13. Exceptions

13.1. Except if otherwise expressly provided for in this document, only the Ethics Committee, in the performance of its activities, may, in the face of an analysis of a concrete case and observing the specific procedure, authorize any exceptions to the provisions of any Compliance Policies.

14. Documents related to this Policy

- Code of Ethics
- Compliance Policies

APPENDIX I – Due Diligence Questionnaire

SUPPLIERS DILIGENCE QUESTIONNAIRE

We request the suppliers to answer the questions contained in the questionnaire below ("Questionnaire"); the filling of the Questionnaire is mandatory and conditional to the analysis of the development and/or maintenance of any partnership.

Instructions for Filling Out:

- The questionnaires must be construed to cover a period of up to five years prior to the date of the filling out of the questionnaire;
- The answers must be provided in the corresponding fields available in the Questionnaire or in separate documents (properly numbered according to the question made);
- If QGMI deems necessary, new documents may be requested;
- If an item is not answered or any document is not sent, we ask that the due justification is sent in the field mentioned or related separate document;
- The documents listed in Annex II, in addition to others occasionally requested by the Company, must be attached to the Questionnaire;
- In case of doubt in the filling out of the questionnaire, contact the QGMI Employee responsible for your evaluation process; and
- Upon answering the questionnaire, please sign it, attach the documents requested and return it to the requesting area of QGMI.

For the purposes of the Questionnaire, "Public Official" is anyone who, even if temporarily or without pay, by election, appointment, designation, contracting or through any other way of investiture or bond, holds office, term, employment or role in:

a) Agencies of the direct, indirect or foundations-related administration of any of the Branches (Executive, Legislative and Judiciary) of Federal Power, of the States, the Federal District, the Municipalities and Territories;
b) Legal entity incorporated to the public property or entity for whose creation or costing the public treasury has contributed or contributes with more than fifty percent of the property or annual revenue;
c) Political party, including candidates to public offices, leaders, their employees or other people who act for or on behalf of a political party or candidate to a public office;
d) Bodies, state entities or diplomatic representations of foreign country, as well as legal entities, directly or indirectly controlled by the public authority of a country; or
e) Public international organizations.

1. GENERAL DATA OF THE LEGAL ENTITY

Trade Name of the Company and type of company (Inc., limited liability company, others):	
Tax Number:	Website:
Address and date of constitution of the company:	
City, State and Country where the business relation will take place:	
Number of people who work for the company:	
Business purpose, branch of activity and service to be provided:	
Countries and places where the Company operates:	

1.1. In order to supply materials, provide services or partner with QGMI, will some form of contact, direct or indirect, be kept will Public Officials (employee of city council, bodies that issue permits, supervisory bodies, Federal, state or municipal Revenue Service, state-run companies, among other)? (Y/N)

1.2. If yes, specify below:

Public Agency	Activity to be performed

2. REPRESENTATIVE OF THE LEGAL ENTITY TO BE CONTACTED BY QGMI

Name:	
Tax Number:	ID Number:
Phone Number:	E-mail:
Nationality:	
Position:	

3. HISTORY OF THE COMPANY

3.1.	For how many years does the Company perform the activities QGMI intends to contract?	

3.2. Describe briefly the history of constitution of the Company, explaining how the activities developed by it began, its main goal, etc.

3.3.	Is the Company required, by law, to be registered with or obtain permit from any governmental body or organization in order to provide service to QGMI? (Y/N)	

3.4. If yes, provide the information requested below:

Number	Registry Body	Start Date	Expiration Date
		/ /	/ /
		/ /	/ /
		/ /	/ /
		/ /	/ /

3.5. List 3 (three) business references, which may be partnerships of which the company is part, and, at least, one client.

Company Name			
Contact Person		Phone	
E-mail		Website	

Company Name			
Contact Person		Phone	
E-mail		Website	

Company Name			
Contact Person		Phone	
E-mail		Website	

4. INFORMATION REGARDING THE MANAGEMENT OF THE COMPANY

4.1. List which people are or have been part, in the last 5 (five) years, of the management and the board of directors of the Company (if applicable), or equivalent bodies, if the company is not a corporation, categorizing them by position, nationality and period.

Name	Position	Nationality	Period

4.2. List which people will be directly involved in the potential business relation with QGMI and/or who will act on behalf of QGMI:

Name	Position	Nationality	Period

5. INFORMATION REGARDING SHAREHOLDING

5.1. Give the data of individuals and legal entities that hold shares in the Company. If there is any legal entity in the list of partner, please name its final beneficiaries, and so on, until there are only individuals. The shares, when added, must equal 100%.

Name/Trade Name	Nationality	% Interest

6. INFORMATION REGARDING RELATED PARTIES

6.1. Parent company(ies) (if any):

Trade Name			
Country		Address	
Phone Number		Website	

Trade Name	

Country		Address	
Phone Number		Website	

6.2. Subsidiaries (if any):

Trade Name			
Country		Address	
Phone Number		Website	

Trade Name			
Country		Address	
Phone Number		Website	

Trade Name			
Country		Address	
Phone Number		Website	

7. FINANCIAL INFORMATION

7.1. Does the Company have an audited financial statement? If yes, provide copies of last year's audit report; if not, answer the question below.

7.2. Does the Company have an unaudited financial statement? If yes, provide copies of last year's financial statement; if not, provide at least a financial reference – ex: bank.

Company / Bank:
Name:
Position:
Address:
City, State, Country, Zip Code:
Phone Number:
E-mail:

8. PERSONAL INFORMATION ITEMS 4 AND 5

Please answer the fields below fully and accurately, for QGMI to have information regarding the person legally responsible for the company.

8.1. Is any of the persons listed in items 4 and 5 above a Public Official or has been? (Y/N)

8.2. Does any of the persons listed in items 4 and 5 currently hold or has held any public office or has duties in any political party or political campaign? (Y/N)

8.3. Is any of the persons listed in items 4 or 5 candidate to any political office or has been? (Y/N)

8.4. If the answer to any of the questions above is yes, fill out the table below:

Name	Position	Public Entity	End date / Current conflict situation

Any relative[2] of any person listed in items 4 and 5 is or has been:

8.5. Public Official? (Y/N)

8.6. Holds or has held any political office, is or has been candidate, has or has had office or bond to a political party? (Y/N)

8.7. If yes, please identify the person and provide the name of the relative, the relationship, position, duties and body below:

Name	Relationship	Position and Body	Duties

8.8. Are any of the persons listed in items 4 and 5 a relative of any Employee of QGMI? (Y/N)

8.9. If yes, provide the following information:

Name	Name of the Employee	Position of the Employee	Relationship

[2] "Relative" means spouse, partner or relatives, by consanguinity or affinity, in direct or collateral line, until third degree (ex: father, mother, children, grandparents, grandchildren, nephews and nieces, cousins, uncles and aunts, in laws).

9. DETAILED INFORMATION

9.1. Does any person, entity, government or agency have any right to manage or any financial or corporate interest in the businesses of the Company? (Y/N)

9.2. If yes, describe the extension of the management control or corporate interest:

9.3. Does the Company intend to subcontract or use other individuals or legal entities to fulfill the contract with QGMI? (Y/N)[3]

9.4. If yes, specify below:

10. COMPLIANCE INFORMATION

10.1. Does the Company have a Code of Ethics or Conduct that addresses professional and business ethics issues; anti-corruption policy that prohibits and condemns the payment of commissions, kickbacks or any other type of bribery or unfair advantages to Public Officials; or similar document that aims at these purposes?

Yes: No:

If YES, please provide copy of the documents.

10.2. Has the Company conducted or allowed the conduction of training of the people listed in items 4 and 5 in which issues related to professional and business ethics, corruption, practice of commercial or corporate illicit acts and relations with public officials were addressed?

Yes: No:

If YES, please attach the material used and the evidence of which people participated and conducted the training.

10.3. Does the Company have a professional or a collegiate body responsible for an anti-corruption program or policies? (Ex: Compliance Officer, Compliance Director or equivalent)

Yes: No:

10.4. If yes, please identify the professional in question, also informing their skills, professional experience, responsibilities and contact data.

[3] Regardless of the positive answer to item 9.3, the effective subcontracting must observe the terms of the contract eventually signed with QGMI.

10.5. Has there been, in the past 05 (five) years, administrative or judicial convictions, proceedings or investigations related to the Company, the people listed in items 4 and 5 above or to the Companies listed in item 6 above and their Administrators on account of illicit acts provided for by laws that prohibit acts related to bribery, kickback, corruption, anti-competitive practices and/or money laundering, such as FCPA – Foreign Corrupt Practice Act, UK Bribery Act, and other related laws? (Y/N)

Yes: No:

10.6 If yes, identify the proceeding, its status and the person(s) involved:

10.7. Has there been, in the last 05 years, criminal convictions, criminal proceedings or criminal investigations related to the Company, to the people listed in items 4 and 5 above or to the Companies listed in item 6 above and their Administrators? (Y/N)

Yes: No:

10.8. If yes, identify the proceeding, its status and the person(s) involved:

10.9. Has the Company, any of the people listed in items 4 and 5 above or the Companies listed in item 6 above and their Administrators been listed or are they listed in any of the following registers/lists?[4] (Y/N)

List of Disabled or Suspended Companies in the countries of its operation	
List of Ineligible Companies (Disreputable) in the countries of its operation	
"Sanctioned Firms and Individuals" List of the BID (Banco Interamericano de Desarollo)	
"Debarred & Cross-Debarred Firms & Individuals" List of the World Bank.	
OFAC (Office of Foreign Assets Control) - USA	

10.10. If the answer to any of the items above is yes, please provide additional information deemed relevant:

[4] The suspension or interruption of any of the records listed in section 10.9 and / or the impossibility, for reasons beyond the control of the Company, to access them when completed and submitted to this Questionnaire, does not exempt the Company from answering the section, in this way, the company must consider the most up-to-date information available, specifying, even, your date and the source. The information will be a declaration.

11. STATEMENT

On behalf of the Company, I do hereby declare that to the best of my knowledge, the information provided above, as well as the documents made available, are true and represent the full disclosure of the relevant information for this Diligence Procedure.

If, in any moment, the information or documents submitted in this questionnaire no longer represents the reality, I agree to report the fact immediately to QGMI and provide a complementary report detailing such change.

[Date]

_____

[Name]

[Position]

[Name of the Company]

APPENDIX II – List of Documents

LIST OF DOCUMENTS

Please list any documents submitted to QGMI along with the diligence questionnaire:

	Document:	Check if attached:
A.	Corporate Chart	☐
B.	Copy of the constitution and register documents of the Company, as well as all permits and licenses required for the performance of the activities potentially contracted.	☐
C.	Brief description of the *curriculum vitae* of the members of the Management and Board of Directors of the Company, as applicable, or equivalent bodies, if the company is not a corporation.	☐
D.	Last financial statement, duly audited, if available.	☐
E.	Copy of the Code of Ethics, or similar document, if any.	☐

Annex XVII - Approach to Ecosystem Services

APPLICATION OF THE ECOSYSTEM SERVICES APPROACH IN ENVIRONMENTAL IMPACT ASSESSMENT

CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

APRIL, 2023

PROJECT DESIGNATION: CONTRACT FOR REHABILITATION OF THE ROAD EC 192 / EN 250 / EC 254 / EC 385, LUAU / CAZOMBO

PROMOTING ENTITY: Angola Roads Institute – Ministry of Public Works, Urbanism and Housing

EXECUTING ENTITY: QG Konstruktion GmbH

CONSULTANT ENTITY: RESURB Ambiente, Lda.

(Company registered with the Ministry of Environment, as an Environmental Consultant, with Certificate No. 20816908221, valid until 08/09/2023)

1. INTRODUCTION

Living beings are heavily dependent on ecosystems, as they provide free of charge essential resources and services such as water, food, fiber/wood, climate regulation and disease control. These services are called Ecosystem Services (ES) and can be defined, according to MEA (2003), as benefits that people receive from ecosystems. These are divided into four categories, namely production services, regulatory services, support services and cultural services.

In IFC Performance Standard 6: Conservation of Biodiversity and Sustainable Management of Living Natural Resources, Ecosystem Services are the *benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types: (i) provisioning services, which are the products that people obtain from ecosystems; (ii) regulatory services, which are the benefits that people derive from regulating ecosystem processes; (iii) cultural services, which are the non-material benefits that people obtain from ecosystems and (iv) support services, which are the natural processes that maintain the other services.* Ecosystem services valued by humans are generally supported by biodiversity. Impacts on biodiversity can therefore negatively affect the provision of ecosystem services.

Thus, economic development and human well-being are intrinsically related to the quality and quantity of services and flow of goods resulting from the activity of ecosystems (PARRON, 2015). However, despite their importance, ecosystems and their services have been and have been negatively impacted to meet the growing demand for resources due to population growth. These impacts have substantially reduced the functions, services and benefits of the ecosystem for the well-being of the future generation, especially in the last 50 years (MEA, 2003). Consequently, this environmental degradation generated by anthropogenic conditions caused a growing concern with the environment that became the object of study by many scientists, especially in the mid-twentieth century, thus pointing out the urgent need for the creation of methods to assess the impacts and on the environment, driven by the strong concern with the availability of natural resources in terms of quantity and quality (ALCAMO *et al*., 2003; BRAGA *et al*., 2005).

To try to understand the question of the cost of this environmental degradation, the value of ecosystems services was developed, which covers not only the direct use value of resources, but also those associated with their independent use or non-use, being of extreme importance for human well-being and for the support of life on the planet. This valuation functions as an evaluation of the contribution of these services to humanity, being important for the evaluation of the impacts and economic impactscaused by the degradation of the ecosystem that are, in most cases, disregarded and underestimated. When one of the services offered by the ecosystem is degraded, the parties that used to benefit from this service need to compensate for its loss and/or remedy it, thus generating costs. With the value of these services, ecosystems can be seen as a natural capital that must be included in economic transactions and that

requireprojects of preservation and remediation (ANDRADE, 2010; LANDSBERG, 2013).

Thinking about the preservation of these resources, management instruments such as the Environmental Impact Assessment (EIA) were created, which is the most used instrument in the world to identify the possible impacts that may be caused by a project. This, in theory, should be ample, identifying and avoiding and/or mitigating and compensating for as many negative impacts as possible triggered by a project. However, the current practice of EIA has numerous shortcomings such as an incomplete identification of impacts and a poor assessment of its significance, generating incomplete and poorly analytical Environmental Impact Studies (EIAs) (ROSA, 2014). Therefore, although EIA has become an important tool used worldwide, in most cases it does not consider ecosystem services.

In this context, the use of another approach to fill the EIA's gaps on eco-ecosystem services has arisen, called the Eco-Mouse Services Approach (ASE). This approach is a joint analysis of the social and environmental effects in the preparation of projects and in the evaluation of their impacts and can be obtained by applying the concept of ecosystem services that would contribute to solving some recurrent deficiencies of the EIA practice (ROSA, 2014).

The objective of the ESA is to complement the traditional method of EIA through the use of the concept of ecosystem services in its procedure and is not configured as an alternative to replace the traditional EIA (BAKER et al., 2013), but rather a way to make it more comprehensive, focusing attention on the socio-economic dimensions of the environmental impacts and s of the project cto e is an attempt at an integrated assessment of thesocial and environmental impacts of a planned intervention. The association of ecosystem services in impact and environmental assessments results in a broader and more effective assessment of the immediate and long-term impacts of a project (SLOOTWEG *et al*., 2010; Landsberg *et al*., 2013; ROSE, 2014).

Therefore, small changes in the conduct of traditional impact assessment can result in substantial benefits to communities, businesses and the environment. Such restructuring leads to a better analysis of impacts, provided that this is carried out in an integrated manner (ROSA, 2014). Guidance is therefore needed in order to be able to incorporate social, environmental and economic aspects into ecosystem services impact in assessment.

2. METHODOLOGY

The methodological procedures used were based on Rosa (2014) who used the form of application of the Ecosystem Services Approach is initially proposed by Landsberg *et al*. (2013), which considers only provision, regulation and cultural services. Support services were excluded following the recommendations of the study by Landsberg *et al*. (2013) in which they state that support services are intermediate services and should not be the focus of the identification of impacted services. The methodology adopted is summarized in the following table (*see* **Table 1**).

Table 1 - Methodological design of the research

Stages of the research	Methodological procedures
1. Identification of ecosystem services in the study area	Identify and characterize the ecosystems potentially affected and impacted by the project, according to the information provided by the environmental diagnosis of the ESIA, considering, mainly, the use, occupation of the soil and the vegetation cover
	Identify the ecosystem services that exist in the area of study, using as a basis the services of provision, regulation and culture proposed by *Landsberg* (2011)
2. Identification of potentially impacted services and systems	To identify the ecosystems potentially impacted by the project by analyzing the cause-and-effect relationship of the activities of the project and the ecosystem to be affected, based on the information presented in the ESIA
3. Comparison between ESA and EIA	Compare the ecosystem services potentially affected with the impacts identified and described in ESIA
4. Determination of priority services and systems potentially impacted	Apply the criteria developed by *Landsberg et al*. (2013) to identify the priority ecosystem services that will possibly be affected by the project
5. Assessment of the significance of impacts on priority ecosystem services	Assessing the significance of impacts and on ecosystem services in accordance with the definition of Rosa (2014), which considers the relationship between the magnitude of the impact and the vulnerability of the beneficiaries affected
6. Comparison of the magnitudes given by the ES and EIA approaches	Compare the magnitude of the impacts identified by the ESA with the significance of the impacts and identified in the ESIA
7. Analysis of the environmental measures	Verifying whether the environmental measures or programs proposed in the ESIA are also capable of mitigating the impacts and on ecosystem services in priority, through the criteria of presence and absence and critical analysis of the content presented

2.1. Criteria for the identification of affected ecosystems and their services

In order to identify the affected ecosystems and their services, it was necessary to know the area of implementation of the project. According to Cooper (2010), land use and vegetation cover information are the most appropriate for this identification. Therefore, the information on vegetation cover and land use, among other relevant information, presented in ESIA was used to identify potentially affected ecosystems.

The aim of this stage is to describe the ecosystems affected by the project and to identify their services, according to the information of the EIAS. For such, we used the generic description of each ecosystem service based on *Hassan et al*. (2005), *Groot et al*. (2010) and *Landsberg et al*. (2011) (*see* **Table 2**), which helped in the identification of the services provided by each ecosystem.

Table 2 - Systematization of the information used to identify the services (Source: Rosa, (2014))

SERVICES	SUBCATEGORY	INDICATORS OF THE NEED FOR SERVICES
PROVISION SERVICES		
Foods	Agricultural cultures	1- Presence of cultivated plants 2- Presence of farmers
	Animal husbandry	1- Presence of animal husbandry
	Fishing	1- Availability of fish for fishing 2- People who fish
	Aquaculture	1- Presence of fish farms
	Uncultivated food	1- Availability of fruits for harvest 2- People who pick fruits
Biological Material	Wood	1- Availability of wood for construction 2- People who extract wood for construction
	Fibers and resins	1- Availability of fibers or resins 2- People who extract fibers or resins
	Ornamental Resources	1- Species of ornamental plants 2- People who harvest medicinal plants
Biomass fuel		1 – People who extract firewood
Water supply		1- Rivers with potential for electricity generation 2- Public Supply (water for drinking, washing clothes. Cooking, etc.)
Genetic resources		*Unknown indicators*
Biochemicals and natural medicine		1- Presence of species of medical importance 2- People who harvest medicinal plants
REGULATORY SERVICES		
Air quality regulation		1- Rate of vegetation suppression and dust production
Climate Regulation	Global	*Unknown indicators*
	Regional and Local	*Unknown indicators*
Regulation of water recharge and flow		1- Geological information about aquifers and surface runoff
Erosion control		1 - Diagnosis of soils and erosive processes
Water purification and effluent treatment		1 - Water quality of tributaries and rivers, associated with their use
Disease regulation		*Unknown indicators*
Regulation of soil quality		*Unknown indicators*
Pest regulation		*Unknown indicators*
Pollination		*Unknown indicators*
Regulation of natural disasters		*Unknown indicators*
CULTURAL SERVICES		
Recreation and ecotourism		1- Presence of tourists 2- Local population that uses the resources for recreational purposes
Ethical and spiritual values		*Unknown indicators*
Educational and inspirational values		1 - Region of Scientific Interest 2 - Presence of caves or archaeological areas of interest

In summary, the generic characterization based on the aforementioned authors allows to identify the key information to be included in the ESIA in order to indicate the provision of each ecosystem service in the area of implementation of the project under analysis.

2.2. Criteria for potentially impacted ecosystem services identification.

After the identification of the affected ecosystems and their services, the ecosystem services potentially impacted by the project were identified. For this purpose, the methodology adopted by the traditional EIA (Partisan and Jesus, 2005) was used and cause and effect relationships were established between the activities planned for the project and the environmental and social characteristics of the affected area, in this case, represented by the provision of ecosystem services. In this sense, the consequences were identified through the main activities of the project described in the ESIA, from the following two perspectives:

I. Change in the ecosystem providing the service or direct change in the provision of the service:
    a. Ecosystem degradation;
    b. Occupation of areas by the project.

II. Increased demand for the service:
    a. Search of the project itself for services;
    b. The project leads to increased demand for services by attracting new beneficiaries to the region.

2.3. Criteria for comparing the impacts and described in the Environmental and Social Impact Study and Ecosystem Services are potentially impacted.

Regarding the comparison between the Ecosystem Services Approach and the Environmental Impact Assessment, a matrix organization of the impacts and s described in ESIA was carried out and the potentially impacted ecosystem services identified by the ESA. This comparison aimed to look for equivalence between the potentially impacted services with the impacts and the ones described in the ESIA, as well as to verify whether the preliminary screening of the ESA was able to identify all the impacts described in the ESIA and whether all the potentially impacted services were referred to in the ESIA.

2.4. Criteria for determining ecosystem services are priorities.

After identifying the ecosystem services that are potentially impacted, the priority ecosystem services were determined. The prioritization process aims to direct the environmental diagnosis and, consequently, the next stages of the evaluation (IFC, 2012b; LANDSBERG *et al*., 2013).

Priority services are those services in which the impact of the project affects the well-being (livelihoods, health, safety, culture) of the beneficiaries of the ESs, and those services which may prevent the project from achieving the planned operational performance. Beneficiaries of ESs include future generations who may be prevented from benefiting from ESs as a result of the impacts ands of the project.

Rosa *et al*. (2014) focused on two aspects for determining priority services: (I) dependence of beneficiaries on the potentially impacted service and (II) dependence on the project on the ecosystem services potentially impacted.

The stage of prioritization of services is characterized by the survey and preliminary systematization of information on the potential of the project cause impact and on the services, based on three key questions:

1. Can the project impact the ability of third parties to benefit from this service and/or its provision?
2. Is this service important for the cultural, health and safety environment of its beneficiaries and/or for the maintenance of the project's performance?
3. Do the beneficiaries and/or the project have alternative access to this service? Is it possible to replace it?

In this sense, the prioritization of services considered the characterization of the reference situation of the project contained in the ESIA, and the answers to the three key questions mentioned above. Being that the service was considered priority when the answers of the first two questions were "yes" or "I do not know" and if the answer to the third question was "no" or "I do not know".

2.5. Criteria for analysis of mitigation measures described in ESIA.

This stage aims to analyze whether the mitigation measures present in the Environmental and Social Impact Assessment of the rehabilitation project cover all the ecosystem services identified by the ESA.

Where identified as a priority, the measures shall be analysed in conjunction with the impacts and s of the project and the impacted ecosystem services identified by the ESA, in order to assess whether the mitigation measures proposed in the ESIA also cover the impacts identified by the ESA.

It should be noted that this step is based on two criteria: (I) presence or absence of a measure or program related to the impact and identified by the ESA; and (II) critical analysis of the content of the measure or program, in order to verify whether it is comprehensive to the point of mitigating, minimizing or compensating for the impact on the beneficiary of the service.

After the description of the methodological steps, the results of the present study, when applicable, should be organized according to the stages of the ESA proposed by *Slootweg et al.* (2010) and *Landsberg et al.* (2011; 2013), as depicted in the following figure (*see* **Figure 1**).

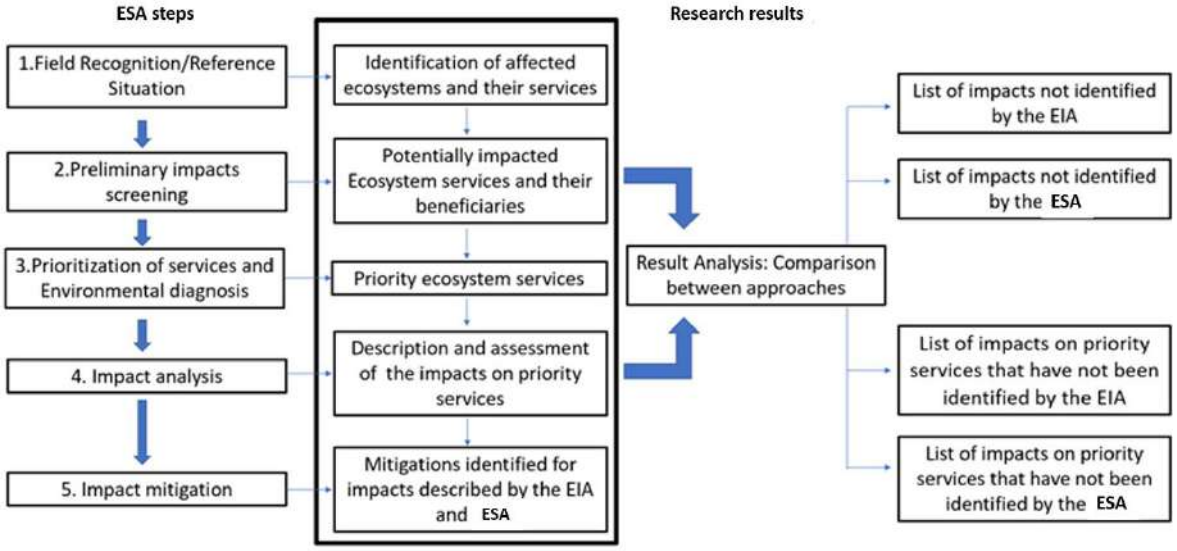


Figure 1 - Schematization of the results, according to the steps of the ESA (Source: Rosa (2014)).

3. IDENTIFICATION AND CHARACTERISATION OF AFFECTED ECOSYSTEMS AND THEIR SERVICES

The identification and characterization of the affected ecosystems and their services was based on the characterization of the reference situation of the project, in particular, the classification of the use and occupation of the land of the area of implantation of the project, vegetation units and information collected after the fieldwork presented at the ESIA.

Regarding land use and occupation, the project implementation area is mostly made up of natural tree, bush and herbaceous vegetation, with urban areas being recorded essentially near the communal centers crossed by the electrification project.

These types of land cover and land use have been grouped into 3 main types of "ecosystems" to group together the ecosystem services provided, including:

1) Anthropic Systems encompassing artificial pasture and infrastructure and maintenance areas;
2) Forest;
3) Aquatic Ecosystems formed by the watersheds of the Upper Zambezi watershed.

For the vegetation units, the project crosses two units, with distinct vegetation cover, namely:

- ✓ Fog forest;
- ✓ Open Miombo (10-20 m) with Brachystegia spiciformis var latifoliolata, Julbernardia paniculata and B. longifolia with stratum graminal of Hyparrhenia.

Based on this information and guided by **Table 2**, we identified the ecosystem services present in the area of influence of the project presented in **Table 3** where the gray cells indicate the relationship between ecosystems and the service, that is to say, the service that the ecosystem provides.

Table 3 - Ecosystems of the area of implementation of the electrification project and its services according to information from ESIA

Services	Subcategory	Forest	Systems anthropic	Ecosystem aquatic
Provision services				
Food	Agricultural crops and animal husbandry			
	Fishing			
Water supply				
Regulatory services				
Air quality regulation				
Climate regulation	Regional and local			
Regulation of water recharge and flow of water resources				
Erosion control				
Water purification and effluent treatment				

Services	Subcategory	Forest	Systems anthropic	Ecosystem aquatic
Regulation of soil quality				
Cultural services				
Educational and inspirational values				

3.1. Identification of potentially impacted SEs

As a result of the analysis of the cause-and-effect relationship, were identified by the ESA, ecosystem services are potentially impacted. As described in the methodology chapter, the ecosystem services that are potentially affected were identified from the establishment of cause-and-effect relationships between the planned actions of the project and the environmental and social characteristics of the region (LIMPEBRÁS, 2012). The result of this step is presented in the following table (*see* **Table 4**).

Table 4 - Systematization Matrix of potentially impacted ecosystem services through the analysis of the cause-effect relationship

Motor Forces of Ecosystem Change	Main activities directly associated with a road project	Ecosystem services										
		Provision				Regulators						Cultural
		Agricultural cultures	Animal husbandry	Fishing	Water supply	Air quality regulation	Regulation of regional and local climate	water recharge and flow of water resources	Erosion control	Water purification and effluent treatment	Regulation of soil quality	Educational values and inspiration
Land use and land cover change	Suppression of vegetation during land clearing actions	■	■			■		■	■	■	■	■
	Excavation, earthworks and opening of accesses	■	■		■	■	■	■	■	■		■
	Installation of infrastructure to support the works (construction sites, temporary warehouses and social facilities)	■	■	■				■				
	Reabilitation of the road infrastructure	■	■	■				■				
	Recovery of degraded areas and dismantling of infrastructure to support the project	■	■	■		■		■				
Pollution	Construction and operation of the project (road infrastructure)	■	■			■			■	■	■	■
	Transport of people, machinery and equipment					■						
	Waste and effluent management					■				■	■	■
	Storage, supply and transfer of chemicals (fuel)					■				■	■	
	Maintenance activity of the road infrastructures and support installations									■	■	
	Emergency situations (spill, fire, flood)	■	■	■		■	■		■	■	■	■
Changes in the economy and demography	Hiring of labor											■
	Attractiveness for investments and population fixation	■	■		■	■	■	■	■	■	■	■

According to the previous table (*see* **Table 4**), which systematizes the potentially impacted ecosystem services through the analysis of the cause-effect relationship inherent to the main activities that may arise from a road construction project, it appears that they may be impacted by the project the various ecosystem services identified in the areas of influence of the project.

Following the approach to ecosystem services carried out in this chapter and summarized in **Table 4**, the following subchapter identifies, for the project under analysis, the priority ecosystem services that may eventually be affected, taking into account the project information constant in the ESIA and recognition of the project's implantation area when carrying out the field work to characterize the reference situation.

3.2. Priority ecosystem services

According to IFC (2012), one of the crucial steps in the evaluation using the ESA is the prioritization of the most important ESs in the region, assisting in the development of the socio-environmental diagnosis and in the analysis of the impacts. To carry out this prioritization, there are two criteria: (I) the potential of the project to change the beneficiary's ability to access the service and (II) the importance of the service to the beneficiary, focusing on what is important for a given region.

In accordance with what is set out in the Criteria for Determining Priority Ecosystem Services, the prioritization of services (provision, regulatory and cultural) is carried out in the following table (*see* **Table 5**), by answering the questions presented therein, based on the information constant in the ESIA and information collected during field work.

Table 5 - Systematization of information for the identification of ecosystem services are priority projects that will be supported by the project "Contract for Rehabilitation of the Road EC 192/EN 250/EC 254/EC 385, Luau, Cazombo

Ecosystem services	Can the project affect the ability of the beneficiaries to use this service?	Is the service important as a means of livelihood or for the health, safety or culture of the beneficiaries?	Do the payees have an alternative to this service? Is it possible to replace it?	Is service a priority? (Result from the combination of the previous answers)
Agricultural cultures	No	Yes	Yes	No
Animal husbandry	No	Yes	Yes	No
Fishing	No	No	Yes	No
Water supply	Yes	Yes	Yes	No
Quality regulation from the air	Yes	Yes	Yes	No
Regulation of regional and local climate	Yes	Yes	Yes	No
Regulation of water recharge and flow of water resources	Unknown	Yes	Unknown	No
Erosion control	Yes	Yes	Yes	No

Ecosystem services	Can the project affect the ability of the beneficiaries to use this service?	Is the service important as a means of livelihood or for the health, safety or culture of the beneficiaries?	Do the payees have an alternative to this service? Is it possible to replace it?	Is service a priority? (Result from the combination of the previous answers)
Water purification and effluent treatment	Yes	Yes	Yes	No
Quality regulation of the soil	Yes	Yes	Yes	No
Educational and inspiration	No	Yes	Unknown	No

Through the result of the previous table (*see* **Table 5**) it is expected that the Project for the Rehabilitation of the Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo will not affect the priority ecosystem services described. Consequently, it is not necessary to continue steps 5 to 7 listed in **Table 1**.

4. FINAL CONSIDERATIONS

The Ecosystem Services Approach showed that the Project for the Rehabilitation of the Road EC 192 / EN 250 / EC 254 / EC 385, Luau / Cazombo will not affect priority services. It should be noted that, as this is a rehabilitation project for an existing road section, implemented in the road easement area, it is not foreseen that the local community's means of subsistence will be affected (e.g. cultivation areas, forests and/or residential areas, among others) by the project since the directly affected area ("footprint") will be limited to the national road easement area.

It should also be noted that in the Environmental and Social Management Plan of the Project, inserted in the Environmental and Social Impact Assessment, several mitigation measures were defined for the various activities foreseen within the scope of the project in order to safeguard the ecosystem services identified in the area of influence of the project, as well as ensuring the good socio-environmental performance of the project.

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Annex XVIII – Register of existing aqueducts

LISTA DE PHS DO RIO SAPO ATÉ A PONTE DO CAZOMBO

Nº	PK	EXISTENTE	TIPO				DIAMETRO (Cm)	COMPRIM. (m)	PONTO SITUAÇÃO	TIPO DE ITERVENÇÃO	REGISTRO FOTOGRAFICO
			ARMICO	BETÃO	SIMPLES	DUPLO					
1	22+500	X	X		X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	
2	23+200	X		X		X	60	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	

03	38+700	X	X			X	80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm
04	45+700	X	X		X		100	10	NOK	EXECUTAR DUAS CELULAS DE BOX CULVERTS
05	23+200	DESTRUIDA	-	-	X		100	10	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm

06	56+400	DESTRUIDA	X		X		120	10	NOK	EXECUTAR PH SIMPLES, BETÃO D120cm	
07	57+100	DESTRUIDA	X		X		100	10	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm	

08	65+300	x		x	x		80	11	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	
09	66+100	X	X		X		100	10	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm	
10	66+600	X		X	X		80	10	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm	

11	67+000	X		X	X		80	10	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm	
12	68+200	X	X		X		100	11	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm	
13	68+800	X	X		X		100	11	NOK	EXECUTAR PH SIMPLES, BETÃO D100cm	

14	80+500	DESTRUIDA		X		X	100	11	NOK	EXECUTAR PH DUPLA, BETÃO D100cm
15	139+900	X	BOX CULVERT UNICELULAR			X	120	9	NOK	EXECUTAR DUAS CELULAS DE BOX CULVERTS
16	145+600	X	X		X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm

17	145+800	X	X		X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	
18	146+700	X	X		X		100	10	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	
19	149+800	X	X		X		100	10	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	

20	165+200	x	x		x		100	10	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	
21	165+500	X	X		X		100	10	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	

22	165+700	X	X		X		100	10	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	
23	166+800	X	X		X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	

24	167+100	X	X				100	11	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	
25	167+900	X	X		X		100	11	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	

26	168+300	X	X		X		100	11	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	
27	170+100	X	X		X		100	11	NOK	EXECUTAR PH DUPLA, BETÃO D100cm	

28	173+600	X	X		X		80	11	NOK	EXECUTAR DUAS CELULAS DE BOX CULVERTS	
29	181+300	X	X		X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm **ZONA COM ELEVAÇÃO DE ÁGUA	

30	190+400	X		X	X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	
31	190+900	X		X			80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	
32	191+400	X		X	X		80	10	NOK	EXECUTAR PH DUPLA, BETÃO D80cm	

LISTA DE PHS DE CAZOMBO AO PK 52+200

Nº	PK	EXISTENTE	TIPO				DIAMETRO (Cm)	COMPRIM. (m)	PONTO SITUAÇÃO	TIPO DE ITERVENÇÃO	REGISTRO FOTOGRAFICO
			ARMICO	BETÃO	SIMPLES	DUPLO					
01	0+843	X	X		X		80	12	OK	LIMPEZA	
02	1+230	X	X		X		80	12	OK	LIMPEZA	

03	2+130	X	X		X		80	12	OK	LIMPEZA	
04	2+730	X	X		X		80	12	OK	LIMPEZA	
05	5+960	X	X		X		80	12	OK	LIMPEZA	

06	6+460	X	X		X		80	12	OK	LIMPEZA	
07	7+110	X	X		X		80	12	OK	LIMPEZA	
08	7+460	X	X		X		80	12	OK	LIMPEZA	

09	8+360	X	X		X		80	12	OK	LIMPEZA	
10	9+260	X	X		X		80	12	OK	LIMPEZA	
11	11+860	X	X			X	80	12	OK	LIMPEZA	

12	12+460	X	X			X	80	12	OK	LIMPEZA	
13	12+960	X	X		X		80	12	OK	LIMPEZA	
15	14+060	X	X		X		80	12	OK	LIMPEZA	

16	14+960	X	X		X		80	12	OK	LIMPEZA	
17	15+760	X	X		X		80	12	OK	LIMPEZA	
18	17+060	X	X		X		80	18	TUBOS EXPOSTOS	ATERRAR O TUBO ARMICO	

19	18+460	X	X		X		80	18	OK	LIMPEZA	
20	20+260	X	X		X		80	18	OK	LIMPEZA	

21	20+960	X	X		X		80	18	OK	LIMPEZA	
22	21+060	X	X		X		80	14		LIMPEZA	
23	21+160	X	X		X		80	14	OK	LIMPEZA	

24	21+360	X	X		X		80	14	EROSÃO NA BOCA	ATERRAR DISSIPADOR DA BOCA	
25	22+260	X	X			X	80	18	TUBOS EXPOSTOS	ATERRAR O TUBO ARMICO	
26	23+360	X	X		X		80	14	OK	LIMPEZA	

27	24+660	X	X		X		80	14	OK	LIMPEZA	
28	25+500	X	X			X	80	14	OK	LIMPEZA	
29	26+660	X	X			X	80	18	TUBOS EXPOSTOS	ATERRAR O TUBO ARMICO	

30	36+100	X		X	X		80	10	DETERIORANDO	EXECUTAR OUTRA	
31	36+400	X	X		X		100	10	TUBO FORA DE SERVIÇO	EXECUTAR OUTRA	
32	37+800	X	X		X		80	10	TUBO FORA DE SERVIÇO	EXECUTAR OUTRA	

33	38+600	X	X		X		120	10	TUBO FORA DE SERVIÇO	EXECUTAR BOXER CULVERTS	
34	38+700	X	X		X		120	10	TUBO FORA DE SERVIÇO	EXECUTAR BOXER CULVERTS	
35	38+750	X	X		X		120	10	TUBO FORA DE SERVIÇO	EXECUTAR BOXER CULVERTS	

36	38+800	X	X			X	150	10	TUBO FORA DE SERVIÇO	EXECUTAR BOXER CULVERTS	
37	40+100	X	X		X		100	10	TUBO FORA DE SERVIÇO	EXECUTAR OUTRA	
38	41+600	X	X		X		80	10	TUBO FORA DE SERVIÇO	EXECUTAR OUTRA	

39	42+500	X	X		X		120	10	TUBO FORA DE SERVIÇO	EXECUTAR BOXER CULVERTS	
40	48+200	X	X		X		120	10	TUBO FORA DE SERVIÇO	EXECUTAR OUTRA	
p											

Annex XIX – Quarry Tests

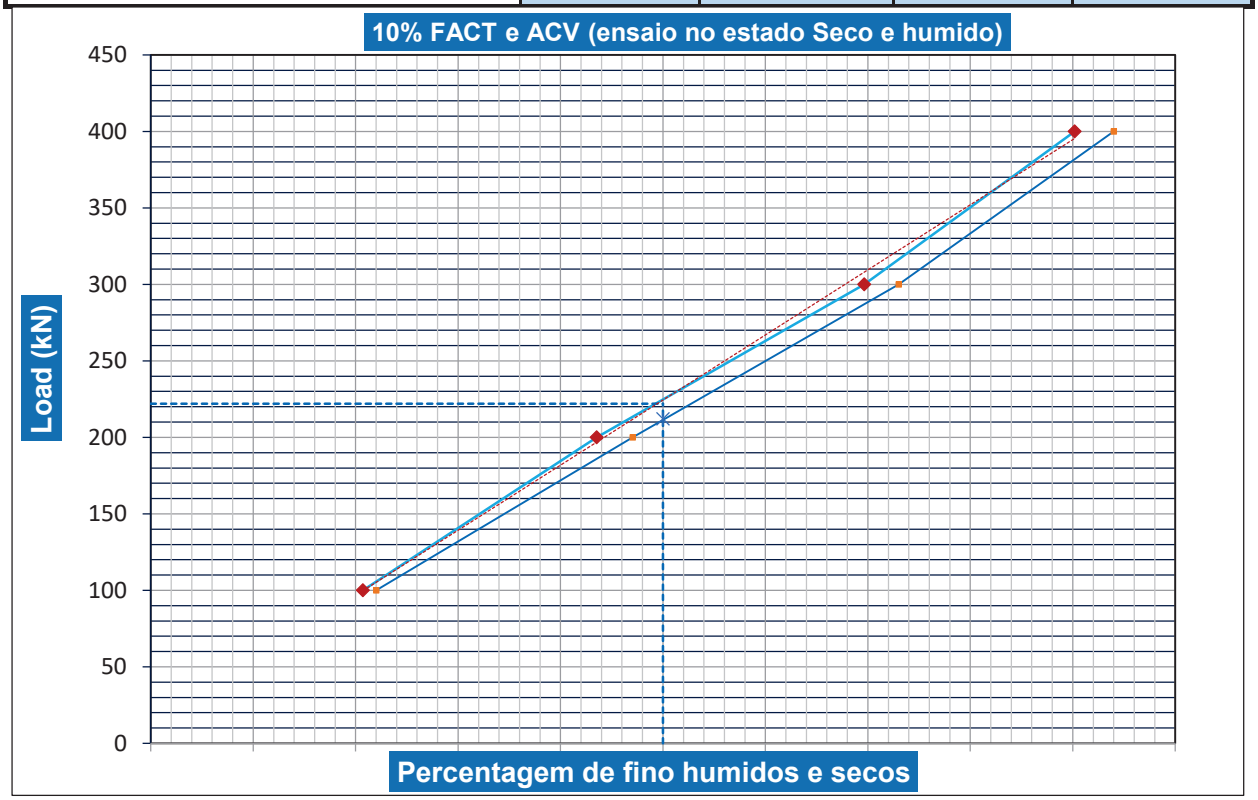
CONSULT LAB ENGENHARIA & GEOTECNIA, LDA	QGMI
	REABILITAÇÃO DA ESTRADA NACIONAL EN 250/190/EC 385 e 284 DO TROÇO LUAU-CAZOMBA-LUMBALA
	CENTRO TECNOLOGICO DA CONSULTLAB

Determination of ACV & 10% FACT for Coarse Aggregate (Dry Test)

TMH-1 (Method B-1 and B-2)

Ensaiado por:	**Eng Paulo Baptista**	**Inspecionado**	**Engª Paulo Baptista**
Data do ensaio	**07/09/2022**	**Amostras:**	**053/2022**
Localiza. da AM	**PEDREIRA NO ANTIGO ESTALEIRO-CAZOMBO**	**Tipo de Material**	**FRAGMENTOS DE ROCHA**
Descrição da AM	**Rocha Granitica - para execução de Betão, BBUQ e ABGE**		

Maxíma força aplicada (kN)	100	200	300	400
Massa da amostra inicial (g)	3610,1	3588,4	3579,5	3604,5
Massa do material passado no 2.36 (g)	149,5	312,5	498,5	650,2
Percentagem de finos secos (%)	4,1	8,7	13,9	18,0
Percentagem de finos huimidos (%)	4,4	9,41	14,6	18,8



Condição da amostra	Seca	Humida
10% FACT valor em (kN)	222	212
ACV valor em (%)	18,0	18,8

Observação: Índice de smagamento atende com o preconizado na SATCC

Ensaiou:	Paulo Baptista	Pelo Engº.	
Data:	07/06/2022	Data	

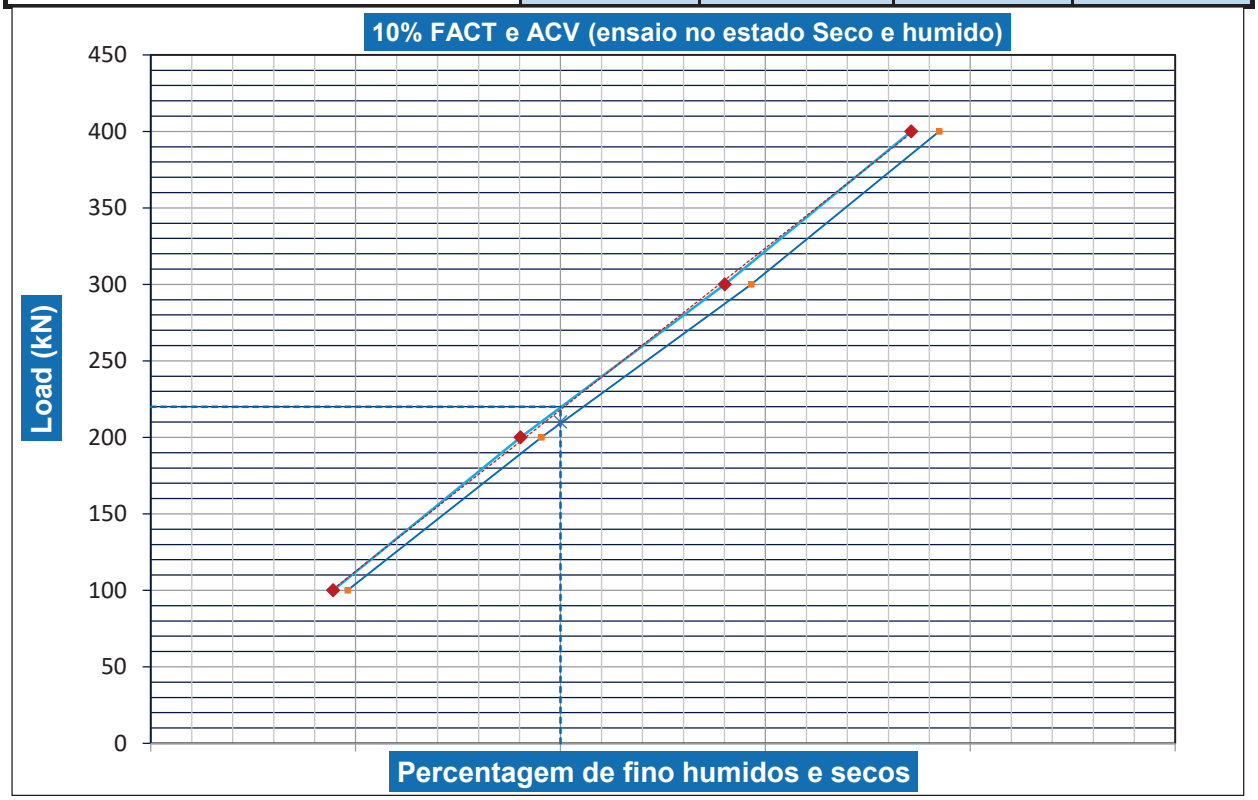
CONSULT LAB ENGENHARIA & GEOTECNIA, LDA	QGMI
	REABILITAÇÃO DA ESTRADA NACIONAL EN 250/190/EC 385 e 284 DO TROÇO LUAU-CAZOMBA-LUMBALA
	CENTRO TECNOLOGICO DA CONSULTLAB

Determination of ACV & 10% FACT for Coarse Aggregate (Dry Test)

TMH-1 (Method B-1 and B-2)

Ensaiado por:	**Eng Paulo Baptista**	**Inspecionado**	**Engª Paulo Baptista**
Data do ensaio	**07/09/2022**	**Amostras:**	**052/2022**
Localiza. da AM	**PEDREIRA KM - 11+900**	**Tipo de Material**	**FRAGMENTOS DE ROCHA**
Descrição da AM	**Rocha Granitica - para execução de Betão, BBUQ e ABGE**		

Maxíma força aplicada (kN)	100	200	300	400
Massa da amostra inicial (g)	3570,4	3601,0	3587,5	3604,5
Massa do material passado no 2.36 (g)	158,9	325,0	502,5	668,9
Percentagem de finos secos (%)	4,5	9,0	14,0	18,6
Percentagem de finos huimidos (%)	4,8	9,53	14,65	19,24



Condição da amostra	Seca	Humida
10% FACT valor em (kN)	220	210
ACV valor em (%)	18,6	19,24

Observação: Índice de smagamento atende com o preconizado na SATCC

Ensaiou:	Paulo Baptista	Pelo Engº.	
Data:	07/06/2022	Data	

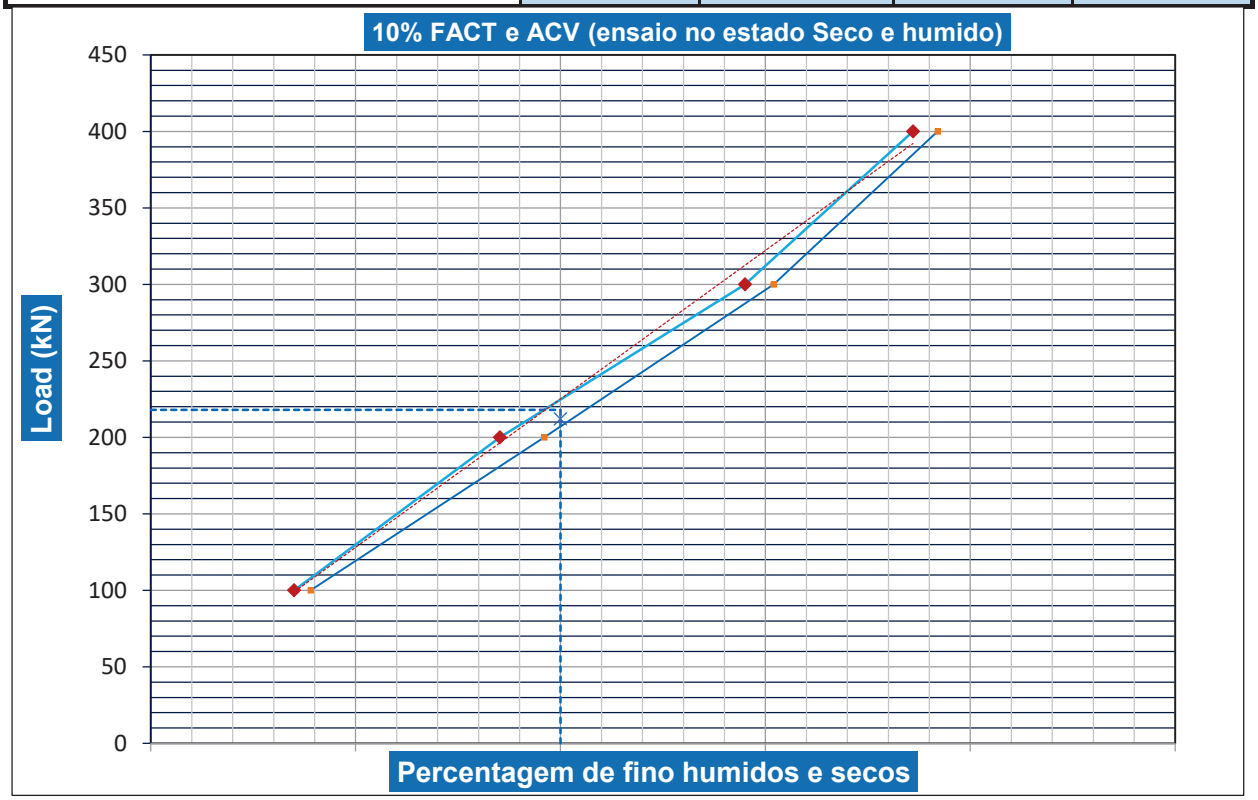
CONSULT LAB ENGENHARIA & GEOTECNIA, LDA	QGMI
	REABILITAÇÃO DA ESTRADA NACIONAL EN 250/190/EC 385 e 284 DO TROÇO LUAU-CAZOMBA-LUMBALA
	CENTRO TECNOLOGICO DA CONSULTLAB

Determination of ACV & 10% FACT for Coarse Aggregate (Dry Test)

TMH-1 (Method B-1 and B-2)

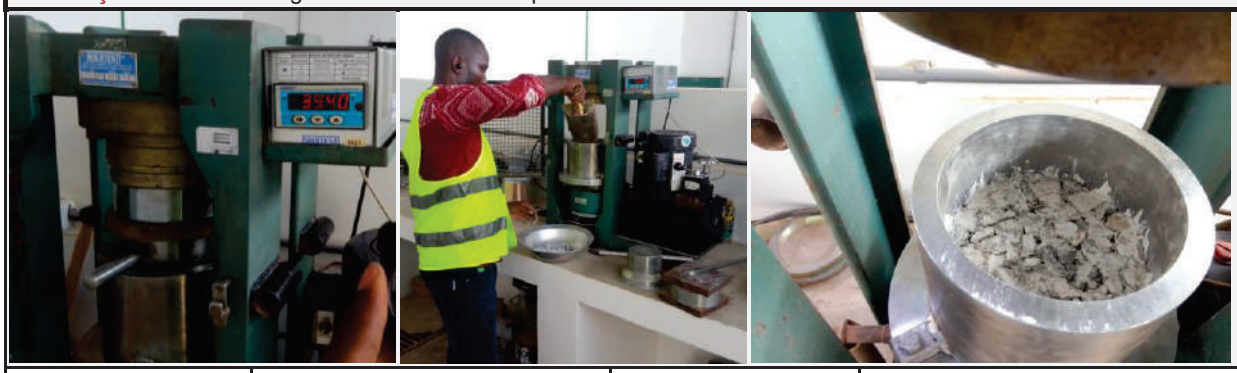
Ensaiado por:	**Eng Paulo Baptista**	**Inspecionado**	**Engª Paulo Baptista**
Data do ensaio	**06/09/2022**	**Amostras:**	**051/2022**
Localiza. da AM	**PEDREIRA KM - 27+450**	**Tipo de Material**	**FRAGMENTOS DE ROCHA**
Descrição da AM	**Rocha Granitica - para execução de Betão, BBUQ e ABGE**		

Maxíma força aplicada (kN)	100	200	300	400
Massa da amostra inicial (g)	3560,0	3605,0	3642,0	3654,5
Massa do material passado no 2.36 (g)	156,2	350,0	562,0	765,0
Percentagem de finos secos (%)	3,5	8,5	14,5	18,6
Percentagem de finos huimidos (%)	3,9	9,6	15,2	19,2



Condição da amostra	Seca	Humida
10% FACT valor em (kN)	218	212
ACV valor em (%)	18,6	19,2

Observação: Índice de smagamento atende com o preconizado na SATCC



Ensaiou:	Paulo Baptista	Pelo Engº.	
Data:	06/06/2022	Data	

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