UNION OF THE COMOROS

Unity - Solidarity - Development

MINISTRY OF AGRICULTURE, FISHERIES AND ENVIRONMENT

DIRECTORATE GENERAL OF ENVIRONMENT AND FORESTRY

(GDEF)

PROJECT "ENSURING A CLIMATE CHANGE RESILIENT WATER SUPPLY IN THE COMOROS

DRILLING OF BOREHOLES IN THE PROJECT AREAS IN NGAZIDJA

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

June 2022

INTRODUCTION

1.1. General context of the study project

Comoros has received Green Climate Fund (GCF) funding of more than $41.9 million for the "Ensuring Climate Resilient Water Supply in the Comoros Islands" project. The main objective of the project is to strengthen the resilience of drinking and irrigation water to climate change risks for 15 of the most vulnerable areas of the Union of Comoros.

Specifically, the project focuses on: creating a paradigm shift in water governance by integrating climate risk reduction into water sector legislation, institutional arrangements, planning, and budgeting; understanding and adapting to climate risks to the country's fragile water resources and weak water management systems using watershed protection and rehabilitation coupled with hydrological monitoring and forecasting ; integrating climate risk reduction into the design of water supply systems; developing drinking water supply and irrigation infrastructure to ensure access to drinking water for 450,000 people (60% of the Comorian population by 2042) and including the operation and management of multiple water sources.

Fifteen target areas on the three islands, comprising 103 villages, were selected because of their vulnerability to climate change and their good hydrogeological and hydraulic potential for water storage and catchment, distributed as follows: 6 areas on Grande-Comores; 7 areas on Anjouan; and 2 areas on Moheli Island

The project was reviewed under the UNDP Social and Environmental Standards procedure and was classified as a moderate risk project with 10 risks identified, of which seven were rated moderate and three were rated low.

During the design phase of the project, the sites for the installation of the infrastructure were not yet identified, an Environmental and Social Management Framework (ESMF) was prepared in an attempt to outline the possible impacts and the types of mitigation measures that might be required during the implementation of the project.

The ESMF states in its executive summary that environmental and social management plans (ESMPs) could be prepared if deemed appropriate. These ESMPs also satisfy the requirements of the AIF in its clause 10.2 (j), which states that: "Prior to commencing any construction work or activity for the implementation of the project, the accredited entity shall submit the detailed environmental and social management plan relating to the relevant construction work or activity to be carried out, in a form and substance satisfactory to the VCF Secretariat.

The ESMP is a corollary of the ESMF and addresses aspects related to "groundwater drilling in Ngazidja", related to sub-activity 3.1 of component 3 of the project.

In order to ensure correlation between the ESMF and the ESMP, the impacts identified in the ESMF in relation to the work on the six groundwater wells in Ngazidja, as well as the

management measures and environmental and social monitoring and follow-up, have been integrated into this ESMP development process.

This ESMP is aligned with the stakeholder engagement plan, as well as the project's gender action plan, ensuring that beneficiary communities, including women, are involved in this phase of project implementation

It is consistent with good practice and in line with the UNDP SES; to this end, it has attempted to identify additional risks and impacts that were not identified in the ESMF at the time of project design, confirm those that were identified, and propose possible mitigation measures.

In its impact identification methodology, the ESMP highlighted the impact-causing activity and the impact receptors (natural and human) during the different phases of the project (pre-construction, construction and operation). This was done in order to have all possible management measures in place to allow for the proper implementation of the activities.

It should be noted that some of the drilling activities were undertaken before the ESMP was validated by the GCF. Currently, all work is suspended. Their resumption will be conditional on the validation of this ESMP by the GCF.

To this end, in the process of identifying impacts, management measures, and follow-up and monitoring, the ESMP will reflect the actual situation of the activities already undertaken.

The drilling work covers for each site:

- Development of access roads;
- The installation of the life base ;
- Installation of the drilling platform;
- The drilling itself

The sites for the installation of the boreholes were determined on the basis of a geophysical prospection study conducted in the 6 intervention zones of the project in Ngazidja.

This study identified 9 potential drilling sites for the exploitation of groundwater, for the supply of drinking water to the beneficiary populations.

Of the 09 drilling sites identified (see Table 1), the selection criteria such as the choice of sites in relation to the accessibility of the resource (presence of an exploitable water table), the accessibility of the drilling sites (access roads), the location of the site and its accessibility in relation to the installation of the piping for the drinking water supply network, made it possible to choose the 06 sites that were the subject of an international call for tenders (see Table 2). The duration of the work is estimated at 11 months.

Within the framework of the project, all the sites for the installation of infrastructure were donated by the various communes. Indeed, in the Comorian context, land is either privately owned (inheritance/purchase) or, for the most part, owned by the communes. In the latter case, the land is used for village or community development projects. It is in this context that the communes have made available to the project all the sites for the installation of the planned infrastructures.

The use of these lands has not resulted in temporary or permanent economic displacement or restricted access to resources.

Each borehole requires a total area of 600 m^2 which covers the immediate and close safety perimeters.

Regarding the access tracks to the sites, there was an existing one (pedestrian tracks). The project proceeded to the development of these tracks. The work undertaken consisted in rearranging and widening the existing. The agreement in principle was given by the landowners, validated by the local authorities. This agreement is based on the layout of the tracks by limiting them to the boundaries between two parcels.

In this phase of the project implementation, the activities those were undertaken before the suspension of the works concerned:

- The development of access roads for the transportation of equipment and materials to the drilling sites;
- The installation of the base camp in the Mkazi site;
- The installation of the drilling platform in the Mkazi site
- The start of the actual drilling at the Mkazi site

1.2. OBJECTIVES OF THIS REPORT

This report constitutes the Environmental and Social Management Plan for the drilling program of the Securing Climate Resilient Water Supply in Comoros Project. This project, supported by UNDP as an accredited Green Climate Fund (GCF) entity, was reviewed under UNDP's 2015 Environmental and Social Standards procedure and was assessed as a moderate risk project.

The main objective of this ESMP is to integrate during this phase of the Project's implementation, in addition to the impacts identified in the ESMF, the specific considerations of the natural and human environment in order to allow the realization of the project while ensuring the protection of its components. The scope of this study, as defined in the terms of reference, covers the identification and analysis of environmental impacts, the identification of management measures to reduce environmental risks, the implementation of follow-up and monitoring measures, as well as the improvement of positive impacts, in order to allow the proper implementation of the project.

1.3. Approach to developing ESMP

The approach adopted in the conduct of this ESMP consisted of the exploitation of existing documentation, particularly the CGES, consultation with resource persons and local populations, field observations and surveys, and finally, the analysis of the data collected.

The literature review and field investigation did not reveal a situation that is different from one site to another. To this end, a single environmental and social management plan will be developed to cover all six drilling sites in Ngazidja.

Data processing and analysis

The exploitation and analysis of the data was based on the review of project documents (CGES, SESP and stakeholder engagement plan and the gender action plan) and via the Internet. It allowed for the collection and synthesis of:

- Data on the legislative and institutional framework;
- Biophysical and human environment data;
- Socio-economic data from the project's area of influence;
- Data on the socio-economic impacts of the project

Organization of** public **consultations

Consultation meetings were held in the communes covering the project's intervention zones, as well as interviews with resource persons (village chiefs, mayors, managers, etc.) to gather their opinions on the project.

Field Observations and Investigations:

Field missions took place at each site planned for drilling. These missions allowed us to diagnose the current state of the sites and to analyze the main socio-environmental issues.

The missions and field investigations have not identified any sensitive areas or protected areas where the project will intervene.

Analysis of collected data:

Once the documentation was analyzed and the field observations were made, the information collected was analyzed in order to :

- Insert the project in the political, legislative and institutional framework;
- Describe the sites and activities to be performed;
- Identify the environmental and social impacts likely to be generated by the project activities;

Propose measures to manage potential negative impacts, and propose measures to enhance positive impacts;

- Develop a follow-up and monitoring plan for identified potential negative impacts.

1.3.1. Characterization of the biophysical environment

The ESMP contains data on aspects of the biophysical environment.

The description of the biophysical environment will allow the project activities to be properly situated in their natural environment so that effective management measures can be put in place to deal with any potential negative impacts.

1.3.2. Characterization of the socio-economic environment

The ESMP also contains data on the socio-economic aspects of the areas identified for drilling activities. The characterization of the human and economic environment is carried out in such a way as to provide the necessary data to fully assess its degree of impairment and its capacity to cope with the positive and negative impacts of the activities.

2 INSTITUTIONAL AND LEGAL FRAMEWORK

This chapter describes the institutional and legal framework applicable in Comoros in the context of drilling for groundwater exploitation.

2.1. Overview of Institutional Arrangements for the ESMP

This ESMP is technically validated by the project implementation stakeholders and by the Technical Committee for the Evaluation of Environmental and Social Impact Studies at the national level. The Directorate General of Environment and Forestry (DGEF) will be responsible for overseeing the implementation of the ESMP. UNDP will obtain the endorsement of the DGEF and ensure that the ESMP is properly implemented.

In the event of non-compliance with the measures identified in this ESMP, the Project Implementation Team (PIT) will ensure that timely corrective action is taken by the contractor.

Other stakeholders that may play an important role in the implementation of the ESMP include

- **The General Directorate of Energy, Mines and Water (DGEME):** The DGEME is the main national institution responsible for sovereign missions in the water sector. In this sense, the project must ensure that it has the necessary information for better project implementation and that environmental protection requirements coincide with project activities.
- **The communes:** Under the law on the Water Code in the Union of the Comoros, the project management of the public drinking water supply and sanitation service is delegated to the communes (local authorities). In this case, the municipalities are responsible for the direct or indirect management of their assets and services. They are also in charge of environmental preservation and sanitation and monitor projects in their district.
- **The Ministry in charge of Health**: it can intervene in the missions of sensitization and popularization of the population in social and health matters;
- **The Labor and Social Laws Inspectorate** will be responsible for (i) ensuring the enforcement of laws, regulations and collective agreements relating to working conditions and the protection of workers in the exercise of their profession, in particular those relating to working hours, wages, safety, health and welfare, employment of children and young people, and other related matters; and (ii) providing information, recommendations and advice to employers and workers on how to comply with the legal provisions Under the project, the Labor and Legal Inspectorate may conduct inspections throughout the construction period and will intervene in case of disputes.

2.2. Legal and legislative framework of the project

The legal framework of the Union of the Comoros consists of national legislation (Constitution, laws, decrees, ordinances) and international and regional conventions ratified by the Union of the Comoros. This ESMP for the drilling program has been prepared in

accordance with the legislation in force. The following paragraphs present the main legal and regulatory texts applicable to the project.

2.2.1. National legislation

- **The Constitution of the Union of the Comoros**: The Comorian State has embarked on a new policy of environmental protection and conservation, defined by the Constitution of 23 December 2001, revised in 2009 and in 2013. The legal foundations of the environmental policy are found in this Constitution, which proclaims in its preamble the right of the Comorian people to a healthy environment and the duty of all to safeguard it. It also requires the state to respect international agreements ratified by the country, including those relating to children's and women's rights. Under the constitution, the tasks of the state include "improving the quality of life of the Comorian people and protecting the landscape, nature, natural resources and the environment, as well as the historical, cultural and artistic heritage of the Nation" (art. 8).
- **The Framework Law on the Environment (Law No. 94-018 of June 22, 1994,** amended by Law No. 95-007 of June 19, 1995) governs all activities relating to the sustainable management and conservation of biological diversity resources in terrestrial, coastal and marine environments. It sets out the general principles that must inspire and guide the regulation of activities likely to affect the environment and has three main objectives:
    - To preserve the diversity and integrity of the environment of the Comoros, which is particularly vulnerable because of its insularity,
    - To create the conditions for a sustainable use of natural resources, in terms of quality and quantity, for present and future generations,
    - To ensure an environmentally sound and balanced living environment for all citizens.

In order to achieve these objectives, the framework law requires that any public or private investment project likely to affect the environment be subject to an environmental and social impact assessment (ESIA) (section 3, articles 11 to 14).

For the project, an Environmental and Social Management Framework (ESMF) is developed at the project design stage, as the infrastructure installation sites have not yet been identified. During this phase of project implementation, specific environmental and social management plans for each type of subproject are developed to complement the ESMF. The ESMF, like the ESMPs, has been technically validated by the project implementation stakeholders and by the national committee for the validation of environmental and social impact studies.

This framework law, which is currently being revised, is an opportunity to integrate other environmental assessment and monitoring tools.

Sections 31 to 36 of the framework law aim to protect the marine environment. Thus, the removal of material from the coastline is prohibited, as well as any discharge into marine waters of any substance likely to affect water quality, destroy the fauna and flora of the marine

environment, and the aesthetic and tourist value of the sea and the coastline.

- **Law N°20-036/UA of 28 December 2020,** on the Water and Sanitation Code in the Union of the Comoros. It defines the principles, rules, procedures and institutions for the planning, use, protection and development of water resources and the environment.

  The management of water resources must comply with the provisions of this law.

- **Decree n° 01/52/CE on the content of the ESIA**: this decree, taken in application of article 14 of the aforementioned framework law n° 94-018 of June 22, 1994, as amended, on the environment, aims to regulate the methods of realization and presentation of impact studies, as well as the methods of their examination by the administration and of information of the public.

- **Forestry legislation**
  - Law n°88-006 of July 12, 1988 relating to the legal regime of reforestation, reforestation and forestry development Date of the text: July 12, 1988
  - Decree n° 55-582 relating to the protection of forests in African territories under the authority of the Minister of Overseas France.
  - Ordinance No. 66-617 regulating users' rights, dated May 11, 1966.
  - Ordinance No. 66-398/PROD implementing Deliberation No. 65-19 of December 14, 1965, regulating land clearing and vegetation fires.
  - Order of August 5, 1932 regulating the exploitation of mangrove stands.
  - Order of October 21, 1931 regulating the exploitation of sandalwood.

  Overall, this forestry legislation establishes rules for the protection, management and exploitation of all forests subject to the forestry regime, namely
  - Natural forests such as integral nature reserves, special reserves, national parks, classified forests, state forests and forest reserves,
  - Woods, forests and woodlands belonging to a forestry group created with the aim of carrying out a land policy in coastal areas to safeguard the coastal zone, respect the natural sites and the ecological balance.

  All clearing operations required on the construction sites (opening of access roads, construction of living quarters, drilling platform and construction site) must comply with forestry legislation.

  Before the realization of work, the company must have in its possession, all the necessary permits.

- **Law No. 95-O13/A/F, on the Code of Public Health and Social Action:** this law includes, among other things, provisions on any other form of deterioration in the quality of the living environment due to factors such as air or water pollution, industrial waste and noise.

  This ESMP is developed to put in place management measures for the mitigation of impacts on the natural and human environment in order to allow for the proper implementation of the project and ensure its success.

- **Law n°84-108 on the Labour Code**

The law establishes the right to work, training and professional development for all and prohibits forced or compulsory labor (art. 2). It applies to workers and employers carrying out their professional activity in Comoros. Law No. 84-108 was amended by the Law of June 28, 2012, repealing, amending and supplementing certain provisions of Law No. 84-108/PR on the Labor Code.

The law specifies the rights and obligations of employers and workers with regard to: the employment contract (Title III), wages (Title IV), working conditions (Title V), working conditions of foreign workers (Title VI), health, safety and medical services (Title VII), enforcement agencies and means (Title VIII), labor disputes (Title IX), penalties (Title X) and transitional provisions (Title XI).

Throughout the implementation of the activities, the project must comply with the labor code.

- **Law No. 14-034/UA of December 22, 2014 on the** fight against child labor and trafficking complements the provisions of the Labor Code.
- **Law -N° 14-036/UA of December 22, 2014**, on the prevention and repression of violence against women: The purpose of this law is to combat all forms of violence against women and girls in the Union of Comoros.

  The project will have to comply with the provisions of this law , in particular by fighting against all forms of gender-based violence in its activities and those of its suppliers and providers.
- **Arrêté n° 31/01/MPE/CB of 14 May 2001** relative to the protection of species of wild fauna and flora in Comoros: This decree lists the provisions to be respected to ensure the protection of wild fauna and flora and provides a list of category 1 species, which are fully protected, and category 2 species, which are partially protected because of their endemism, rarity, or the threats of extinction that they face

  In this regard, the sites where the drilling work will be carried out do not harbor endemic or endangered species of flora or fauna. These sites are located on areas already transformed for agriculture.

2.2.2. International agreements, conventions and treaties

The Union of the Comoros has ratified various international conventions and treaties on environmental protection and social issues, reflecting its commitment to integrate the environment into development. The most relevant to this project are:

- The RAMSAR Convention on Wetlands of International Importance of 1971. Ratification by decree n°94 -007/AF of June 6, 1994
- The Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora of 1972). Ratification by decree n° 94 -005/AF of June 6, 1994
- United Nations Framework Convention on Climate Change (1992). Ratification by decree n°94 -010/AF of June 6, 1994
- Convention on Biological Diversity (June 5, 1992), Rio Earth Summit, ratified on August 30, 1994.

2.2.3. UNDP Social and Environmental Standards (2015)

The UNDP Guidance Note on Social and Environmental Assessment and Management defines the ESMP as a key outcome of the assessment process and consists of avoidance, mitigation, monitoring, and institutional measures - as well as the measures needed to implement these measures - to achieve the desired social and environmental sustainability outcomes. UNDP support for the project covered by this study means that the project must comply with the social and environmental standards (SES) of this international institution and must align with its general principles in the programming and design of the projects it supports. These standards are guidelines that must be taken into account in the environmental and social assessment of the activities to be undertaken by the project. Through these standards and principles, UNDP aims to:

- Strengthen the environmental and social benefits of programs and projects;
- Avoid negative impact on people and the environment;
- Minimize, mitigate and manage their negative impact where it cannot be avoided
- Strengthen the capacity of UNDP and its partners to manage environmental and social risks;
- Ensure full and effective stakeholder participation, including a mechanism for responding to complaints from those affected by a project.

The GES requires that all UNDP programs and projects promote environmental and social opportunities and benefits and ensure that negative environmental and social risks and impacts are avoided, minimized, mitigated and managed. They represent a commitment by UNDP to integrate environmental and social sustainability into its projects and programs to promote sustainable development.

The following UNDP 2015 GES principles are applicable to the project:

- Principle 1: Human rights.

In the area of human rights, UNDP will support the government in meeting their human rights obligations and empowering individuals and groups, particularly the most marginalized, to realize their rights.

- Principle 2: Gender equality and women's empowerment.

With respect to Principle 2, this ESMP has made provisions to ensure the participation of women in all stages of project implementation, including in the training program and in the monitoring and follow-up plan for risk and impact management and mitigation measures.

- Principle 3: Environmental sustainability.

For Principle 3, UNDP is committed to integrating environmental sustainability throughout the project cycle. Thus, environmental sustainability issues are considered and integrated into the concept, design of a project and this ESMP. UNDP's commitment to integrating environmental sustainability into this project is focused on meeting standards 1, 2, and 7 to promote sustainable development.

The following UNDP SES 2015 standards are applicable to the project:

- **Standard 1: Biodiversity conservation and sustainable natural resource management**

The applicability of this standard is established during the environmental and social review and categorization process. In areas with modified habitat, UNDP will ensure that measures in this ESMP are implemented to minimize impacts on natural resources, including the introduction of invasive plant species.

- **Standard 2: Climate Change and Disaster Risk**

Regarding standard 2, UNDP will assist the government in integrating the objectives of reducing emissions and resisting climate shocks in the implementation of this project. Thus, this ESMP will identify the mitigation and adaptation measures to be implemented.

- **Standard 3: Health, Safety and Working Conditions in the Community**

The Community Health and Safety Standard recognize that project activities, equipment, and infrastructure may increase community exposure to risks and impacts. Therefore, UNDP will assist the Government in implementing measures to avoid or minimize risks and impacts to community health and safety that may result from project activities. These measures are incorporated into this ESMP. The present project is likely to improve the supply of drinking water to the population. It is therefore directly aimed at improving the health, safety and working conditions of communities.

- **Standard 4: Cultural Heritage**

Based on field investigations, the project does not fall within any of the scope of this standard:

- The project is not likely to have an adverse impact on cultural heritage;
- It is not located on or near a cultural heritage site;
- It does not involve significant excavation, demolition, earth movement, flooding or other environmental changes;
- It will not use tangible or intangible forms of cultural heritage for commercial or other purposes.

- Standard 5: Removal and Relocation

UNDP projects will seek to avoid physical and economic displacement and mitigate the impact of displacement and its inherent risks where it cannot be avoided.

Within the framework of the project, all the sites for the installation of infrastructure were donated by the various communes. Indeed, in the Comorian context, land is either privately owned (inheritance/purchase) or, for the most part, owned by the communes. In the latter case, the land is used for village or community development projects. It is in this context that the communes have made available to the project all the sites for the installation of the planned infrastructures.

The use of these lands has not resulted in temporary or permanent economic displacement or restricted access to resources.

- **Standard 6: Aboriginal Peoples**

Standard 6 was not triggered because the project will not impact Aboriginal peoples

- **Standard 7: Pollution Prevention and Resource Efficiency**

Regarding Standard 7, UNDP will ensure that projects avoid the release of pollutants, and if they cannot be avoided, minimize and/or limit the intensity and mass flow of releases. This applies to the release of pollutants into the air, ensuring that pollution prevention and control technologies and practices consistent with international good practice are applied during the life cycle of the project.

3 PROJECT DESCRIPTION

3.1. Background and location of drilling areas

The "Ensuring Climate Resilient Water Supply in the Union of the Comoros" project involves the installation of six groundwater wells and three monitoring piezometers in its six intervention zones in Grande-Comore. These areas include Moroni-Itsandra, Ngongwe, Hambou, Mboikou, Oichili and Hamanvou. They were selected based on their vulnerability in terms of access to water. Figure 1 shows the geographic distribution of the six zones.

3.2. Geographic and administrative distribution of proposed drilling sites

The sites for the installation of groundwater exploitation boreholes were determined on the basis of a geophysical prospection study that was conducted in the 6 intervention zones of the project in Ngazidja. This study allowed for an analysis of the different perspectives for the determination of favorable sites for the implementation of exploitation drillings in the 6 project areas. The study identified a total of 09 potential drilling points for the exploitation of groundwater, of which 6 were initially planned (one drilling per zone) and were the subject of an international call for tenders. Each borehole in its insertion requires a surface of 600 m^2 to be able to establish a security perimeter (immediate and close perimeter).

The 3 additional boreholes could be used to reinforce the water needs of the populations beyond 2042, depending on the needs in the areas served.

The distribution of the nine (09) boreholes and their characteristics are illustrated in **Figure 1 and Table 1 below**.

Table 1: Location of proposed drilling points

N°	Zone	Number of potential sites	Code assigned to the Site	Locations	Location coordinates		Altitude (m)	Distance from the sea (m)
					X	Y		
1	Bambao - Itsandra	01	PFVZ-1	Mkazi	43°15'27.13 "E	11°43'38.05 "S	125	2 300
2	Ngongwe	01	PFVZ-2	Makorani	43°21'55.90 "E	11°51'2.93 "S	120	900
3	Hambou	01	PFVZ-3	Mdjoiezi	43°17'58.07 "E	11°50'06.19 "S	128	1 600
4	Mboikou	01	PFVZ-4	Chezani	43°23'52.05 "E	11°25'39.46 "S	137	1 800
5	Oichili	02	PFVZ-51	Koimbani	43°22'56.09 "E	11°38'1.52 "S	130	1 500
			PFVZ-52	Sima	43°22'53.13 "E	11°36'41.79 "S	120	1 000
6	Hamanvou	03	PFVZ-61	Hahaya	43°17'34.30 "E	11°31'48.25 "S	115	2 500
			PFVZ-62	Mbaleni	43°17'10.00 "E	11°33'25.51 "S	140	2 200
			PFVZ-63	Bibavou	43°16'52,33 "E	11°34'38,78" S	118	1 400

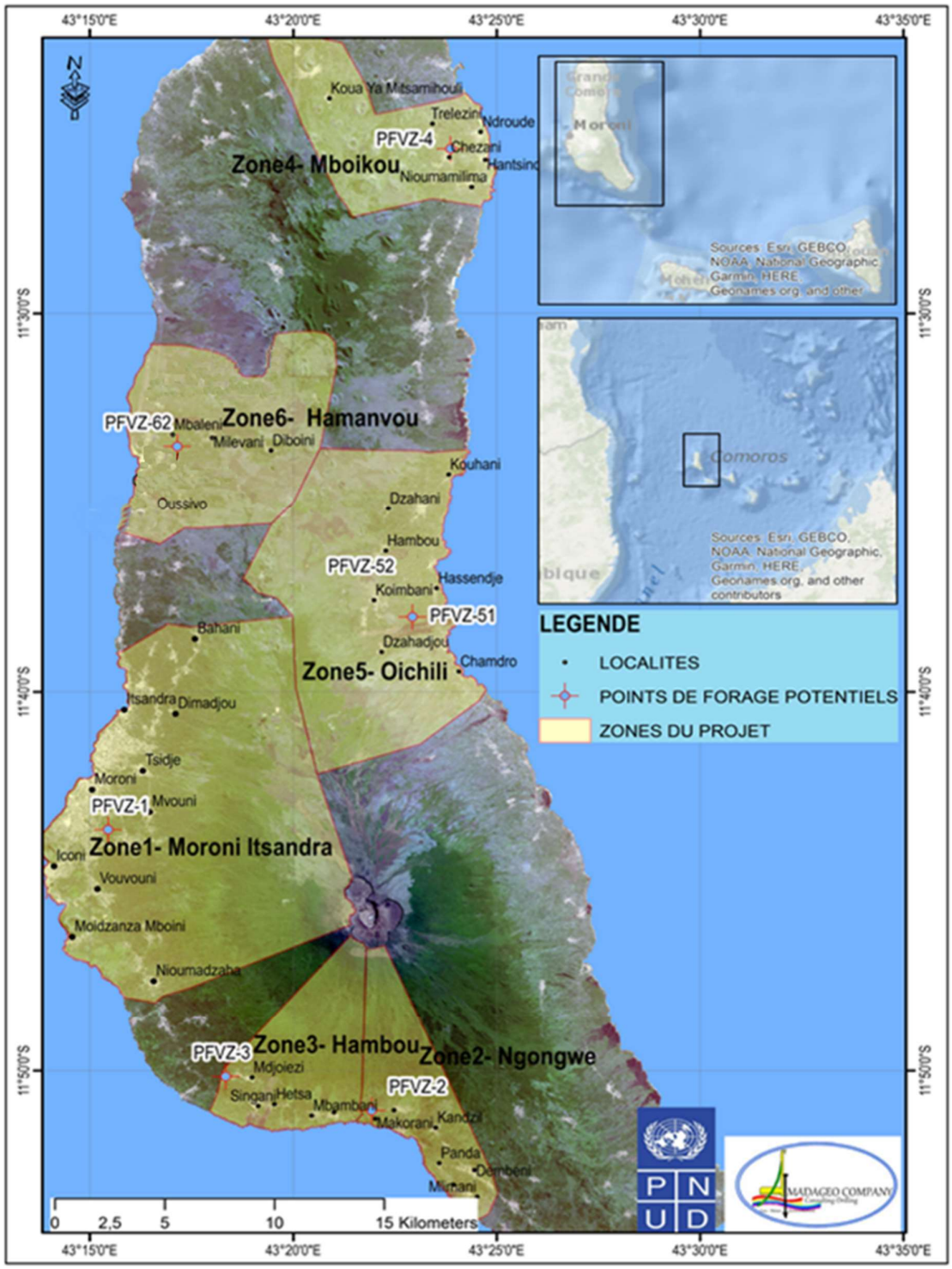

Figure 1: Location map of Six (06) study areas and distribution of Nine (09) drilling sites

Table 2 below presents the 6 drilling points selected for an international call for tenders. The criteria applied to select these sites are: the choice of sites in relation to the accessibility of the resource (presence of an exploitable water table), the accessibility of the drilling sites (access roads), the location of the site and the accessibility it presents in relation to the installation of the piping for the drinking water supply network.

Table 2: Presentation of the locations of the six groundwater wells

N°	Zone	Number of boreholes	Code assigned to the site	Locations	Location coordinates		Altitude (m)	Distance from the sea (m)
					X	Y		
1	Bambao - Itsandra	01	PFVZ-1	Mkazi	43°15'27.13 "E	11°43'38.05 "S	125	2 300
2	Ngongwe	01	PFVZ-2	Makorani	43°21'55.90 "E	11°51'2.93 "S	120	900
3	Hambou	01	PFVZ-3	Mdjoiezi	43°17'58.07 "E	11°50'06.19 "S	128	1 600
4	Mboikou	01	PFVZ-4	Chezani	43°23'52.05 "E	11°25'39.46 "S	137	1 800
5	Oichili	02	PFVZ-51	Koimbani	43°22'56.09 "E	11°38'1.52 "S	130	1 500
6	Hamanvou	01	PFVZ-62	Mbaleni	43°17'10.00 "E	11°33'25.51 "S	140	2 200

3.3. Technical components of the drilling project

As a reminder, the project includes the construction of six (06) groundwater wells in the six (06) areas mentioned above. To develop the activities, the project plans to implement the following components at each site (**Table 3**)

Table 3: Technical components of the drilling program

Component	Description
Component 1	**Access roads** (earthen) for the transportation of equipment and materials to the drilling sites. ***The company has already built all the access roads for the transport of equipment and materials to the drilling sites, with the exception of Chezani where the road already exists.*** Several variants were studied according to local parameters (distance from the sites, techniques to be used, environmental and social impacts, etc.) before validating the choice of trail routes. The clearing of brush was done manually. However, the construction of the trails required the use of a small backhoe.

Component	Description
Component 2	Drilling platform generally 20m * 20m in size. Generally, it is temporary, except at the location of the drilling head. The platform is intended for the implementation : - the drilling itself - service access (water supply), - of the sludge and decantation basin if necessary, - of the spoil storage area, - Storage area for drill rods and other equipment (compressors, pumping units, motors, etc.) ***The company has set up the drilling platform in site 1 at Mkazi***
Component 3	Temporary living base, easily movable (installation and demobilization) at the end of each campaign. It does not exceed 20m*10m. It is composed of : • Four (04) tents for staff accommodation • One (01) shelter for various preparations (kitchen, dining room, etc.). • Protective devices (fire extinguishers, etc.) • Hygiene preservation equipment (waste bins and a shower for the staff, ...). *The company has already proceeded with the installation of the life base in site 1 at Mkazi*

In general, the diagram **(Figure 2)** below shows the layout of a drilling rig with its components.

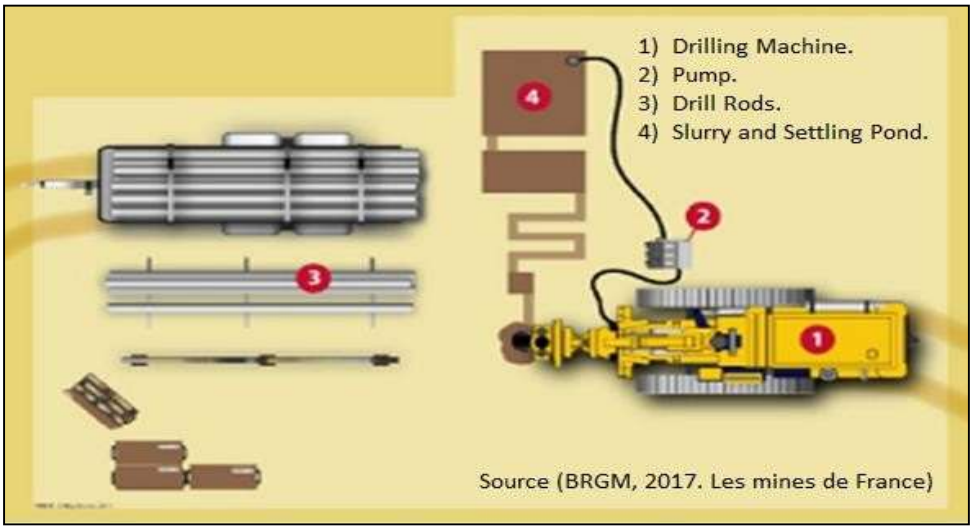

Figure 2: General layout of the drilling platform components

3.4. Activities to be carried out during the different phases

At the operational level, the project is divided into four phases. The first phase is related to the operational readiness. The second phase includes the fittings and various installations. The third is the actual drilling. At the end, the closure phase will focus on well development (protection) and site rehabilitation. The various activities are summarized in the table below**. (Table 4)**

Table 4: Presentation of activities according to the different phases

Project phases	Project components		
	Access path	**Temporary living base**	**Drilling site**
Preparatory phase. It is already carried out	This phase consisted of: - The request of all necessary authorizations from the concerned services; - Informing the local population of the work schedule; - Negotiation of the companies with the landowners for the installation of the living bases - Identification and validation (after study of the different variants) of the tracks to allow access to the drilling sites; - Mobilization of materials and equipment - Recruitment and training of local workers		
Installation phase	Construction of tracks for the transport of equipment and materials to the drilling sites. ***The company has already built all the access roads for the transport of equipment and materials to the drilling sites, with the exception of Chezani where the road already exists.***	- Re-profiling the terrain manually (20m*10m) - Set up camp components The company has already completed a base camp installation in Zone 1, in the village of Mkazi	Set up the drilling platform (20m * 20m) - Install drilling equipment (machine, pipes, pumps, compressor, etc.) - Develop the drilling and settling pond (if necessary) The company has already completed a drilling rig installation in Zone 1 in the village of Mkazi.
Drilling development phase	No	- Activities related to drilling (preparation, cooking, data processing) - Manage waste, wastewater	Prepare for drilling - To carry out the drilling itself and the monitoring piezometer - Manage any drilling waste or sludge and wastewater At the Mkazi site, the forging work itself had begun before the suspension of work.

Project phases	Project components		
	Access path	**Temporary living base**	**Drilling site**
Closing	Rehabilitation of sites	- Uninstall camp components - Demobilize components to the next drill site - Rehabilitate the premises	- Develop (protect) the wellhead - Delineate the protection perimeter - Rehabilitate sites (living bases, construction sites)

4. REFERENCE DATA

4.1. Project intervention areas

In Ngazidja, the project intervenes in 6 zones which include zone 1 to zone 6.

In 2020, the population for all of these areas was 144,122. This population is projected to reach 238,332 in 2042. Table 5 below shows the population changes for the beneficiary areas between 2020 and 2042.

Table N°5: Population of the beneficiary areas between 2020 and 2042

Zone	Villages concerned	Number of inhabitants 2018	Number of inhabitants 2042
Zone 1	Mvouni, Mkazi, Mavingouni, Tsidjé, Mirontsi, Salimani, Moroni Sahara, Maouéni, Sambambodoni, Dimadjou, Dzahani II, Ouellah, Sima, Dzahadjou, Bahani, Sambankouni, Vanadjou and Mhandani, VounaMbadani, Zipvandani, Batsa, Milembeni and Ntsoudjini.	**64 600**	**104 269**
Zone 2	Dembeni, Itsoudzou, Kandzile, Makorani, Mandzissani, Mboude, Mdjamkagnoi, Mindradou, Mlimani, Panda, Tsini Moichongo, Dima, Domoni, Dzoidjou, Famare, Ifoundihe Chadjou, Ifoundihe Chamboini, Ouzioini and Nkourani	**28 108**	**47 386**
Zone 3	Dzahadjou, Hetsa, Mbambani, Mdjoiezi, Singani	**10 290**	**17 347**
Zone 4	Bandamadji, Chezani, Hantsindzi, Madjeoueni, Ndroude, Nioumamilima, Sadani/Mavatseni and Trelezini	**13 830**	**23 316**
Zone 5	Songomani, Toiyfa and Ngaza, Boeni, Chamro, Chomoni, Dzahadjou, Irohe, Koimbani, Saadani, Sada, Samba Madi, Sima, Dzahani, Hambou, Hassendje, Itsinkoudi, Kouhani and Mtsamdu	**18 170**	**30 632**
Zone 6	Bangani, Bibavou, Boenindi, Diboini, Mbaleni, Mbambani, Milevani and Oussivo	**9 124**	**15 382**
Total		**144 122**	**238 332**

4.2. Description of the physical environment

4.2.1. Landmarks and landscapes

René De Maximy, in his book entitled "Archipelago of the Comoros, geographical study" specifies the orogenic conditions of the Comoros Islands. He emphasized the volcanic origin of the islands of the archipelago following the succession of different volcanic phases.

The Great Comoros is comparable to an elongated massif in a north-south direction. Its relief is marked by two large strombolian domes, of which on the one hand the Karthala which culminates at nearly 2 361 m of altitude and on the other hand the Massif de la Grille. In addition to these two massifs, small elevations of relief formed by successive flows at the level of small adventitious craters are observed in the northern part of the island.

In terms of landscape, the island is dominated by vegetation that differs according to the altitude.

In addition to the landforms, Grande Comore is marked by the presence of different geomorphological units **(Figure 3).** They are among others:

- The summit crater of Karthala which dominates the central-southern part of the island. This volcanic edifice is located at an altitude of 2 361 m.
- Small adventitious craters that are concentrated on a giant north-south ridge line. They are abundant especially on the northern part of the island on the side of Ouemani, Helendje, Koua, Ivembeni, Trelezini, They are often scattered following rectilinear orientations. A rather high concentration of craters also appears on the slopes of Karthala towards the southeast. Other craters, but rare, have formed on the west coast between Moroni and Moidzaza Mboini.
- The probable faults, the most important of which crosses the coast of Oichili Zone 5 in a north-south direction. The second fault is tangent to the Karthala Caldera in a north-south direction.
- Fissures are abundant especially in the northern area from Diboni to Bangoi Kouni. They seem to be on the paths of small eruptions connecting the small adventitious craters to each other. The ensemble forms a wide range. They converge towards the massif.
- Rocky cliffs composed of compact volcanic bombs on the surface and deep olive basalts. They are not numerous and are found on the slopes of the massifs at Helendje, Nkomioni, between Intsoundzou and Kandzile and between Maoueni and Mtsangadjou.

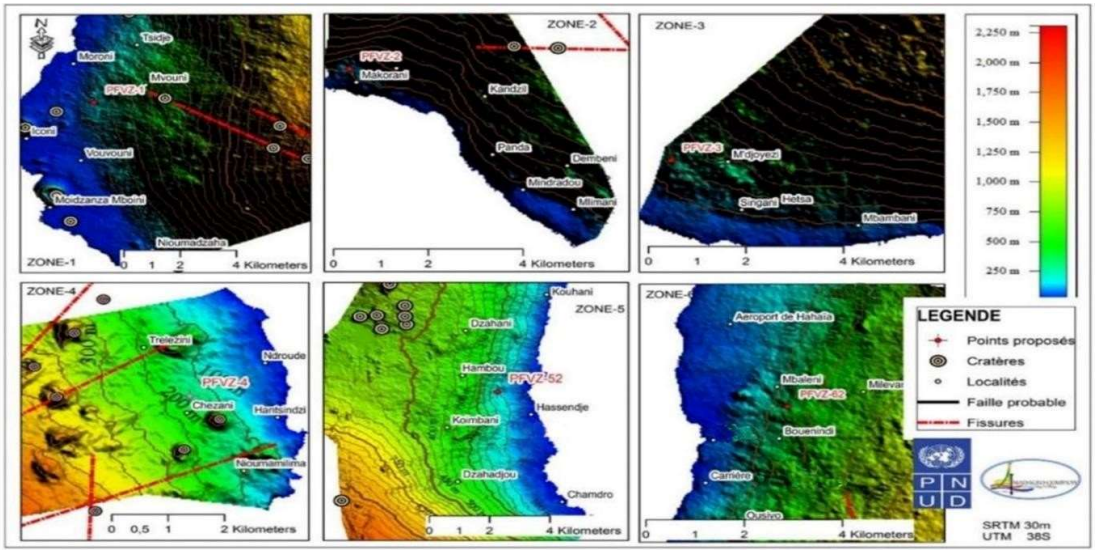

Figure 3: Map of morphological units in the six project areas

The proposed drill sites are generally located on the edges of the coastal plains and slopes of the Karthala and Grid massifs. Some are located on the eastern flank, but most are on the western and southern sides of Karthala. The distance of these areas from the sea varies from 900 m to 2,500 m to avoid brackish water.

The following is a description of the drill sites:

Proposed drilling site at Mkazi

Topographically, the site of the drilling platform in the Mkazi area and the project components is on flat ground at an altitude of 120m. The site is characterized by a flat slope from the top of Mkazi to the RN2 which runs west-east. The site is located in a future residential area.

Proposed drilling site in Makorani

The proposed drilling site in the Makorani area is located on the slope of a narrow valley covered by vegetation. This valley is the main slope of the western side of the Mlima Makorani range. The part where the drilling will be located is situated on an altitude of about 110m.

Proposed drilling site at Mdjoiezi

The drilling site in the M'djoeyzi area is at an altitude of 110m. It is located on the eastern slope of a steep valley that descends from the village of M'djoeyzi. This area is marked by an abundance of dry water flow lines.

Proposed Chezani Drill Site

The site is located on a flat terrain devoid of woody formations. This flat land is tributary to the upper slopes of the village of Chezani. The altitude at the site is 135m. The slope continues to descend with gentle slopes to the east.

Koimbani drilling site

The Koimbani drilling site is located on the northern slopes of Karthala at an altitude of 130m. It is located to the south-east of the town of Koimbani, on the recent outwash areas where the slopes soften towards the eastern shore.

Mbaleni drilling site

The site is located at 140m above sea level. The land is slightly sloping and covered with brush.

4.2.2. Water resource

Hydrology and surface water

This is because of the fact that, apart from the three lakes, Bangoikouni, Karthala and Hantsongoma, the territories of Grande-Comore are devoid of surface water systems. Despite the abundance of rainfall in many parts of the island during the rainy season, the permeability of the pozzolanic/volcanic soil and the internal structures of the volcanic rocks (fissured) cause a high infiltration. On the other hand, due to the local geomorphology, preferential flow lines are abundant in many places. But due to the high permeability, their beds are dry all year round. The figure below shows the spatial and geographical distribution of these preferential flow lines. In steeply sloping areas where flow lines are abundant, there may be instances of rapid torrential flow during periods of heavy rainfall. As a result, runoff flows quickly return to the lowest points of the road networks. It is quite possible that this water could arrive with a considerable concentration of sediment. The proposed drilling sites are also devoid of river systems. On the other hand, each is located in or near areas of preferential flow line crossings. **(Figure 4) .**

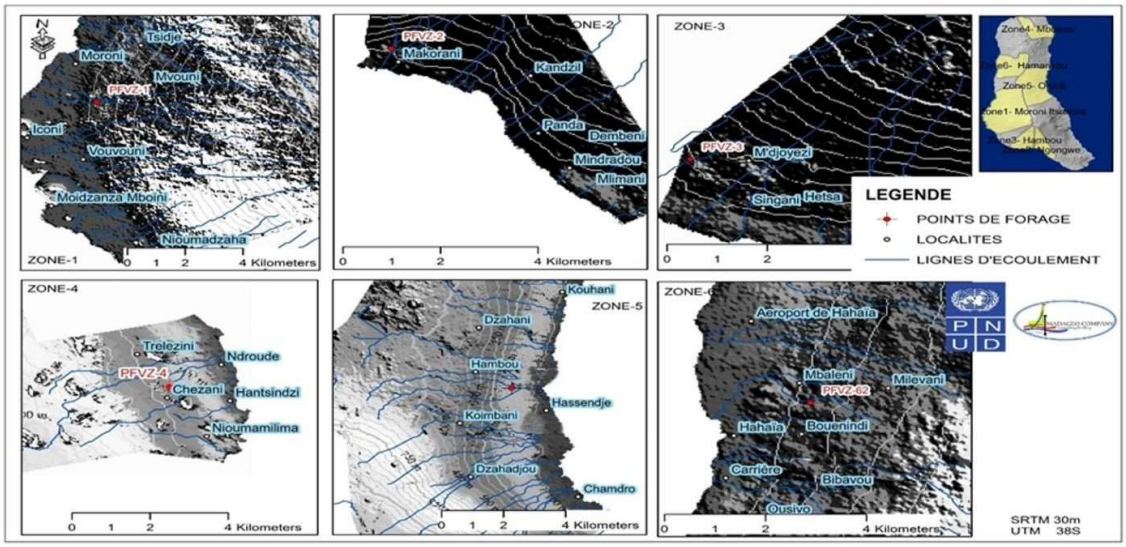

Figure 4: Distribution map of preferential surface flows

Hydrogeology and groundwater

In hydrogeological terms, generally speaking, two types of aquifers can be distinguished in the Great Comoros. These aquifers are:

- A perched or high altitude layer found in the clayey alteration layers of ancient basalt and in pyroclastic formations often containing clayey crusts, altered volcanic ash north of the Grille Massif and in the Mbadjini Massif (Cornelis L. L. and Said Hotman A, 1986 and Jean - louis l. and Sylvianes., February 2011). These are very low flow aquifers.
- A base layers those results from surface recharge. By the way, these saturated zones were formed on the salt wedge. These waters generally come from the surface due to the conditions of infiltration and rapid transfer of water through the interstices of the soils and cracks in the basaltic rocks.

The project areas are generally characterized by this second layer. Thus, depending on these permanent factors, groundwater storage depths differ from area to area. For the drill sites, these conditions are described below.

- For the Mkazi site, the water saturated zone is 86 to 135 m deep. The aquifer is characterized by a layer of weathered basalt rock or a thick layer of constant slag about 50 m thick. The roofs of the aquifer are composed of a compact basalt layer with cracks to recharge these aquifers.
- For the Makorani drilling site, the aquifer still appears as a permeable layer of volcanic unit. The storage conditions are fulfilled from a depth of 110m. The thickness of the layer reaches 25 m and more.
- For the Mdjoiezi site, the water table is at a depth of 127 to 139m. The storage layers are permeable with a thickness of about 12m. These layers probe loose or fissured volcanic nature (slag or altered or fissured basalt).
- At Chezani level, the subterranean layers are heterogeneous in terms of texture. They are marked by the superposition of permeable and impermeable layers. The aquifer layer is between 127m and 139m deep. These layers are characteristic of alteration zones or loose formations.
- At Koimbani, at the runoff site, the aquifer is located at a depth of approximately 127 m.

The aquifer consists of vacuolated basalt or slag or altered basalt layers about 15 m thick.

- In the vicinity of Mbaleni, on the eastern slope leaning towards Hahaïa, the saturated layers are found at a depth of more than 110m under the fractured roofs leaving the hydrogeological transfer of water in the base aquifer. As an estimate, the power of the aquifer can go up to 35m.

Groundwater resources are one of the sources of water supply in Grande Comore. It is true that each household builds rainwater storage tanks. However, the amount of water stored does

not guarantee a year's worth of water for the household. As a result, the population of the nine localities faces a water shortage of three (03) to five (05) months

4.2.3. Floors

In pedology, the soil of the Great Comoros is essentially volcanic. Moreover, a common point between the types of soils existing on the territory of Grande Comore is their porous or fissured structure. The latter favors a high permeability of the soil. Therefore, in most cases, they rarely retain rainwater.

Soil/lithological profiles of the soils at the drilling sites

For soil or lithological profiles for each drill site, see the summary tables for electrical and TDEM drilling (Feasibility Study of Drill Sites in Project Areas. Hydro-geological and geophysical surveys. The figure below is a generalized representation of the soil profiles in the study areas. **(Figure 5)**

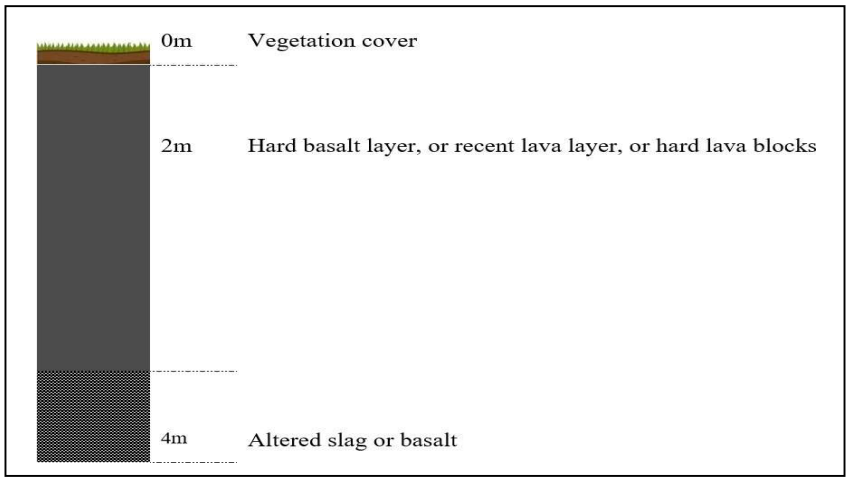

Figure 5: General soil profile to a depth of 4 m

Typology of soils in drilling sites

Pozzolan and basalt alteration soils

They occur very often in the form of pozzolans or in the form of soils of alteration of basalt. In both cases, the areas formed by these soils are favorable for cultivation unless the slopes are high. Most of the drill sites are dominated by these soil types, particularly Chezani and M'djoiezi (**Figure 6).**

Figure 6: Type of soil as pozzolan and basalt alteration

Lava blocks (slag) and recent lava

Other areas are also marked by the presence of recent lava blocks and lava. Generally, these soils are not suitable for cultivation. However, the population exploits the arable soils between the lava blocks or outside the lava to develop mainly shrub crops. In areas where these soils are dominant, agroforestry techniques are developed. **(Figure 7)**

Figure 7: Soil type with recent lava or lava blocks (Koimbani)

Soil sensitivity to erosion

The drilling sites are not located in erosion sensitive areas. These phenomena are more likely to occur in areas where the altitude is well over 140m.

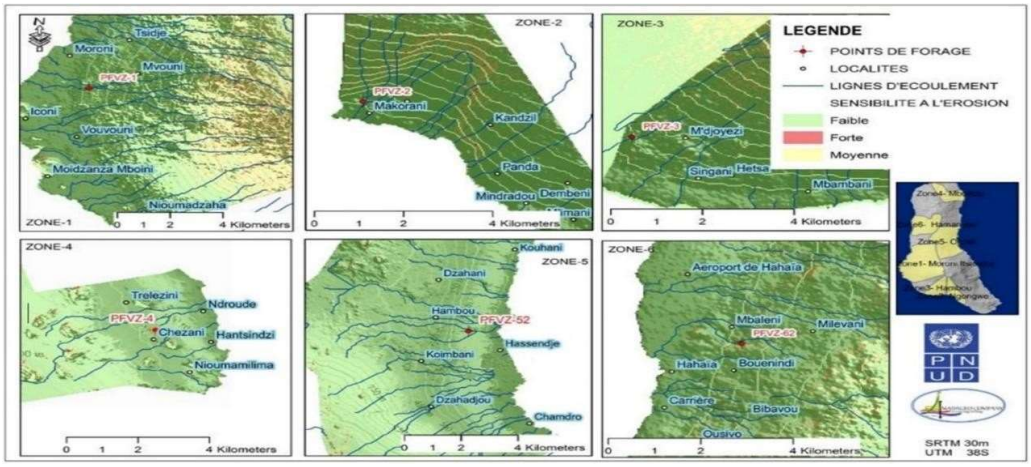

Figure 8: Erosion sensitivity map of drill sites and project areas

4.2.4. Climate

Variations in climatic factors within the island play a more important role in the supply and especially the recharge of aquifers. Grande Comore is subject to a tropical climate, marked by a great climatic variability and the existence of many microclimates, due in particular to the influence of the volcano. There are two main characteristic seasons:

- A hot season, which is also the rainy season, corresponding to the southern summer (November to April)
- And a "cool" season, from May to October, corresponding to the southern winter

The hot season (or rainy season), from mid-November to mid-April, is characterized by a humid heat, frequent thunderstorms and, especially in January and February, by some strongly disturbed episodes due to the presence of a tropical depression near the Archipelago. In the coastal zone, the average temperature is around 27°C, the maximums vary between 31 and 35°C and the minimums are around 23°C.

The cool season occurs from the beginning of June to the end of September. At low altitudes, average temperatures vary from 23 to 24°C. The maximum temperatures remain high, around 28°C, but the minimum temperatures are 4° to 5°C lower than in the warm season.

Wind

Monsoon winds from the North to the North-West called "kashkazi" blow weakly in general during the hottest month (January and February). From May to August (the coolest month), southeasterly trade winds called "kussi" which are locally oriented from the southwest come from the Mozambique Channel. Apart from the kussi and kashkazi, two other winds prevail on the island including, in July, August and September, the "matulay" and the "mnyombeni" from the Northeast in October and November. (Saïd A., 1998).

The average wind speed is significantly higher than in the warm season, with a large predominance of the trade winds blowing south or southwest. On the other hand, in the absence of cyclonic circulation, there are no strong winds.

Precipitation

In Grande Comore, the amount of rainfall or the amount of rain that falls is very important for the direct supply of fresh water to the population. Most people collect rainwater through artificial impluviums (roof, tarpaulin, etc.). The collected water is stored in tanks (cisterns). However, the storage capacity of rainwater in tanks is very limited. Generally, the stored water covers the needs of the population for a period of three to five months after the rainy season.

Average annual rainfall exceeds 1000mm on all islands. In Grande Comore, it varies from 1398mm to 5888mm. The following table and graph show the rainfall characteristics at the station located at the airport between 2013 and 2017. **(Table 6 and Figure 9)**

Table 6: Overall variation in rainfall between 2013 and 2017 at the Moroni meteorological station.

	Véro nique	Feb	Marc	Apr	May	June	Jul	Augu st	Seven .	Opo	Nove mber	Dec
2013	399.8	296.5	321.2	315.8	567.6	58.9	275.4	23	67.7	172.8	123.1	416.9
2014	316.9	333.8	348.3	349.3	89.2	40.2	260.5	21.6	94.4	19	274	89.2
2015	665.8	264.8	276.5	250.3	406.3	73.5	13.3	9.4	44.3	116.3	206.4	152.4
2016	975.1	401.4	117.7	291	208.1	653.2	43.3	65.6	34.6	62.1	27.8	206.2
2017	111.6	235.9	305.7	319.7	235	311.2	130.8	97.8	33	19.5	33	284.4
Average	**493.8**	**306.5**	**273.9**	**305.2**	**301.2**	**227.4**	**144.7**	**43.48**	**54.8**	**77.94**	**132.9**	**229.8**

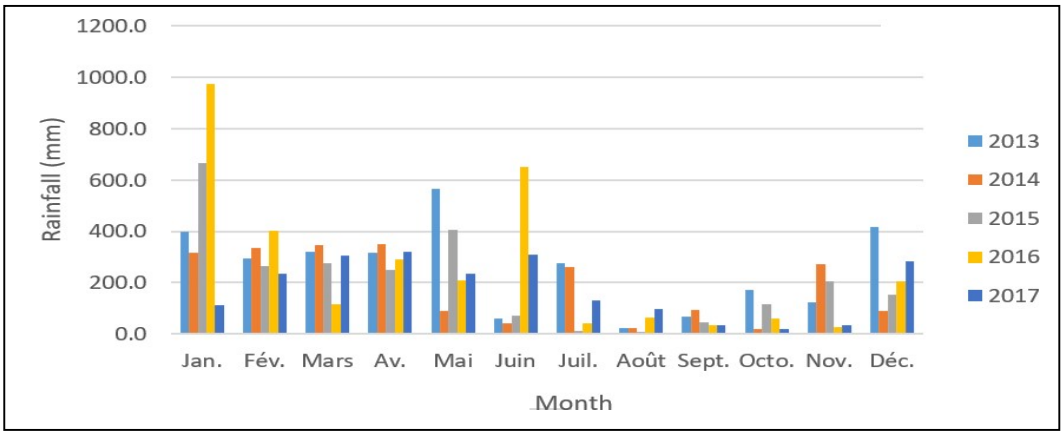

Figure 9: Graph of the monthly variation in rainfall between 2013 and 2017 at the Moroni climate station.

Temperature

In Comoros, during the austral summer, i.e. from November to April, the average temperature varies between 26°C and 28.64°C while during the austral winter, from April to May to October, the average temperature varies between 24.1°C and 27.6°C and is minimal (14°C and 15°C) on the highlands. For Grande Comore, there is little difference between the hottest and the coolest month (3°C to 4°C). The decrease in temperature as a function of altitude is of the

order of 0.6°C on average per 100 m. At the summit of Karthala (2361 m), the minimum temperature is 0°C and the maximum temperature can reach 35°C. Along the coast, the average monthly temperature varies from 24.10°C to 28.64°C. (**Table 7) (Figure 10)**

Table 7: Overall temperature variation between 2013 and 2017 at the Moroni climate station.

	Véronique	Feb	March	Apr	May	June	Jul	August	Seven.	Opo	November	Dec
2013	28.6	28.8	28.5	27.5	27	25.5	24.9	24.7	25.6	26.5	27.6	27.5
2014	28.5	27.4	28.5	27.4	27.4	26.5	25.4	25.3	25.6	27.9	28.1	29
2015	28.4	28.6	28.6	28.4	27.7	26.5	25.8	25.6	26.2	27.6	28	29.1
2016	29	28.7	29.8	29.1	27.4	25.5	24.9	25	25	26.7	28.7	28.8
2017	28.7	28.6	28.8	28.2	27.8	26.3	25.6	26.2	25.9	27.6	27.9	29
Average	**28.64**	**28.42**	**28.84**	**28.12**	**27.46**	**26.06**	**25.32**	**25.36**	**25.66**	**27.26**	**28.06**	**28.68**

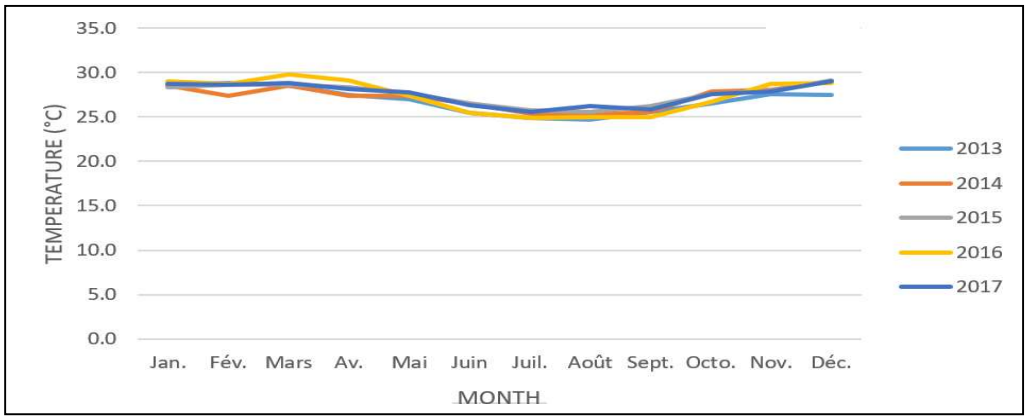

Figure 10: Graph of monthly temperature variation between 2013 and 2017 at the Moroni climate station.

4.2.5. Noise and vibration

The ambient noise level inside the drilling sites is relatively low. This is because these sites are far from all sources of noise pollution, such as heavy traffic, industry, market places, the port, etc. However, in some sites, the noise of cars driving on the roads can be heard

Based on the measurements made, the ambient noise level at the drilling sites can vary from 25 dB to 30 dB. These values may well increase due to the noise generated by the drill and motors during the work. However, the change is not observed at the village level, except at Chezani. Thus, for the village, the working hours (8h/d) will be scrupulously respected by the company. In addition, for workers exposed to noise, although it does not exceed the threshold of 85 dB (-80 dB) earplugs will be made available to them.

The impact of the drilling machine could increase vibrations at the site. However, they are not perceived at the village level. The figures below represent the spatial distribution of ambient noise in the project areas. They are obtained by interpolating the data measured in the field **(Figure 11)**

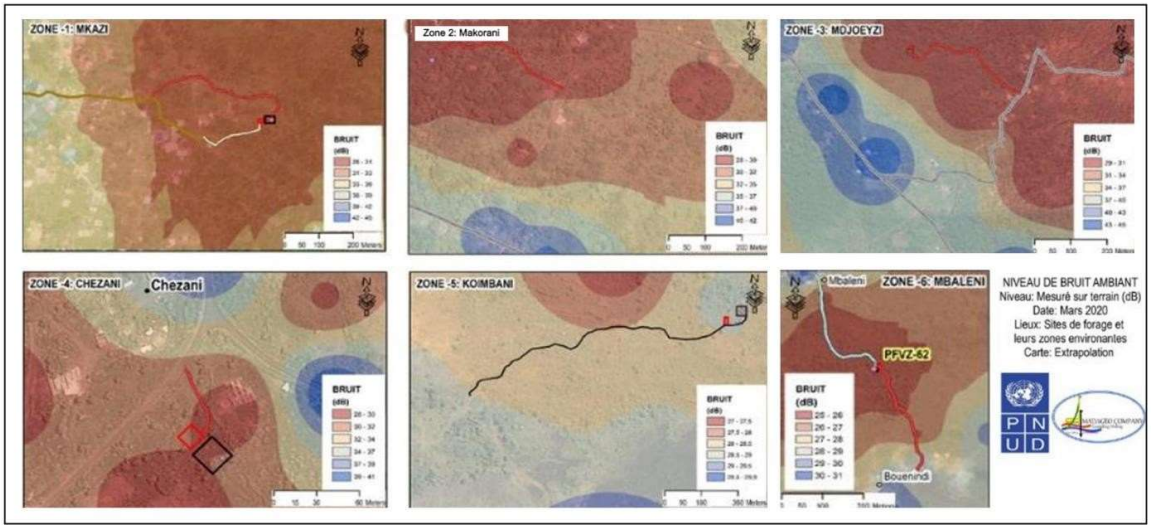

Figure 11: Ambient Noise Map at Project Components

4.3. DESCRIPTION OF THE BIOLOGICAL ENVIRONMENT

Following environmental studies at the sites that were the subject of geophysical surveys, the summary characteristics of the biological environment are given in the following paragraphs.

4.3.1. Wildlife

In Comoros, the terrestrial fauna is diversified and all major zoological groups are represented. There are currently 24 species of reptiles including 10 endemic ones, 98 species of birds including 35 endemic subspecies and 17 species of mammals including 2 endemic species. Among the species of global interest, mega chiropters (including the giant bat Livingstone) and lemurs (reference 4ème report on biodiversity).
These two species are not present in Grande Comores
The endemic terrestrial species are located in the Karthala Forest Park area.

Although endemic and partially protected species are found on the island of Grande-Comores (see Table 8 below) as indicated in the ESMF, the sites selected for the drilling operations do not harbor these protected species.

Table N°8 Endemicity of fauna in Ngazidja (ECDD, BCSF & Durrell 2014)

	Endemic to the island	Endemic to the Comoros	No Endemic	Total
Grande-Comore				
Birds	16	7	6	29
Reptiles	2	1	3	6
Butterflies	10	1	12	23

In order to determine the presence or absence of these species at the drilling sites, questions were asked to the local users (farmers). This was based on the lists of endemic species that are fully and partially protected (Annex 1 and 2). While some species could not be translated into Comorian, users were also asked to name and describe the species they usually see in their locality. All species cited were then compared to the list in Annex 1 and 2. None of these species were named or described by the users. This is due to the fact that these species are located high in the forest.

Figure 12 below shows the distribution of special status species in Grande-Comore.

The drilling sites are located in the coastal areas between 115 and 137m altitude (Table 1). The map of the location of endemic and threatened species in the ESMF (Figure 14 and 15) shows that these species are located at high altitude in the Karthala forest between 1200m and 2000m, far from the drilling sites. This confirms the results of the user survey regarding the presence or absence of these species.

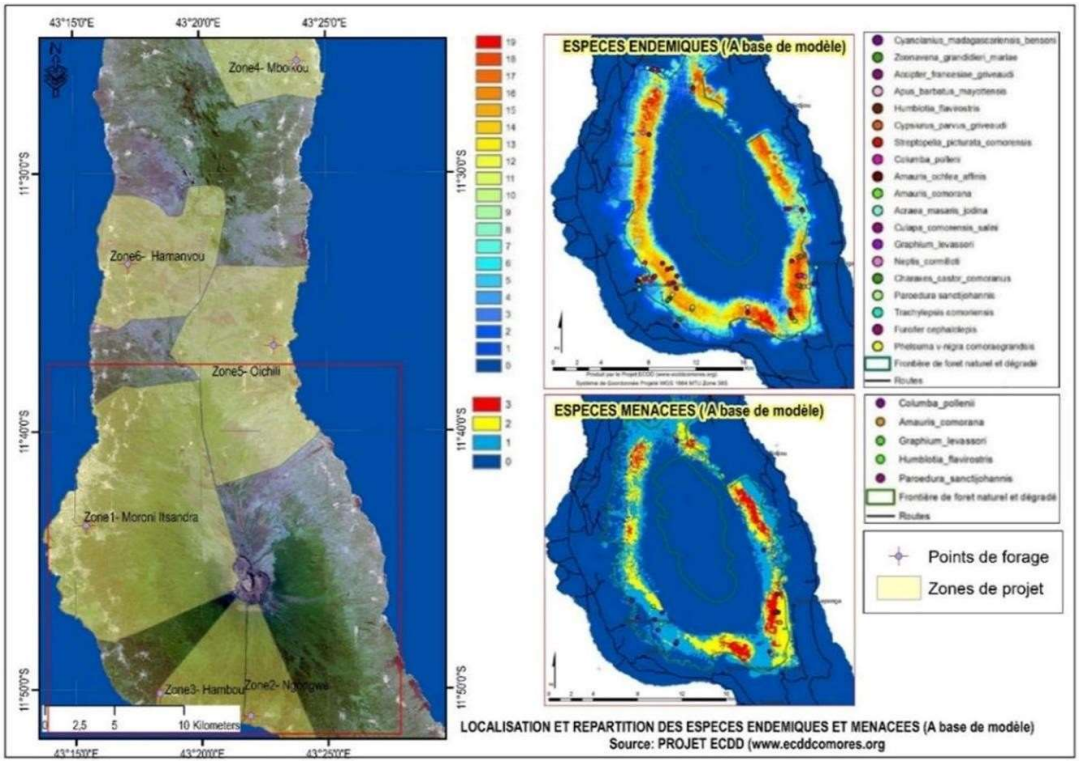

Figure 12: Distribution map of special status species in the territories of Grande-Comore

The few animal species observed in the vicinity of the drilling sites are livestock (a few individuals at the stake (goats and oxen)). These are intended for family festivities, particularly for the big wedding.
Table 9 below shows the species observed at each site.

Table N° 9 animal species observed in the vicinity of the drilling sites

Animal presence	Mkazi	Makorani	Mdjoiezi	Chezni	Koimbani	Mbaleni
Cabri	-	-	-	X	-	X
Cow	X	X	X	X	-	X

X=presence of animals

4.1.1. Flores and vegetation

The floristic formations observed are almost the same on all sites. Generally, they are characteristic of the altitude fringe where the boreholes will be located. In these areas of intervention of the project, generally speaking, three types of plant formations were encountered: degraded forest, agroforestry and cultivated areas, and savannah formations.

The vegetation formation encountered at each drilling site is described in Table 10 below. Figures 13 to 17 highlight the occupation of the sites.

Table 10: Vegetation formation at each drill site

Flora and vegetation	Mkazi	Makorani	Mdjoiezi	Chezani	Koimbani	Mbaleni
Plant formation at each site	The drilling site is occupied by shrubs and agroforestry species (mango, coconut jackfruit and some trees.	The drilling site is occupied by grass, shrubs and some agroforestry species (mango and coconut trees).	The drilling site is occupied by shrubs	The drilling site is occupied by grass and some shrubs	The site for the installation of the drilling, is occupied by shrubs.	The site for the installation of the well is occupied by grass, shrubs and coconut trees.

Figure n° 13 : Koimbani drilling site

Figure 14 : Mbaleni drilling site

Figure 15 : Makorani drilling site

Figure 16 : Mdjoiézi drilling site

Figure 17 : Chezani drilling site

4.1.2. Protected environments

The sites selected for the project (Mkazi, Makorani, Mdjoiezi, Chezani, Koimbani, and Mbaleni sites) are not located in or near protected areas. These sites are generally located in areas used for agriculture.

4.2. Characteristics of the socio-economic environment

4.2.1. Economic activities and income generating activities

In the project areas, as in the whole country, the main economic activity is agriculture. This activity occupies more than half of the active population. In the villages covered by the study, in order of importance, agriculture is followed by trade, small trades (sewing and embroidery) and livestock.

Agriculture

Overall, the majority of activities carried out by the population in the six villages concerned is agriculture, which is practiced by nearly 85% of the total population. Food production is the main source of income, with bananas, fresh tubers such as cassava, sweet potatoes, taro and yams, breadfruit and vegetable products. Cultivation takes place mainly during the rainy season to benefit from the abundant rainfall. The production is most often intended for self-consumption. A small part is sold on the local market (the agricultural products sold generally come from Madagascar and Tanzania). The techniques used and the materials used are still traditional and do not allow farmers to obtain a good yield. In addition, problems with irrigation of agricultural land, lack of water and arable land resources, destruction of crops by animals roaming the fields, and insecurity of the land penalize the agricultural sector.

Breeding

In the past, livestock farming was practiced by a larger number of people. It occupied the 3th place after agriculture and fishing. Production was rarely intended for sale, since livestock was considered a mark of wealth and notoriety for family owners. However, the cattle and goat herds are decimated by various diseases and export via Tanzania. For the few remaining individuals, traditional techniques are still used, leaving the herds in the fields all day and returning them to their pens in the evening. The breeders deplore the lack of care and the lack of veterinary services and follow-up, but especially the lack of water for watering and grazing.

Trade

The localities concerned by the project have sales outlets or grocery stores that supply the local population with basic necessities. Traders mainly use cabs to get to Moroni as a means of transport.

Fishing

All the villages covered by the study are located at high altitude without access to the sea.

The small trades

Sewing and embroidery are the main trades. This sector employs more women than men. Sewing consists of making traditional clothing typical of the Comoros (boubous, djoho,

djouba, boucheti and dragula). The DJOHO DJOUBA and DRAGULA are worn only by men who have completed the big wedding. In customary and cultural meetings and festivities, the mode of dress distinguishes people who have performed the great wedding, commonly called great notables, from those who have not. Embroidery consists of hand-embroidered hats for men only. The production period of a single hat is at least two months.

4.2.2. Existing infrastructure

Educational infrastructure

The following Table 11 provides information on the educational infrastructure at the six village level.

Table 11: Distribution of school infrastructure in the six villages covered by the project

Village	Kindergarten	Elementary School		College (College)		Senior High School	
		Public	Private	Public	Private	Public	Private
Koimbani	0	1	0	0	0	0	0
Chezani	0	1	1	1	1	0	0
Mdjoyezi	0	1	1	0	0	0	0
Mbaleni	0	0	0	0	0	0	0
Makorani	1	1	0	1	0	0	0
Resident	0	1	1	0	1	0	0
Total	**2**	**8**	**4**	**4**	**5**	**2**	**1**

This table 11 shows that only the village of Mbaleni has no school infrastructure. Thus, students must travel to schools in the village of Hahaya (the capital of the region). Schools are accessible with the presence of public primary and secondary schools. Data on student enrollment in schools is not available for the most part. According to surveys, the number of students is decreasing significantly at the secondary level because the students' parents cannot afford to pay school fees. As for the state of the infrastructure, the schools need to be rehabilitated. They also mentioned the lack of equipment and educational materials mainly for the public elementary school.

Health infrastructures

Most villages have basic health facilities. More serious illnesses or those requiring more extensive interventions must be treated in the capital or in the district health centers (DHCs). According to reports from local authorities, the most common illnesses in the six villages covered by this ESMP are malaria, diarrheal diseases and paralysis.

The following table 12 presents the health infrastructure in each village

Table 12 Health infrastructure in each village

Type of health infrastructure present	Village					
	Mkazi	Makorani	Mdjoiézi	Chezani	Koimbani	Mbaleni
	Family health post	No health infrastructure	Dispensary and maternity	Health post	Health district	No health infrastructure
			ward			

5. COMMITMENT OF BENEFICIARY COMMUNITIES

During the design of the project, consultations were held with various stakeholders, including the beneficiary communities, in accordance with the stakeholder engagement plan. Based on this plan, the beneficiary communities were involved in the different phases of the project from design to implementation. Consultation meetings were held involving all parties in accordance with the stakeholder engagement plan (Annex XIII_c of the project document): local authorities, NGOs and beneficiary communities including women's associations, opinion leaders and youth representatives. These consultation meetings are part of the continuation of the public consultations mentioned in paragraph 79 of the CGES (Annex VI_b). In addition to presenting the activities to be carried out, the objective of these consultations was to raise awareness among the various parties and gather their opinions. The involvement of stakeholders, and particularly that of the beneficiary communities, is essential to the ownership and progress of the project. No protests against the project were expressed. The parties present at these meetings expressed their willingness to accompany and support the project so that it can achieve its objectives and that the supply of drinking water and irrigation in the beneficiary localities becomes a reality. In addition, the various stakeholders (in the areas that concern them) are informed of the progress of the project activities

6. ANALYSIS OF ALTERNATIVES

Drilling with less impact on the environment and the project was a key element of the project design. Several alternatives were considered during the pre-feasibility study phase. The selected alternatives were then studied in detail during the feasibility phase and a more accurate project cost was determined.

The most relevant proposed project alternatives are:

- The "No Project" Alternative;
- Location Alternatives

a. Alternative "NO PROJECT

The "No Project" alternative is the option of not implementing the proposed project. This alternative would mean that the proposed drilling would not be carried out and the situation would remain as it is now. This would avoid any environmental, social, economic and cultural impacts. Under the current conditions, the population

Without a drilling program, there would be no water supply, no improvement in quality of life, no reduction in poverty, no improvement in access to safe and clean water, no improvement in the overall health of the beneficiaries, etc. The direct benefits associated with construction activities, such as increased employment opportunities and associated economic benefits, would also not occur if these boreholes did not materialize.

b. Alternative location

The locations of the boreholes were determined by the geophysical survey conducted under the project. This study identified nine potentially exploitable groundwater drilling sites for water supply in the six beneficiary areas of the project. For the 06 drilling sites planned within the framework of the project, the choice of sites is made in relation to the accessibility of the resource (presence of an exploitable water table), to the accessibility of the drilling sites (access tracks) to the location of the site and the accessibility that it presents in relation to the installation of the piping for the drinking water supply network .

7. IDENTIFICATION, ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS IN 6 ZONES IN NGAZIDJA

7.1. Methodology for identifying and evaluating impacts

The identification of the impacts was based on the documentary analysis, mainly the CGES and the analysis of the data collected in the field, by highlighting the components of the project (activities sources of impact), to the components of the receiving environment (physical, natural and human environment) during the different phases (pre-construction, construction and operation).

This comparison of project elements and environmental components (physical, social, natural) makes it possible to evaluate the probable impact and thus to have all the possible mitigation measures available for the proper implementation of activities. To this end, a matrix for highlighting the probable impacts on each of the activities to be carried out during the different phases was adopted (see Table 17). Subsequently, the determination of significance and assessment of impact risks were carried out in accordance with the methodology adopted in the project's ESMF (see Tables 13, 14 and 15 below).

Table 13: Assessment of the "impact" of a risk

Ranking	Evaluation	Social and environmental impact
5	Review	Significant negative impact on human populations and/or the environment. Large and/or geographically extensive negative impact (large area, large number of people, trans-boundary impact, cumulative impact) and of long duration (long-term, permanent and/or irreversible); affected areas include valuable or sensitive areas (e.g., valuable ecosystems, critical habitats); negative impact on the rights, lands, resources, and territories of indigenous peoples; involves large-scale displacement or resettlement; generates substantial amounts

Ranking	Evaluation	Social and environmental impact
		of greenhouse gas emissions; may result in significant social conflict.
4	Grave	Negative impact on people and/or the environment of moderate or large magnitude, spatial extent, and duration, more limited than critical impact (e.g., predictable, mostly temporary, reversible). The potential risk of project impacts that may affect the rights, lands, resources, and traditional territories and livelihoods of Indigenous Peoples should be considered at least potentially severe.
3	Moderate	Impact of small magnitude, limited (site-specific) extent and (temporary) duration that can be avoided, managed and/or mitigated with relatively simple and accepted measures.
2	Minor	Very limited impact in terms of magnitude (e.g. small area affected, very small number of people affected) and duration (short), can be easily avoided, managed and mitigated.
1	Negligible	Negligible or no impact on communities, individuals and/or the environment.

Table 14: Assessment of the "probability" of a risk

Ranking	*Evaluation*
5	Expected
4	Very likely
3	Fairly likely
2	Improbable
1	Slight

Table 15: Determining the "magnitude" of a risk

Impact	5	**H**	**H**	**H**	**H**	**H**
	4	**M**	**M**	**E**	**E**	**E**
	3	**L**	**M**	**M**	**M**	**M**
	2	**L**	**L**	**M**	**M**	**M**
	1	**L**	**L**	**L**	**L**	**L**
		1	**2**	**3**	**4**	**5**
		Probability				
Low, Moderate, High						

7.2 Activities that cause impacts

The sources of potential impacts are defined as all the activities planned within the framework of the project. The impact receptors (or environmental components likely to be affected by the project), correspond to the sensitive elements of the study area, i.e. those likely to be considerably modified by the project activities (or sources of impact). Implementation of the proposed developments could result in some adverse impacts on the human and natural environment. For the most part, these impacts are generally temporary and controllable.

7.2.1. Phase near construction

- Recruitment of local labor
- Mobilization of materials and equipment

7.2.2. Construction phase

- Development of access roads (clearing of brush, clearing of land, re-profiling of land...)
- Routing of materials and equipment
- Development of the life base
- Site installation
- Installation of materials and equipment
- Installation of the drilling platform
- Carrying out the actual drilling work
- Use of the base life
- Rehabilitation of drilling sites (platform)
- Refurbishment of the base camp

7.2.3. Operation phase

- Operation of the infrastructures put in place
- Training on infrastructure maintenance and upkeep

***NB**: In this phase of project implementation, activities related to drilling have already been carried out for 27% of the total work to be done. These include:*

- The construction of access roads for the transport of equipment and materials to the drilling sites (all sites except Chezani where the road already exists);
- The installation of the base camp in the Mkazi site;

- The installation of the drilling platform in the Mkazi site

All work related to the drilling is currently suspended, pending validation of this ESMP by the GCF.

7.3. IDENTIFICATION OF IMPACTS ACCORDING TO THE ACTIVITIES THAT CAUSE IMPACTS DURING THE DIFFERENT PHASES

The impacts of the ESMP were identified based on the CGES analysis and field surveys.

This determined:

- The risks and impacts identified in the ESMF that are related to the implementation of drilling in Ngazidja.
- Risks and impacts identified in the ESMF that are not related to drilling in Ngazidja.
- Identification of other risks and impacts that were not identified in the ESMF and that complement it.

To identify impacts, the ESMP highlighted activities that cause impacts at different phases of the project (pre-construction, construction, and operation/use). This allowed for the identification of impacts according to the impact receptors (natural and human level). To this end, the dimensions and impacts identified in the ESMC are well integrated into the ESMP.

In addition, the scope of the activities covered by this ESMP is limited to the sub-activities related to the implementation of the drilling works in Ngazidja, which are part of project activity 3.1 as described in Table 2 of the ESMF.

a) Risks and impacts identified in the CGES, related to the drilling works in Ngazidja

- Pollution of the terrestrial environment
- Air pollution
- Production of solid / liquid / hydrocarbon waste
- Health and safety of site personnel and populations
- Impact on women and children (gender risk)
- Risk of spillage and/or physical damage from liquid chlorine
- Non-inclusion of women in training
- Damage to infrastructure by floods or volcanic eruptions
- Social risk
- Temporary disruption of animal (livestock) lifestyle
- Introduction of invasive plant species
- Groundwater contamination

- Vibration due to drilling
- Loss of habitat
- Decrease in vegetation cover
- Increase in noise level
- Impacts of climate change (precipitation variations)
- Fire and emergency prevention and management strategies implemented

b) Risks and impacts identified in the CGES not related to drilling in Ngazidja

Potential impacts on endangered species.

The project does not intervene in protected areas. Although there are fully and partially protected endemic species on the island, these have not been identified in the project's infrastructure installation sites.

Land use change

There will be no risks associated with land use changes.

Excessive groundwater extraction

The work associated with the drilling does not require excessive use of resources.
For a 150 meters deep drilling, it requires 3 trucks of 12 m3, that is to say approximately 36 m3 per drilling.

Increased dust levels in sensitive receptors

No sensitive receptors were identified in the project sites.
However, the impact of dust on crops and the atmosphere has been noted.

Flood damage to infrastructure,

This risk is an eliminatory factor in the choice of sites for drilling construction.
Borehole heads will be protected and landscaped. The risk of flooding of the wells will be almost non-existent

c) Risks and impacts identified during the ESMP development process

These impacts are identified based on the analysis of field investigation data and data on the infrastructure to be put in place. These include:

- Risk of disease transmission (including STIs and Covid-19)
- Poor quality of drinking water
- Risk on the maintenance of the infrastructures
- Poor management of water resources
- Siltation and destruction of crops
- Failure to consider the local workforce
- Temporary traffic disruption

The negative impacts identified in the CGES, related to drilling in Ngazidja, and those identified by the PGES, constitute an exhaustive list of impacts that may occur throughout the drilling work and during the operation of the infrastructure to be put in place.

Based on the impacts presented in Table 16 below, the following sections will be addressed: impact analysis, impact assessment and application of management measures, as well as the implementation of follow-up and monitoring of impacts during the different phases.

Table 16: Highlighting of impacts and impact-causing activities during the various project phases

X : *Indicates the presence of impact type*

: *Likely negative impact*

	Negative socio-environmental impacts																							
	Temporary disruption of animal (livestock) lifestyle	Temporary traffic disruption	Health and safety of site personnel and populations	Increased noise level	Risk of disease transmission (including STIs and Covid-19)	Impact on women and children (gender risk)	Non-consideration of the local workforce	Poor quality of drinking water	Non-inclusion of women in training	Bad water resource management	Silting and destruction of crops	Social risk	Introduction of invasive plant species	Risk of spillage and/or physical harm associated with liquid chlorine	Waste generation (solid, liquid and hydrocarbon waste),	Air pollution	Groundwater contamination	Pollution of the terrestrial environment	Impacts of climate change (precipitation variations)	Vibration due to drilling	Loss of habitat	Decrease in vegetation cover	Risk of erosion	Fire and emergency prevention and management strategies implemented
Pre-construction phase																								
Recruitment of local labor							X					X												
Mobilization of material and equipment			X																					
Construction phase																								
Development of access roads	X		X	X		X					X				X	X					X	X	X	X
Routing of materials and equipment	X	X	X	X		X										X								
Development of the life base	X		X			X					X				X						X	X	X	X

X : *Indicates the presence of impact type*

: *Likely negative impact*

	Negative socio-environmental impacts																							
	Temporary disruption of animal (livestock) lifestyle	Temporary traffic disruption	Health and safety of site personnel and populations	Increased noise level	Risk of disease transmission (including STIs and Covid-19)	Impact on women and children (gender risk)	Non-consideration of the local workforce	Poor quality of drinking water	Non-inclusion of women in training	Bad water resource management	Silting and destruction of crops	Social risk	Introduction of invasive plant species	Risk of spillage and/or physical harm associated with liquid chlorine	Waste generation (solid, liquid and hydrocarbon waste),	Air pollution	Groundwater contamination	Pollution of the terrestrial environment	Impacts of climate change (precipitation variations)	Vibration due to drilling	Loss of habitat	Decrease in vegetation cover	Risk of erosion	Fire and emergency prevention and management strategies implemented
Site installation	X		X			X					X				X						X	X		X
Installation of materials and equipment	X		X	X		X																		X
Installation of the drilling platform	X		X			X					X				X						X	X	X	X
Carrying out the actual drilling work	X		X	X		X									X	X	X	X		X				X
Use of the base life	X				X	X									X			X						X
Site withdrawal	X	X	X	X		X																		X
Rehabilitation of the drilling sites (platform) and the temporary living base	X		X			X						X	X											
Operation phase																								
Operation of the infrastructures put in place								X	X	X		X		X					X					

X : *Indicates the presence of impact type*

: *Likely negative impact*

	Negative socio-environmental impacts																					
	Temporary disruption of animal (livestock) lifestyle	Temporary traffic disruption	Health and safety of site personnel and populations	Increased noise level	Risk of disease transmission (including STIs and Covid-19)	Impact on women and children (gender risk)	Non-consideration of the local workforce	Poor quality of drinking water	Non-inclusion of women in training	Bad water resource management	Silting and destruction of crops	Social risk	Introduction of invasive plant species	Risk of spillage and/or physical harm associated with liquid chlorine	Waste generation (solid, liquid and hydrocarbon waste),	Air pollution	Groundwater contamination	Pollution of the terrestrial environment	Impacts of climate change (precipitation variations)	Vibration due to drilling	Loss of habitat	Decrease in vegetation cover	Risk of erosion	Fire and emergency prevention and management strategies implemented
Training on infrastructure maintenance and upkeep									X															

7.4.ANALYSIS AND EVALUATION OF THE IMPACT OF THE PROJECT ON THE NATURAL AND HUMAN ENVIRONMENT

The environmental impacts of the project are analyzed and their evaluation is presented in Table 17 (evaluation of negative impacts before and after management measures).
Furthermore, the environmental assessment of a project on the environment should not be limited to the description of negative impacts, but should also highlight positive impacts. This will help to better judge and evaluate the project from an environmental point of view and in particular to show that the non-implementation of the project itself poses problems for the natural and human environment. The main positive impacts of the project are presented in section **8**

7.4.1. Analysis of the impacts related to the sub-activity of drilling during all the different phases

The analysis of an impact makes it possible to situate it and measure its consequence in relation to its receptor. This will enable the impact to be properly assessed and appropriate management measures to be proposed to ensure the proper implementation of activities. With respect to the identified impacts, this analysis will focus on

Non-consideration of the local workforce

There is a risk that during the recruitment of site personnel, the company will not favor local labor, especially unskilled labor. In particular, there could be a risk of marginalizing women during the recruitment of site personnel.

- ✓ *As part of the work carried out, the company identified a focal point in each village. No demonstrations from the population on this subject have been observed.*

Social risk

This risk could be related to the recruitment of labor and the reclamation of the site, as well as to the management of water resources and infrastructure.

- ✓ *The company has identified a focal point at each site. No public protests on this subject have been observed.*

Temporary disruption of animal (livestock) lifestyle

Only animals for breeding are observed on the Project's intervention sites.
The presence of humans and car traffic on the sites will not have a significant impact on their way of life. However, the noise from the drilling could disturb them.

- ✓ *The animals are used to human presence. The risk could be related to noise emissions from the drilling itself.*
- ✓ *As part of the opening of the access roads, the work takes place during the day. At most, the work lasted 8 hours for each site.*

Health and safety of site personnel and populations

The handling of machines, the movement of machinery and the execution of work can cause accidents to site personnel and the population

Also, this impact could be related to the transportation of materials and equipment to the drilling sites and during the site retreat.

- ✓ *The work carried out did not cause any accidents or illnesses to the site personnel or the beneficiary population*

Increased noise level

Noise pollution could be related to the drilling work itself, the earthworks for the access roads, the construction of the temporary living quarters and the drilling platform. They can be a nuisance in particular for people suffering from hearing diseases.

- ✓ *The work carried out did not cause any noise pollution. During the drilling works, the personnel who are engaged had earplugs.*
- ✓ *No site personnel were identified as having a hearing impairment.*
- ✓ *The drilling sites are not located inside the villages, but rather on the outskirts.*

Risk of disease transmission (including STIs and Covid-19)

The presence of workers, especially non-resident workers, can encourage sexual relations, thus increasing sexually transmitted diseases

- ✓ *Only at the Zone 1 site in Mkazi has a base camp been installed. This site is a bit far from the houses and it is forbidden to people not working in the site.*

Impact on women and children (gender risk)

Risk of employment of children on the sites. If female workers are present, risk of abuse and non-integration. Few women or almost none at all engage in such activities.

- ✓ *The work carried out was not a source of GBV or child exploitation.*

Silting and destruction of crops

Dust from the earthworks to open the access roads, from the construction of the temporary living quarters and the drilling platform, and from the drilling itself, could fall on the crops in the fields surrounding the drilling work.

Introduction of invasive plant species

During site reclamation, there is a risk that invasive plant species may be introduced to the sites.

Clearing

This impact would be related to the opening of access roads and the construction of temporary living quarters and work sites.

In total, 1.8 km of trails are open for all sites.

Two impacts occur during the opening of the access roads:

- ✓ *Destruction of unripe vanilla plants in Mdjoiési*
- ✓ *Destruction of banana crops in Makorani.*

Two complaints were made about this. They were resolved amicably.

Waste generation (solid, liquid and hydrocarbon waste)
The production of waste would be linked to the opening of access roads, the construction of temporary living quarters and work sites, the drilling itself, as well as during the use of the living quarters and work sites

As part of the work carried out in Zone 1 at Mkazi, the company has watertight drums on site for the collection of hydrocarbon waste. The organic waste is collected and disposed of outside the site in public dumps dedicated to this purpose. The materials resulting from the drilling (sand) will be used for the construction of the head of the drilling well

Air pollution
This impact would be related to exhaust emissions from vehicles during construction, and from generators during the use of the water pumping facilities. Also, the production of dust could have an impact on air quality.
In the context of the work already carried out, the risk of air pollution by dust has not been identified.

Groundwater contamination
This risk would be related to the operation of the drilling platform and the temporary living base.
As part of the drilling platform and work site installed at Site 1 in Mkazi, the area reserved for fuel storage is permeabilized with a tarp. The fuel is stored in watertight drums.

Poor quality of** drinking **water
This impact would be related to the quality of the water at the source (groundwater) and the quality of the water distributed for consumption.
Close and immediate safety perimeters are set up for each site. Therefore, the risk of pollution of the water table is very low.

Non-inclusion of women in training
During the training sessions on the maintenance of the infrastructure, there is a risk that women will not be involved;

Poor management of water resources
The availability of water at any time could have a poor management of water resources

Risk of spillage and/or physical harm associated with liquid chlorine
This risk could have an impact on the health of the beneficiary population

Risk on the maintenance of the infrastructures

This impact would be related to the operation phase

Vibration due to drilling

The use of the platform may cause vibrations on the site

Habitat loss,

This impact could be related to the clearing of land following the opening of access roads to the drilling sites and the development of living quarters and construction sites.

Pollution of the terrestrial environment

This risk would be related to the drilling platform and the use of the temporary life base

7.4.2. ASSESSMENT OF NEGATIVE IMPACTS AND MANAGEMENT AND MITIGATION MEASURES

The impact management measures include the measures identified in the ESMC (presented in Table 17), in addition to the other measures identified in the ESMP. These form the measures for managing the adverse impacts associated with the drilling operations during the various phases.

Table N°17 : Management measures identified in the CGES

Component	Performance criteria	Management measures
GROUNDWATER	- No significant reduction in water quality as a result of project construction and operation activities	Conduct regular monitoring of groundwater quality
ECOLOGY	- No clearing beyond established limits; - No new weed species introduced as a result of construction activities	- Limit clearing activities and reduce habitat disturbance through protection and proper management of vegetation - Restore vegetation in disturbed areas using native and local endemic species that adapt to the environment
EROSION CONTROL	- No accumulation of sediment in aquatic environments and/or surface and/or groundwater as a result of construction and operation activities; - No water quality degradation on or off the site of all projects;	- Plan/organize the work to limit the areas to be cleared - Plan/organize the proposed work to ensure that major vegetation disturbances and earthworks are conducted during periods of low rainfall and wind speed.

SOCIAL MANAGEMENT	- The community was consulted and the project components were designed with their informed consultation and participation throughout the process; - All stakeholders are appropriately	- Conduct community consultation on the purpose and benefits of land use change - Ensure compliance with the grievance mechanism process
Component	**Performance criteria**	**Management measures**
	represented; - Avoid adverse impacts on the local community during construction and, to the extent possible, reduce, restore or compensate for such impacts; - Cultural heritage is not affected; - Community health and safety are protected and the project has an overall positive impact on well-being; - Complaint and grievance mechanisms are in place and proactively managed; - And long-term benefits are assured.	- Women will need to be trained in the maintenance of local water management systems, including monitoring of small waterworks and water treatment systems to indicate when they are in need of repair and to prevent inefficiencies in resource use (e.g., leaks) (ensuring that some of the trainers are female). - Design, standardize, and implement socially sensitive water tariffs in each target area that promote climate-sensitive water management.
WASTE MANAGEMENT	- Application of the waste hierarchy (avoid, reduce, reuse, recycle) ; - No littering in the project area or surrounding area due to site personnel activities; - No complaints received regarding waste generation and management; - Used oil will be collected and sent for recycling	- Give preference to materials that reduce waste - Disposal of waste shall be in accordance with the requirements of the appropriate authorities. - Fuel and lubricant leaks from vehicles and facilities shall be repaired immediately. - Apart from the drilling platform equipment, major maintenance and repair work on the site's machinery will have to be carried out off-site whenever possible.

NOISE AND VIBRATION	- Noise from construction and operational activities shall not cause an environmental nuisance in a noise sensitive location; - Take measures at all times that help reduce noise associated with construction activities; - No damage to off-site properties caused by vibrations from construction and operation activities;	- Avoid working at night, and respect the working hours: 7 am - 5:30 pm - If working outside of normal working hours (7:00 a.m. - 5:30 p.m.), consult with the local population for their approval. - The contractor shall provide training to employees and operators to increase awareness of the need to reduce excessive noise

Component	Performance criteria	Management measures
AIR QUALITY	- The release of dust/particles must not harm the environment; - Take actions at all times that help reduce air quality impacts associated with construction and operation activities	- Ensure that vehicles/engines are stopped when not in use. - Ensure that all vehicles and equipment are well maintained
EMERGENCY MANAGEMENT MEASURES	No Fire Impact; - No failure of water retention structures; - No major chemical or fuel spills; - No preventable industrial or occupational accidents; - Provide an immediate and effective response to incidents that pose a risk to health, safety or the environment; and - Reduce damage to the environment due to unforeseen incidents.	- Containment/storage areas for flammable liquids and combustibles shall be designed in accordance with appropriate international standards; - Fire extinguishers should be available on site; - Open fires are not permitted in the project area; - Communication equipment and emergency protocols will need to be in place prior to the start of construction activities; - Train all staff in emergency preparedness and response (covering workplace health and safety). Work in coordination with the national disaster management office.

7.4.2.1. Impact mitigation measures at the study phase and at the preparation of the CAD

In order to ensure compliance with the ESMP, environmental and social clauses are included in the tender documents and form an integral part of the contracts with the companies carrying out the work. These clauses will ensure that the environmental and social safeguards are respected by the companies throughout the execution of the work.
In addition, prior to the start of the works, the company must submit its site ESMP, which will be aligned with the management and monitoring measures established in this ESMP. The contractors shall also submit a health, safety and environment procedures manual, as an operational tool expressing the E&S requirements submitted detailed in each ESMP, as well as procedures derived from good practices such as OHS risk analysis, PPE management, first aid management, accident and incident management, life base and hygiene management, local population risk management, excavation management, electrical risk management, handling, electrical tools and machinery circulation.

Note: The Company's specifications must include all specific environmental provisions and obligations to be implemented. Failure to comply with any of these environmental requirements will constitute a serious offence for which a fine will be imposed on the company.

7.4.2.2. MPACT MANAGEMENT AND MITIGATION MEASURES DURING CONSTRUCTION AND OPERATION

During the construction and operation of the boreholes, measures will be put in place to manage and mitigate the impacts.

In the tables below, all risks and negative impacts that could occur during the development and operation of the wells are assessed, managed and mitigated.

This assessment addresses the magnitude of risk and impact prior to the implementation of management and mitigation measures and after the implementation of these measures.

The assessment shows that the magnitude of the risks and impacts associated with the drilling activities is "low".

Table 18: **Pre-mitigation risk and impact assessment, and post-mitigation risk and impact assessment.**

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
Pre-construction phase							
Failure to consider the local workforce	3	3	Moderate	In order to stimulate local economic development, it is recommended that priority in hiring be given to local unskilled labor. The choice of local suppliers should also be encouraged.	1	2	Low
				Encourage women to join the work force.			
				The exploitation of children is strictly prohibited. The employer will not accept workers under the minimum age for employment of young people (18 years) on its sites.			
				In the recruitment of staff, women should not be omitted as they can perform certain tasks.			
				Before starting the work and throughout the work, the company must ensure compliance with all the specific provisions and obligations to be implemented with regard to the environment.			
				The company must have a Quality, Health, Safety and Environment (QHSE) manager on its team who will be responsible for the implementation of this ESMP throughout the execution of the works contract.			
Social risk	3	3	Moderate	The company must inform and educate the public about the nature of the work to be performed. The information must specify the routes and places likely to be affected by the work as well as its duration. Details of the	1	1	Low

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
				nuisances that may be caused by the work and the behavior that users must adopt to avoid any risk of accident. The company is also required to define the working hours and to inform the public in advance of this schedule in order to avoid possible disruptions of the traffic of the construction machines and to avoid noise emissions outside the working hours. The company must ensure that it has all the necessary authorizations prior to the work. Ensure compliance with the grievance mechanism process Integrate gender into the recruitment and training process.			
Construction phase							
Temporary traffic disruption	3	3	Moderate	A traffic plan will be prepared prior to the start of construction to minimize traffic disruptions associated with construction setbacks and installation. In this plan, will be presented the calendar on the folds and installations of the work sites.	2	1	Low
Temporary disruption of animal (livestock) lifestyle	1	1	Bottom	In the work areas, wildlife and livestock could be disturbed by human presence: - Limiting noise emissions - Avoid night work	1	1	Low

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
Pollution of the terrestrial environment	2	2	Bottom	Apart from the drilling platform equipment, major maintenance and repair work on the site's machinery will have to be carried out off-site whenever possible. Waterproofing the ground at the level of the parking of the machines on the sites in order to protect the ground from oil and fuel leaks In case of soil pollution by hydrocarbons, the soiled area must be immediately covered with highly absorbent materials (sawdust). The area will then be stripped and evacuated to a suitable landfill after agreement with the project manager on site.	1	1	Low
Groundwater contamination	1	2	Low	Conduct regular monitoring of groundwater quality Protect boreholes from runoff and flooding and keep the surrounding area clean Conduct daily checks of all vehicles and storage equipment and materials for possible fuel, oil and chemical leaks. The places identified for the deposit and storage of hydrocarbons must be far from the drilling points and will be waterproofed to avoid any soil contamination. Pumping tests should be conducted to ensure that flows are sustainable Monitor groundwater extraction	1	1	Low

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
Risk of erosion	1	1	Low	Plan/organize the work to limit the area to be cleared	1	1	Low
				Plan/organize the proposed work so that major vegetation disturbances and earthworks are performed during periods of low rainfall and wind speed.			
				Plan/organize work to reduce the amount of time materials are stored on vegetated land.			
Air pollution	3	1	Low	Routes for transporting materials and structures to the site should be as direct as possible	2	1	Low
				Ensure that vehicles/machines are turned off when not in use.			
				Construction equipment and trucks must be well maintained and meet current standards. They must be subject to regular technical control in order to reduce odors and fumes to a minimum.			
				During the maintenance of the platform equipment (oil changes, repairs), use an impermeable tarpaulin to reduce as much as possible the hydrocarbon leakage on the ground. For other rolling stock, maintenance and cleaning operations should preferably be carried out at the nearest service stations			
Production of solid / liquid	4	2	Moderate	Fuel and lubricant leaks from vehicles must be repaired immediately.	2	2	Low

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
/ hydrocarbon waste				Major maintenance and repair of equipment shall be performed off-site whenever possible.			
				Strict application of the "reduce - reuse - recycle" principle in order to minimize the volume of waste going to landfill			
				Hazardous waste must be collected and stored in containers adapted to its nature and in safe conditions, before evacuation to a recycling facility (used oil)			
				Landfill disposal should be considered the ultimate solution. Waste disposal sites should be identified prior to the commencement of operations in consultation with local authorities.			
				Before working, check the condition of the machine to be used			
				Ensure the maintenance of the machines and check their condition daily			
Increased noise level	2	1	Low	Avoid working at night, and respect the working hours: 7 am - 5:30 pm	1	1	Low
				If working outside of normal working hours (7:00 a.m. - 5:30 p.m.), consult with the local population for their approval.			
Health and safety of site personnel and populations	3	3	Moderate	Before the work begins, an information campaign should be conducted to warn of the dangers and risks of the work to be undertaken.	2	2	Low
				Prohibition of the building site to the public: Thus, the building site will be			

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
				the object of a defense by the installation of delimitations (fluorescent bands), and the installation of a system of information of the public (panels of danger).			
				Put up signs to inform the public about the work in progress and the duration of the work.			
				Put a first aid kit on each site to be renewed as needed.			
				Provision of personal protective equipment to each worker			
				Observe traffic regulations.			
Risk of disease transmission (including STIs and Covid-19)	3	3	Moderate	Favor the recruitment of local labor to reduce the risk of disease proliferation	2	2	Low
				A program of awareness and information of the site personnel must be set up by the company, in particular on the means of protection against COVID-19, sexually transmitted diseases and AIDS and the rules of hygiene to be respected during the period of execution of the work.			
				The company is obliged to provide, free of charge, personal protective equipment (disinfectant gel, mask, gloves, special clothing, etc.) for all workers on the site.			
Impact on women and children (gender risk)	2	3	Moderate	Setting up awareness-raising activities on gender-based violence (type of behavior concerned, sanctions foreseen) on the work sites	1	3	Low
				Adoption of a code of conduct at the sites and zero tolerance for gender-			

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
				based violence and all forms of child abuse and exploitation. Strict prohibition of child labor If incidents of gender-based violence occur, Anonymous accompaniment of victims in the formulation, filing and throughout the processing of the complaint. Setting up, in collaboration with local medical services, a medical and psychological support unit for victims Dismissal without notice with immediate effect of the offender			
Failure to consider the local workforce	3	3	Moderate	In order to stimulate local economic development, it is recommended that priority in hiring be given to local (unskilled) labor. The choice of local suppliers should be overly privileged Encourage women to join maintenance teams.	2	2	Low
Damage to infrastructure by floods or volcanic eruptions	1	3	Bottom	Avoid locating infrastructure in areas of risk (flooding, earthquakes and landslides, etc.). Elevate drill heads and landscape drill sites.	1	3	Low
Loss of habitat	1	1		Limit clearing activities to the rights-of-way necessary for the work Restore vegetation in cleared areas using native and local endemic species that adapt to the environment	1	1	Low
Vibration due to drilling	1	1	Low	Limiting night work	1	1	Low

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
				Use low ground pressure construction vehicles,			
Silting and destruction of crops	2	3	Moderate	Respect project rights-of-way and clear only as much land as necessary. Clearing operations will be carried out without damaging adjacent un-cleared areas: topsoil is stockpiled within the cleared perimeter and at the edge of the clearing area, trees are felled towards the interior of the area. Sites will be cleared from side to side, or from the center outward, to avoid the risk of animal entrapment	2	2	Low
Introduction of invasive plant species	1	3	Bottom	Restore vegetation in cleared areas (temporary base camp, drilling platform and construction site) using native and local endemic species that adapt to the environment	1	1	Low
Decrease in vegetation cover	3	3	Moderate	Limit clearing to the area necessary for infrastructure installation. Whenever possible, avoid cutting down large trees. Restore vegetation in cleared areas (temporary base camp, drilling platform and construction site) using native and local endemic species that adapt to the environment. Agree with the owners on the species to be put in place.	2	1	Low
Social risk related to site remediation	3	3	Moderate	One month before the dismantling of the first base camp, the company will hire an agricultural technician to provide the landowners with a nursery that will be prepared according to their expressed needs. Subsequently, in the other sites the nursery will be prepared according to the needs expressed by	1	1	Low

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
				the landowners.			
Failure to consider the fire prevention and management strategy and emergencies implemented	1	3		- Fire extinguishers should be available on site; - Open fires are not permitted in the project area; - Train all staff in emergency preparedness and response (covering workplace health and safety). Work in coordination with the national disaster management office.	1	2	Low
Operation phase							
Social risk	1	3	Low	It will be necessary to design, standardize, and implement socially sensitive water tariffs in each target area that promote climate-sensitive water management.	1	2	Low
				Women should be trained in the maintenance of local water management systems, including monitoring of small waterworks and water treatment of water supply systems, to indicate when they need to be repaired and to prevent inefficiencies in water use (e.g., leakage) (ensuring that some of the trainers are female).			
				Ensure compliance with the grievance process			
				Restore work sites with native and local endemic species.			
				Inform stakeholders of the status of the project and any changes during the implementation process			

Unmitigated impacts	Pre-Mitigation Assessment			Management and Mitigation Measures	Post-mitigation evaluation		
	P	C	A		P	C	A
Risk of spillage and/or physical damage associated with liquid chlorine	1	3	Low	Equip the technicians in charge of water treatment and potabilization with adequate equipment for their protection and with tools to properly dose chlorine	1	3	Low
Non-inclusion of women in infrastructure maintenance training	2	3	Moderate	Encourage women to integrate maintenance work and prioritize it in training Women will need to be trained in the maintenance of local water management systems, including monitoring of small waterworks and water treatment systems to indicate when they are in need of repair and to prevent inefficiencies in resource use (e.g., leaks) (ensuring that some of the trainers are female). All project activities must meet the indicators of the project's gender action plan, which targets the involvement of 50% women and youth in training.	1	2	Low
Poor management of water resources	3	3	Moderate	Sensitization of the beneficiary population of the project for the good valorization of the water by avoiding the waste; Establish integrated water resources management committees with at least 30% female representation	1	1	Low
Impacts of climate change, particularly variations in precipitation	3	3	Moderate	Reforesting watersheds to promote groundwater recharge	2	2	Low

Reference:

P= Probability

C= Consequence

A= Magnitude of the consequence of the risk and or impact

In order to maintain this low level of risk and impact on the boreholes, the above-mentioned mitigation measures will be followed up and monitored throughout the construction period and during operation (see Table 19).

7. ENVIRONMENTAL AND SOCIAL MONITORING OF THE DRILLING PROGRAM

7.2. Overview of the monitoring program

The objective of the monitoring and follow-up program is to ensure that improvement and mitigation measures are implemented and that they produce the desired results. It also assesses compliance with national environmental and social policies and standards. This program will be implemented during the construction phase and will also continue during the operation phase. It covers the following principles:

- Control and supervision of the work,
- Monitoring and follow-up during the operational phase,
- And the inspection.

The objective of environmental monitoring is to ensure compliance with: (i) the measures proposed in this ESMP, including mitigation measures; (ii) commitments to local communities and departmental authorities; and (iii) the requirements of other laws and regulations related to public health and safety, management of the living environment of the population, and protection of the environment and natural resources. Environmental monitoring will cover all phases of the project.

A control office has been hired to ensure permanent monitoring of the work. In the same way as the drilling works, the environmental aspects are subject to control, follow-up and monitoring:

- The daily control of the contractor's level of compliance with the regulatory and legal provisions relating to environmental protection, in parallel with its mission of technical control of the works
- Follow-up and monitoring of the effective implementation of the various natural and social environmental protection measures specified in this study (ESMP).
- Follow-up and monitoring of the management of solid waste and water generated by the works and by the temporary living base.
- Grievance tracking for each intervention site
- Inform local authorities, NGOs, communities and the population of the work schedule.

After the resumption of work, the DGEF will evaluate the environmental and social performance of the company in charge of the execution of the work and will guarantee compliance with this ESMP. This evaluation will be based on the verification of the results of the daily inspections by the control office, which must be recorded in a register and available at the worksite at all times; the monthly worksite monitoring reports drawn up by the control office.

The contractor will maintain and preserve all administrative and environmental records, which would include a record of complaints, as well as records of all actions taken to mitigate the cause of the complaints.

In case of non-compliance or non-application of environmental and social measures, the control office initiates the process of formal notice, through the owner, which will be sent to the company a copy to UNDP.

7.3. Performance criteria for site monitoring and surveillance

The performance criteria indicate success and compliance with the management measures. In this case for drilling, the performance criteria can be summarized as follows:

- No clearing beyond established limits;
- No new weed species introduced as a result of site remediation activities
- The community was consulted and the project components were designed with their informed consultation and participation throughout the process;
- All stakeholders are appropriately represented;
- Avoid negative impacts on the local community during construction and, to the extent possible, reduce or mitigate such impacts
- Community health and safety are protected and the project has an overall positive impact on well-being;
- Complaint and grievance mechanisms are in place and proactively managed;
- Long-term benefits are assured.
- Application of the waste hierarchy (avoid, reduce, reuse, recycle) ;
- No littering in the project area or surrounding area due to site personnel activities;
- No complaints received regarding waste generation and management;
- Used oil will be collected and sent for recycling
- Noise from construction and operational activities shall not cause an environmental nuisance in a noise sensitive location;
- Take measures at all times that help reduce noise associated with construction activities;
- No damage to off-site properties caused by vibrations from construction and operation activities;
- The release of dust/particles must not harm the environment;
- Take actions at all times that help reduce air quality impacts associated with construction and operation activities
- No Fire Impact;
- No major chemical or fuel spills;
- No unavoidable work or occupational injury;
- Provide an immediate and effective response to incidents that pose a risk to health, safety or the environment; and
- Hygiene and sanitation in the temporary bases are ensured;
- The level of maintenance of the drilling rigs and trucks (maintenance sheet);
- The use of personal protective equipment for workers (helmets, bibs, boots, uniforms, gloves, masks, goggles, hydro alcoholic gel, etc.);

The analysis of these indicators is the main input for monitoring and surveillance reports. It forms the basis for suggestions to reverse or replace ineffective measures.

7.4. Budget for follow-up and monitoring of the measures put in place

During the construction period, the follow-up and monitoring of management measures for the mitigation of risks and impacts are the responsibility of the company. The related budget is included in the company's offer.

In fact, in the preparation of the DAO, the measures for environmental and social management were integrated into the latter, to be part of the offer of the companies.

During the operation phase, the follow-up and monitoring of management measures for risk and impact mitigation will be the responsibility of the competent authorities (DGEF, DGEME, GIRE committees and SONEDE), with the support of the project during its implementation period. This budget is included in the operating budget of each institution.

The budget for the implementation of this ESMP, which commits the project, will be charged to the budget (training and awareness, and the budget for the implementation of ESMC activities).

Measures that do not require a budget are indicated by N/A (not applicable).

Table 19 below presents the follow-up and monitoring measures, indicators, frequency, persons responsible for follow-up, and timetable for follow-up and monitoring of management measures to achieve the performance criteria.

Table 19: Follow-up and monitoring measures to mitigate risks and impacts during the drilling phase and during operation.

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
Pre-construction phase						
Failure to consider the local workforce	In order to stimulate local economic development, it is recommended that priority in hiring be given to local unskilled labor. The choice of local suppliers should also be encouraged.	Number (Nb) of local workers and technicians hired	Quarterly	Control office (BC) Directorate General of Environment and Forestry (DGEF) BC, Project Safeguarding Expert (ESP)	Pre-construction phase	Included in the company's offer
	Encourage women to join the work force.	No. of women among site personnel				
	The exploitation of children is strictly prohibited. The employer will not accept workers under the minimum age for employment of young people (18 years) on its sites.	Presence of children on the site				
	The company must have a Quality, Health, Safety and Environment (QHSE) manager on its team who will be responsible for the implementation of this ESMP throughout the execution of the works contract.	An operational QHSE manager				
Social risk	Information and public awareness on the nature of the work to be carried out. The information must specify the routes and places likely to be affected by the work as well as its duration.	Before the start of the work, awareness meetings were held in the villages	1 time	Project Team (PT), DGEF	Pre-construction phase	Included in the budget for the implementation safeguard

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
						measures
	Details of the nuisances that may be caused by the work and the behavior that users must adopt to avoid any risk of accident.					
	The company is also required to define the working hours and to inform the public in advance of this schedule in order to avoid possible disruptions of the traffic of the construction machines and to avoid noise emissions outside the working hours.					
	The company must ensure that it has all the necessary authorizations prior to the work. Ensure compliance with the grievance mechanism process Please ensure compliance with the gender action plan indicators					
Construction phase						
Temporary traffic disruption	A traffic plan will be prepared prior to the start of construction to minimize traffic disruptions associated with construction setbacks and installation. In this plan, will be presented the calendar on the folds	Prior to the start of the work, the company shared a schedule for the execution of the work	1 time	EP	Before the start of the work	N/A

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
	and installations of the work sites.					
Temporary disruption of animal (livestock) lifestyle	In the work areas, wildlife and livestock could be disturbed by human presence. Limit noise emissions and avoid night work	Respect of the schedule (7am to 7:30am)	Daily	BC, ESP	Throughout the work	N/A
Pollution of the terrestrial environment	Apart from the drilling platform equipment, major maintenance and repair work on the site's machinery will have to be carried out off-site whenever possible.	No. of machine maintenance performed on site	Quarterly	BC, ESP	Throughout the work	Integrated into the company's budget
	Waterproofing the ground at the level of the parking of the machines on the sites in order to protect the ground from oil and fuel leaks					
	In case of soil pollution by hydrocarbons, the soiled area must be immediately covered with highly absorbent materials (sawdust). The area will then be stripped and evacuated to a suitable landfill after agreement with the project manager on site.	Nb of soil treatments performed	Quarterly	BC, ESP, DGEF, PND	Throughout the work	Integrated into the company's budget

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
Groundwater contamination	Set up piezometers for regular monitoring of groundwater quantity and quality. Protect boreholes from runoff and flooding and keep the surrounding area clean	Number of piezometers installed	Once	EP, IWRM Committee, NDP	During operation	Integrated into the project's multi-year budget
	Conduct daily checks of all vehicles and storage equipment and materials for possible fuel, oil and chemical leaks.	Audit report	Daily	BC	Throughout the work	Integrated into the company's budget
	The places identified for the deposit and storage of hydrocarbons must be far from the drilling points and will be impermeable to avoid any soil contamination.	- Distance from the drilling point Report on the cleanliness of the premises	Once Daily	BC, DGEF	Throughout the work	Integrated into the company's budget
	Pumping tests should be conducted to ensure that flows are sustainable Monitor groundwater extraction	Number of pumping tests performed	1 time	BC, EP, PND	Operation phase	Included in the company's offer
Risk of erosion	Plan/organize the work to limit the area to be cleared	Site Report	Once	BC, ESP, DGEF, PNUD	Construction phase	Included in the company's offer
	Plan/organize the proposed work so that major vegetation disturbances and earthworks are performed during periods of low rainfall and wind speed.					

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
	Plan/organize work to reduce the amount of time materials are stored on vegetated land.					
Air pollution	Routes for transporting materials and structures to the site should be as direct as possible	Site Report	Daily	BC, ESP, DGEF	Construction phase	Included in the company's offer
	Ensure that vehicles/machines are turned off when not in use.					
	Construction equipment and trucks must be well maintained and meet current standards. They must be subject to regular technical control in order to reduce odors and fumes to a minimum.					
	During the maintenance of the platform equipment (oil changes, repairs), use an impermeable tarpaulin to reduce as much as possible the hydrocarbon leakage on the ground. For other rolling stock, maintenance and cleaning operations should preferably be carried out at the nearest service stations					
Production of solid / liquid /	Fuel and lubricant leaks from vehicles must be repaired immediately.	Site Report	Daily	BC, ESP, DGEF	Construction phase	Included in the

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
hydrocarbon waste	Major maintenance and repair of equipment shall be performed off-site whenever possible.					company's offer
	Ensure the maintenance of the machines and check their condition daily					
	Strict application of the "reduce - reuse - recycle" principle to minimize the amount of waste going to landfill. Landfill disposal should be considered as the ultimate solution.	Volume of waste on site	Weekly	BC, ESP, DGEF	Construction phase	Included in the company's offer
	Hazardous waste must be collected and stored in containers adapted to their nature and in safe conditions, before evacuation to a recycling facility (used oil)	Number of drums filled	Weekly	BC, ESP, DGEF	Construction phase	Included in the company's offer
Increased noise level	Avoid working at night, and respect the working hours: 7 am - 5:30 pm	Site Report Complaint filed	Daily	BC, ESP, DGEF	Construction phase	N/A
	If working outside of normal working hours (7:00 a.m. - 5:30 p.m.), consult with the local population for their approval.					
	Periodically measure the noise level with a sound level meter to verify compliance with established standards					
Health and safety of site personnel and	Before the work begins, an information campaign should be conducted to warn of the dangers and risks of	Before the start of the work, awareness meetings were held in the	1 time and as needed	EP, BC	Prior to the work and if	Included in the company's

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
populations	the work to be undertaken.	villages			necessary	budget
	Prohibition of the building site to the public: Thus, the building site will be the object of a defense by the installation of delimitations (fluorescent bands), and the installation of a system of information of the public (panels of danger).	Number of sites marked with visual beacons in the evening and during the day.	1 time	BC, ESP	During the work	Included in the company's budget
	Put up signs to inform the public about the work in progress and the duration of the work.	Number of signs installed and visuals	1 time	BC ESP, DGEF	During the work	Included in the company's budget
	Put a first aid kit on each site to be renewed as needed.	Nb of first aid kit to renew	1 time and as needed	BC, ESP	During the work	Included in the company's budget
	Provision of personal protective equipment to each worker Observe traffic regulations.	Number of equipment issued and number of workers wearing protective equipment	1 time and as needed	BC, ESP	During the work	Included in the company's budget
Risk of disease transmission (including	Favor the recruitment of local labor to reduce the risk of disease proliferation	Number of local workers recruited	Once	BC, ESP	At the beginning of the work	Included in the company's offer

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
STIs and Covid-19)	A program of awareness and information of the site personnel must be set up by the company, in particular on the means of protection against COVID-19, sexually transmitted diseases and AIDS and the rules of hygiene to be respected during the period of execution of the work.	No. of awareness-raising activities carried out	Quarterly	BC, ESP	Throughout the work	Included in the company's offer
	The company is obliged to provide, free of charge, personal protective equipment (disinfectant gel, mask, gloves, special clothing, etc.) for all workers on the site.	Number of materials given to workers, No. of cases of disease on site.	Quarterly	BC, ESP	Throughout the work	Included in the company's offer
Impact on women and children (gender risk)	Setting up awareness-raising activities on gender-based violence (type of behavior concerned, sanctions foreseen) on the work sites	No. of awareness-raising activities carried out	Quarterly	BC, ESP	Throughout the work	Included in the company's offer
	Adoption of a code of conduct at the sites and zero tolerance for gender-based violence and all forms of child abuse and exploitation.	Number of cases of violence observed on site Number of complaints on GBV filed	Daily	BC, ESP, UNDP	Throughout the work	Included in the company's offer
	Strict prohibition of child labor	Presence of miners on	Daily	BC, ESP,	During the	Included in

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
	If incidents of gender-based violence occur, Anonymous accompaniment of victims in the formulation, filing and throughout the processing of the complaint. Setting up, in collaboration with local medical services, a medical and psychological support unit for victims Dismissal without notice with immediate effect of the offender	site Number of GBV cases on site, Number of dismissals		DGEF, PNUD	work	the company's offer
Loss of habitat	- Limit clearing activities to the rights-of-way necessary for the work - Restore vegetation in cleared areas using native and local endemic species that adapt to the environment	Cleared area	1 time	BC, ESP, DGEF	During the work	Included in the company's offer
Vibration due to drilling	Limiting night work	On-site report Number of complaints filed	Daily	BC, ESP, DGEF	During the work	Included in the company's offer
Silting and destruction of crops	Respect project rights-of-way and clear only as much land as necessary. Clearing operations will be carried out without damaging adjacent un-cleared areas: topsoil is stockpiled within the cleared perimeter and at the edge of the clearing area, trees are felled towards the interior of the	Cleared area Number of complaints filed	1 time	BC, ESP, DGEF	During the work	Included in the company's offer

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
	area. Sites will be cleared from side to side, or from the center outward, to avoid the risk of animal entrapment					
Introduction of invasive plant species	Restore vegetation in cleared areas (temporary base camp, drilling platform and construction site) using native and local endemic species that adapt to the environment.	Plant species to be afforested	1 time	BC, ESP, City Hall	During site withdrawal	Included in the company's offer
Decrease in vegetation cover	Limit clearing to the area necessary for infrastructure installation. Whenever possible, avoid cutting down large trees.	Cleared area	1 time	BC, ESP, DGEF	During the work	Included in the company's offer
	Restore vegetation in cleared areas (temporary base camp, drilling platform and construction site) using native and local endemic species that adapt to the environment. Agree with the owners on the species to be put in place.	Plant species to be afforested	1 time	PO, ESP, City Hall, Owner	During site withdrawal	Included in the company's offer
Social risk related to the restoration of sites	One month before the dismantling of the first base camp, the company will hire an agricultural technician to provide the landowners with a nursery that will be prepared according to their expressed needs. Subsequently, in the other sites the nursery will be prepared according to the needs expressed by the	Plant species to be afforested	1 time	PO, ESP, City Hall, Owner	During site withdrawal	Included in the company's offer

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
	landowners.					
Fire and emergency prevention and management strategies implemented	- Fire extinguishers should be available on site; - Open fires are not permitted in the project area; - Train all staff in emergency preparedness and response (covering workplace health and safety).	Number of fire extinguishers on site Number of people trained in risk management	1 time	BC, ESP	During the work	Included in the company's offer
Operation phase						
Social risk	It will be necessary to design, standardize, and implement socially sensitive water tariffs in each target area that promote climate-sensitive water management.	No. of pricing studies	1 time	UNDP, Project Coordinator (PC), DGEME	Prior to the operation of the infrastructure	Government co-funding
	Women should be trained in the maintenance of local water management systems, including monitoring of small waterworks and water treatment of water supply systems, to indicate when they need to be repaired and to prevent inefficiencies in water use (e.g., leakage) (ensuring that some of the trainers are female).	Percentage of women who received training in accordance with the gender action plan	1 time	CP, UNDP	Prior to the operation of the infrastructure	Included in the project budget

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
	Ensure compliance with the grievance process	Number of complaints handled	As needed	Local authorities, DGEF, Project, UNDP	Throughout the different phases	
	Inform stakeholders of the status of the project and any changes during the implementation process	Number of meetings organized No. of women participating in the meetings	Quarterly and as needed	Project	During the construction and operation phase	Included in the project budget
Risk of spillage and/or physical damage associated with liquid chlorine	Equip the technicians in charge of water treatment and potabilization with adequate protective equipment and tools to properly dose chlorine	Number of protective equipment given to technicians No. of technicians who use it	Semi-annual	DGEME, SONEDE,	During operation	SONEDE funding in their operating budget
	Continuous monitoring of the quality of the distributed water by means of	Number of analyses performed	Monthly	DGEME SONEDE	Operation phase	
Non-inclusion of	Encourage women to integrate maintenance work and prioritize it in training	No. of women trained (%)	1 time and as needed	Project	During operation	Included in the project

Mitigated impacts	Follow-up and monitoring measures	Monitoring indicator	Frequency	Person in charge of follow-up	Calendar	Budget
women in infrastructure maintenance training	Women will need to be trained in the maintenance of local water management systems, including monitoring of small waterworks and water treatment systems to indicate when they are in need of repair and to prevent inefficiencies in resource use (e.g., leaks) (ensuring that some of the trainers are female). All project activities must meet the indicators of the project's gender action plan, which targets the involvement of 50% women and youth in training.	No. of women technicians No. of awareness-raising activities carried out				budget
Poor management of water resources	Sensitization of the beneficiary population of the project for the good valorization of the water by avoiding the waste; Establish integrated water resources management committees with at least 30% female representation	No. of committees set up	1 time	Project	4th quarter 2022	Included in the project budget
Impacts of climate change, particularly variations in precipitation	Reforesting watersheds to promote groundwater recharge	Number of plants reforested	1 time	Project	4ème Quarter 2022	Included in the project budget

7.5. Presentation of the situation on the work already done

As a reminder, prior to the suspension of the work, the company awarded the contract for the boreholes carried out the following work:

- Development of all access roads (except for Chezani where this development was not necessary);
- Construction and installation of work sites, temporary living quarters and drilling platforms in site 1 at Mkazi
- Installation of the site
- Drilling works in site 1 at Mkazi (these are at a depth of 10 m for a total of 150m).

Table 20 below shows the impacts recorded their magnitude and the management measures that were applied.

Table 20: Impacts occurring during the execution of the works and management measures applied

Activity carried out	Actual impacts recorded	Consequence of the impact on the affected component	Mitigation measures applied
Near-construction phase			
Applications for authorizations	No	No	- Before starting the work, meetings are held with the local authorities to inform them of the work schedule. - All authorizations have been collected before the beginning of the work - Prior to the start of construction, the project, along with local authorities and landowners, organized reconnaissance and site demarcation visits to ensure that the company stayed within the project site rights-of-way.

Activity carried out	Actual impacts recorded	Consequence of the impact on the affected component	Mitigation measures applied
Recruitment of the workforce	No	No	Six focal points (one per village) were recruited by the company. The choice was based on the person's capacity for responsibility, availability and leadership at the village level.
Construction phase			
Development of access roads to drilling sites	During the construction of access roads to Mdjoiézi and Makorani, crops were destroyed. Respectively, unripe vanilla plants and banana crops were destroyed. These two impacts occurred accidentally: - The destruction of the vanilla plants occurred during hand clearing, following the descent of tree branches. The one related to the banana crops was caused by debris thrown up by the backhoe during the layout of the runway. These banana plants were mostly small shoots that measured less than 20 centimeters.	2	***The construction of access roads to the drilling sites takes place at all sites.*** - The work takes place in the morning. - The company provided a first aid kit. - The entire population of the villages covered by the study was made aware of the work to be carried out and was informed of the schedule for the execution of the work. - During the work, the area was marked with fluorescent strips. - Access to the site was strictly forbidden to anyone other than site personnel. - Each employee carried their own safety equipment. - A first aid kit was provided by the company - The equipment used was in good condition. No noise impacts were reported. -As a result of these two incidences, complaints were filed and

Activity carried out	Actual impacts recorded	Consequence of the impact on the affected component	Mitigation measures applied
			resolved.
Clearing of land for the construction of the base camp and drilling platform at Mkazi	Scattering of the materials resulting from the stripping	1	The company was reminded of its commitment and since then, all organic waste is collected and disposed of weekly.
Routing of materials and equipment and installation of the drilling platform	No	No	***The installation of the drilling platform and the transport of materials and equipment took place only at the Mkazi drilling site.*** The project sensitized road traffic officials. They worked with community and village authorities and the project team to facilitate the passage of the convoy. All site personnel were equipped with safety equipment.
Installation of the temporary living base	No	No	***It is only at the Mkazi site that the company has installed its base.*** The company's staff is composed of an environmentalist who ensures awareness on the attitude to adopt and the good environmental and social practices to observe and all the QSE aspects The drilling site is a bit far from the houses. Extra-professional visits are strictly forbidden on the site. The site is marked with a fluorescent strip.
Circulation of rolling stock	No	No	- The company has a tanker truck, a dump truck, two pick-ups and a

Activity carried out	Actual impacts recorded	Consequence of the impact on the affected component	Mitigation measures applied
			drilling truck. - With the exception of the drilling truck, the rolling stock is supplied by the service stations. - The drilling truck is supplied on site. The fuel is transported in waterproof drums. During refueling, an impermeable tarp is placed on the ground to avoid soil contamination. - The drums used for refueling are placed far from the actual drilling
	Plant loss: This loss is related to the clearing of land following the construction of the base camp and drilling platform at the Mkazi site.	1	

NB: during the preparatory phase (development of access roads, installation of the life base and the drilling platform), the follow-up and monitoring of the measures initially planned were carried out by the control office. The environmental and social safeguards expert carried out supervision missions.

8. MAIN SOCIO-ECONOMIC BENEFITS OF THE PROJECT

8.2.1. Job creation

Although the drilling work can be carried out over a relatively short period of time, a focal point has been identified at each forge site to facilitate the insertion of the drilling sub-project into its environment, but also to facilitate the proper implementation of the work.
As part of the site removal, a nursery will be set up to prepare plants for the rehabilitation of the temporary living base, the construction site and the drilling platform at the 6 drilling sites, which will create one additional job during the construction period.

8.2.2. Improvement of the living conditions of the population and increase of the national economy.

For a country where the lack of water is a real nightmare that is really felt, the realization of boreholes and the monitoring of the quality and availability of water resources, will allow on the one hand, to supply the population with drinking water and on the other hand, to ensure a rational and sustainable management of resources.

To this end, the availability of quality water will improve the health of the population by reducing water-borne diseases and by reducing the efforts made by women and young girls (travelling long distances) in search of water. It will also promote the development of income-generating activities, which will have a considerable positive impact on economic development.

The measures to increase the positive impacts of the project are presented in Table 21 below

Table N° 21 : presentation of positive impacts

Impact receiver	Positive impact	Bonus measure	Monitoring indicators	Frequency	Responsible for Follow-up	Calendar	Cost in USD
Social	Job creation	Favor local labor, especially unskilled labor	NB of local workers on the sites	1 time at the beginning of the work and as needed	DGEF, CP	All phases	Included in the company's offer -
		Continuous monitoring of the quality of the distributed water by means of analysis	Number of analyses performed	Monthly	DGEME, SONEDE	Operation phase	SONEDE funding in their operating budget
	Reduced drudgery and time for water collection for women and girls	Involve women (30% of women in IWRM committees) in water management and/or public awareness activities	Number of women attending outreach meetings Number of women on the management committee	Quarterly	DGEF, DGEME and project	Operation phase	Project funding during its implementation period and to be determined after the project
	Reduction of waterborne diseases in the region	Supervision and monitoring of the project beneficiaries for an efficient management of the distributed water while	Number of people affected by water-related diseases	Quarterly	IWRM Committee	Operation phase	Project funding during its implementation period and to be

Impact receiver	Positive impact	Bonus measure	Monitoring indicators	Frequency	Responsible for Follow-up	Calendar	Cost in USD
		avoiding waste, water losses, wastewater discharge in the open air...					determined after the project
Operation of the infrastructure	Water availability at all times	Sensitization of the beneficiary population for the payment of bills to allow the maintenance of the infrastructures	Number of missions carried out Number of days of water shut-off Outreach Mission Report	Once and as needed	IWRM Committee Operator	During the operation phase	Integrated into outreach missions by the IWRM Committee (see Table 20)

10. SITE INSPECTIONS

During the different phases of the drilling program, inspection will be carried out by the DGEF and the UNDP. It will assess compliance with the effective application of environmental mitigation measures. More specifically, it will determine, based on the regulations applied, whether these measures are adequate and effectively achieve the environmental and social protection objectives set.
In addition, the inspection will specify specific recommendations and/or penalties for non-compliance with the measures established in the ESMP.

10.2. ENVIRONMENTAL AND SOCIAL COMPLIANCE REPORTS

Table 22 below shows the process for reporting

Table 22: Reporting Framework

Report prepared by	Submitted to	Frequency
Contractor, environmental officer and site engineer	Project Manager, PMU	Monthly
Project Manager, PMU	Project Council	Semi-annually
Project Manager, PMU	UNDP CO	Quarterly

In addition to regular reporting, the Contractor will be required to report any major incident within 36 hours to UNDP. This includes an incident or accident related to the implementation of the project, with details of any incident of an environmental or social nature; and/or the nature of occupational health and safety; and/or the nature of public health and safety.

When a significant incident occurs, UNDP shall implement a stop work order until an investigation is conducted and all corrective measures are put in place to prevent further damage.

Contractors should minimize the impact that may result from construction activities and implement mitigation measures to prevent damage and nuisance to local communities and the environment. Remedial measures should also be implemented effectively during the construction phase.

10.3. Contractual relationships

Contractor shall comply with (but not limited to) the following:

- Comply with relevant legislation governing social and environmental safeguards and SES, including impact on human health.
- Undertake work within contractual requirements and other conditions.
- Assign one or more qualified and competent representatives to the site and participate in joint site inspections undertaken by the UMP, UNDP CO and responsible parties.
- Comply with the recommendations made by UNDP and DGEF officials during the follow-up visit.
- Ensure regular monitoring of environmental and social compliance.
- Maintain a record of all instructions, incidents and actions taken.

- Provide a compliance report to the PMU and the UNDP CO when requirements arise.
- Document grievances and recommend corrective action.

Failure to comply with the above would be treated seriously in accordance with the laws of the country and the contractual terms.

10.3.1. Legal reports

The following measures will be implemented:

- All environmental licenses and permits are complied with in accordance with legislative requirements.
- All instructions to contractors shall be in writing with the time frame for compliance and the consequences if deferred.

Construction activities must comply with environmental, OHS and social requirements.

11. CAPACITY BUILDING AND TRAINING

The capacity building and training activities for the drilling program align with the overall "Ensuring Climate Resilient Water Supply in Comoros" project, and are described below:

11.2. Training of network managers and operators

The effectiveness of the consideration of environmental and social issues in the implementation of activities will be achieved through the training of key technical staff involved in the validation, follow-up and monitoring of the implementation of identified mitigation measures. This training will benefit the following beneficiaries:

- The GGES agents who will be responsible for monitoring and following up on the implementation of the various measures indicated in the ESMP within the framework of this study, particularly for the execution phase of the project activities;
- The members of the future management committee of the network who will take charge of the management of the water system to be installed.

11.3. Awareness program for project beneficiaries

The outreach program for project beneficiaries will be established throughout the project implementation period. For greater effectiveness, it should also continue during the first year of project operation.

In this program, local associations and NGOs should be involved in the forefront. The main theme of this mission will be the drinking water supply sector and the natural and social environment. It will be carried out by an NGO with proven expertise in this field, supervised by GDEF.

The sensitizations will touch various areas, mainly the maintenance of the infrastructures to be installed, the management and preservation of water resources, the adoption of hygiene and sanitation rules, the empowerment of the project beneficiaries to respect the infrastructures to be installed within the framework of the project and to avoid the illicit exploitation of water and the promotion of equality/equity between sexes
In order to comply with the gender action plan, all trainings will have a target of 50% women.

11.4. Training for contract workers

The contractor is responsible for ensuring that systems are in place so that relevant contractor and subcontractor employees are aware of the environmental and social requirements of construction, including the ESMP. All construction personnel will attend an induction that covers health, safety, environmental and community requirements.

12. GRIEVANCE MECHANISM

The implementation of project activities may negatively affect, directly or indirectly, the beneficiary population. In this sense, a grievance mechanism is developed within the framework of the project to allow any person affected by the project activities to file a complaint.

The purpose of the proposed mechanism is to:

- Be a legitimate process to build trust between stakeholder groups and reassure them that their concerns will be assessed in a fair and transparent manner;
- To be accessible to all affected persons, and to provide adequate assistance to those who may have faced barriers to expressing their concerns in the past;
- Provide clear and known procedures at each step of the Grievance Mechanism process and specify the types of outcomes that individuals and groups can expect;
- To ensure fair treatment of all individuals and groups involved through a consistent and formal approach that is fair, informed and respectful of complaints and/or concerns;
- Provide a transparent process, keeping aggrieved individuals/groups informed of the progress of their complaints, the information used to assess their complaints, and the information about the mechanisms that will be used to address their complaints; and
- To allow for regular learning from experience and improvements to the Grievance Mechanism. Through ongoing evaluation, lessons learned can help reduce potential complaints and grievances.

13. ESTIMATED BUDGET FOR THE IMPLEMENTATION OF THE PGES

The budget for ESMP implementation is presented in **Table 23** below. This budget is part of the overall budget for the implementation of ESMF activities and the budget incorporated into the company's activities.

Table 23: Budget for ESMP Implementation

Designation	Cost (USD)	Observation
Social and administrative approach	1000	Incorporated into the company's budget during the preparation of the tender document
Hazard and risk management	3000	IDEM
Approaches to addressing gender-based violence	2000	IDEM
Various environmental measures	3000	IDEM
Waste management	5000	IDEM
Rehabilitation of the site	8500	IDEM
Environmental monitoring mission by the administration	3000	Incorporated into the overall budget for the implementation of ESMF activities
TOTAL	**25500**	

Appendix 1: List of fully protected species

Scientific name	Name in French	Comorian name
Mammals	Linvingstone Dogfish	Ndéma
Pteropus livingstonii	Small Comoros red wine	Nguva
Roussettus obliviosus	Dugong	Kima
Dugong dugon	Lemur mongoz, Maki	
Lemur mongoz	All dolphins and all	
Cetacea	whales	
Birds	Heron de Humblot	
Adrea humbloti	Peregrine Falcon	
Falco pregrinus	Buzard de Maillard	Panduzi, Ivanga, Bundibacangui
Circus maillardi	Drome ardéole	Mweya, Ngakanga, Lulu
Dromas ardeola	Pigeon of the Comoros	Ninga
Columba polleni	Comoros green pigeon	Chinding, Ndehu
Treron griveaudi	Founigo from Comoros, Pigeon	Msopve
Alectoenas sganzini	blue	Nakushiru, lulu
Otus capnodes	Anjouan Screech-Owl	Perachwa
Otus moheliensis	Mohéli's screech-owl	Narimudu, Kwasiru
Otus pauliani	Karthala Screech-Owl	Nyandronga, Nadonga
Hypsipetes parviriostris	Comoros Bulbul	Mbera-gog, Mbere
Turdis bewsheri	Comoro thrush	Ntuba, Shitsozi
Humblotia flavirostris	Karthala Flycatcher	
Nesillas mariae	Mohéli's warbler	
Nesillas longicaudata	Anjouan warbler	
Nesilas brevicaudata	Grande Comore Warbler	
Decrirus fuscipennis	Drogon of Grande Comore	
Zosterops mourouniensis	Mount Karthala White-eye	
Foudia eminentissima	Foudy from Comoros	
Nectarina comorensis	Souimanga of Anjouan	
Nectarina humbloti	Humblot's Sunbird	
Cyanolanius comorensis	Comoros Blue Artemia	
Reptiles	Green turtle	Nyamba

Scientific name	Name in French	Comorian name
Chelonia mydas Eretmochelys imbricata Dermochelys coriacea Ohurus cuvieri	Hawksbill turtle, hawksbill turtle scale Leatherback turtle Iguana of Grande Comore	
Fish Latimeria chalumnae	Levasseur outbreak	
Coral Antipathes dichoioma		Mtakamaka Mrikudi, Mremdu Mkafure, Mrobwa

Appendix 2: List of partially protected species

Scientific name	Name in French	Comorian name
Mammals Pteropus seychellensis Microchiroptera : Miniopterus mino Myotis goudoni Tadarila pumida	Roussette of Seychelles, of Comoros All microchiropterans	
Birds Agapornis cana Coracopsis nigra Coracopsis vasa Puffinus therminieri Tachybaptus ruffucolis Accipitridae, faloconidae Tytonidae Aredeidae Larids Charadriidae Scolopacidae	Inseparable grey-headed Parrot noi Vesa parrot Audubon's Shearwater Castrated Grebe All diurnal raptors and nocturnal except those in list I All herons and egrets All ducks All stenes, gulls All the beakers, knights etc	Mpwayi, karrarrowki Issui Kwendzou

Scientific name	Name in French	Comorian name
Sulidae Phoenicopterridae	All the crazies All flamingos	
Reptiles Gekkonidae Chamaeleontidae scincidae	All Geckos All chameleons All Mabuyas	
Fish carcharhinidae	For sharks and rays: The export of the fins is prohibited unless authorized	
Insects Lepidoptera	All butterflies, except the species to list I	
Mollusks Tridacnidae Cassidae Cymatiidae Cupraeudae Muricidae Chiton comorensis Pinctada capensis	The clams The helmets The conchs or newts The porcelain The Murex Pearl oyster	
Echinoderms Holothuridae and Stichopodidae	The Holothurians	Boo will be
Plants Cyatheaceae Orchidaceae Tambourissa leptophylla Corissa comorensis Euclae sp	Tree ferns The orchids	Kowray