AFRICAN DEVELOPMENT BANK GROUP

COUNTRY : REPUBLIC OF SENEGAL

Project to Reinforce Multiple-Use Water Supply along the Louga-Thiès-Dakar Road from the Keur Momar Sarr Treatment Plant

Date : March 2016

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

SUMMARY
1. INTRODUCTION

This environmental impact assessment concerns the project to extend the Keur Momar Sarr water treatment unit. In keeping with Senegal’s environmental legislation, the Senegal National Water Corporation (SONES) carried out an environmental and social impact assessment of its project to ensure that it complies with national laws and regulations governing the implementation of such a project. In addition to other regulatory instruments, the assessment is in line with the provisions of Section L48 of Law No. 2001-01 of 15 January 2001 on the Environmental Code and Article R38 of Decree No. 2001-282 implementing the said law which respectively provide that “any development project or activity that may affect the environment shall be the subject of an assessment” and “impact assessments shall be carried out prior to any administrative authorization required for the implementation of the planned activity.”

The methodology used in this assessment centred on the following research activities:

- holding of preparatory meetings with technical project officers. These meetings helped to trace the origin of the project and discuss its stakes and background and, thus, define the scope of the Consultant’s mandate. Documents belonging to interviewees were also consulted to that end. These meetings helped to exchange and upgrade available information.

- field trip to identify the impact area from the environmental, human and socio-economic standpoints, and to map out the assessment area (spatial and temporal boundaries of the project area). Based on this delimitation, the relevant environmental components were accurately described with respect to the project’s potential stakes and impacts.

- literature review which consisted in collecting relevant documents and information on the impact assessment area. It also focused on the legal framework (legal and regulatory instruments, local and national planning documents, etc.). Other information on technical project aspects was collected from the Promoter and technical services. The preliminary analysis of this information led to the identification of the relevant issues to be deepened and to the categorization of impacts. The field trip and surveys mainly helped to describe the (biophysical, socio-economic and human) environment of the site and its immediate environs.

The impact assessment report was submitted for validation by the Technical Evaluation Committee (TEC) under the supervision of the Ministry of Environment which uses very lengthy procedures. The technical pre-validation of the report was carried out on 17 May 2016. The compliance certificate will be issued as soon as the comments made by the Technical Evaluation Committee and last concerns of the population which may be raised during the final public presentation of the report are addressed. SONES and the Ministry of Environment will widely disseminate the validated final report.
2. **PROJECT DESCRIPTION AND RATIONALE**

The project to build a treatment plant in Keur Momar Sarr and reinforce multiple-use water supply along the Louga-Thiès-Dakar Road is a comprehensive project designed in a coherent manner. It will be jointly financed (in parallel) by the French Development Agency (AFD), the European Investment Bank (EIB), the Islamic Development Bank (IsDB), the World Bank (WB), the African Development Bank (AfDB) and the Senegalese Government. AfDB’s intervention will focus on multiple-use water control and the design of a component for the development of agricultural and market garden production infrastructure.

The main expected outputs are: (i) the construction of a third water treatment and pumping plant in Keur Momar Sarr (KMS3) with a production capacity of 100,000 m³/day; (ii) the laying of a distribution pipeline between the treatment plant and Thiès and between Thiès and Dakar over a distance of about 216 kilometres; (iii) the construction of two water storage reservoirs, each with a capacity of 10,000 cubic metres in Thiès, and three distribution reservoirs in Thiès, the Blaise Diagne International Airport (AIBD) and Diamniadio; (iv) the installation of anchor supply and distribution systems; (v) the extension of distribution systems and the installation of 85,000 social connections; (vi) the construction of support infrastructure for the production and marketing of agricultural and market garden products; and (vii) the design of an information, education and communication (IEC) programme to sensitize and assist the population before, during and after project implementation.

The project area covers the Dakar Region, the surrounding areas of Lake Guiers and areas located along the distribution pipeline. The project beneficiaries (about 3 million people) are the population in the areas mentioned above and the entire population in new development poles, particularly the AIBD area and Diamniadio urban centre. The selection of the project area is justified by the determination of the State and SONES to secure the supply of drinking water in Dakar, ensure the supply of drinking water to the population in production areas and along the distribution pipelines as well as the population in new development poles.

The project right-of-way is 216 kilometres long. Many localities located along this relatively long distance will be affected by pipe laying works. In fact, some twenty municipal councils will be affected by the works in the three project regions. Most of these municipal councils are located in the administrative departments of Louga (5), Kébémer (5) and Tivaouane (4). The others are located in Thiès (2) and Rufisque (2).

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The supply of drinking water to the Dakar Region plays an important role in the urban water supply sub-sector investment strategy. The production of drinking water for the Dakar Region represents 70% of national water production in the leased area. The study on the Water Resource Mobilization Master Plan in the Dakar Region and Petite Côte carried out by SONES in 2008 and updated in 2015 shows that if nothing is done to increase water production, the peak water production deficit will increase exponentially. The study findings show that this deficit will reach 202,017 m$^3$/day in 2025 and 390,888 m$^3$/day in 2035. Hence, the need to increase production in order to ensure and secure the supply of drinking water to the population. Furthermore, by helping to reinforce and secure drinking water supply to Dakar and new economic zones, the project will promote industrial and agricultural development in the project area.

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 The policy framework builds, among other things, on the following instruments:

The Emerging Senegal Plan (ESP) adopted in November 2012 by the Government is the country’s development strategy. It is based on the vision for the economic emergence of Senegal by 2035. The Priority Action Plan covering the 2014-2018 period is the reference document for the State, technical and financial partners, public-private partnership and the citizen participation in the medium term. The Senegalese Government’s ambition is to promote economic growth with a high impact on human development. Water and the environment play a key role through the strategic human capital, social protection and sustainable development thrust.

The Water Sector Policy Letter: the Government prioritizes the drinking water sector. This priority is reiterated in the Water and Sanitation Sector Policy Letter. In 2005, the Government designed the Millennium Drinking Water Supply and Sanitation Programme (PEPAM) through which the objectives of reducing poverty in the water and sanitation sector are pursued.
The Integrated Water Resources Management Action Plan (PAGIRE): PAGIRE promotes integrated water resources management which consists in promoting the allocation of water resources among competing uses in a manner to meet basic human needs and strike a balance between the need to preserve or restore ecosystems and their functions, particularly in fragile environments, and the need for water for agricultural, industrial and domestic use, without neglecting the need to preserve drinking water quality.

The Millennium Drinking Water Supply and Sanitation Programme (PEPAM): the programme approach principle referred to as the 2015 “Millennium Drinking Water Supply and Sanitation Programme (PEPAM)” was chosen as an operational tool for achieving the Millennium Development Goals.

3.2 The legal framework makes reference, among others things, to the following instruments:

- The provisions relating to the mandate of the Senegal River Development Organization (OMVS) which seek to ensure the concerted management of the Senegal River which is a common asset of member countries of the Organization. The provisions include: (i) the 11 March 1972 Convention on the Status of the Senegal River; (ii) the 11 March 1972 Convention establishing the Senegal River Development Organization (OMVS); (iii) the 21 December 1978 Convention on the Legal Status of Common Infrastructures; (iv) Resolution No. 89/CM of 5 January 1978 laying down the bylaws of the Permanent Water Commission; and (v) the Senegal River Water Charter (Resolution No. 5/GCCC of 28 May 2002).

- Senegal’s Water Code: a set of provisions established by the United Nations as basic principles for good water management, particularly in the health and pollution control domains. This code enshrines water as a public utility, making the resource a common asset. Thus, every promoter must obtain a prior authorization for the exploitation of water resources and, in particular, ensure that the resources comply with WHO health standards and the status of this resource as a common asset.

- The Environmental Code: it is the main environmental management instrument in Senegal. It governs all environmental sectors and provides guidelines for proper management which must be complied with irrespective of the domain concerned. Decree No. 2001-282 of 12 April 2001 was issued in keeping with the legal provisions of the Environmental Code. Sections L49, L50, L51, L52, L53 and L54 of the Code relate to environmental impact assessments. The legal provisions relating to EIAs have been the subject of implementing decrees.

- Prime Ministerial Circular No. 9 of 30 July 2001 on the application of the Environmental Code relating to environmental impact assessments.

Administratively, many entities are involved at various levels in the implementation of the project in particular and in the water supply sub-sector in general. These are notably the ministries in charge of the environment, water supply and sanitation, urban development, health and the interior. Given the right-of-way chosen and its consequences on the national road network, the Ministry in charge of Infrastructure, Transport and Road Access will be involved in the project as it will have to issue authorisations.
These ministries have departments that are responsible for the application of these sector policies. In addition to these central departments, there are decentralized State entities, namely local governments.

The analysis of the regulatory framework shows that Senegal has an efficient legal arsenal to support this project through the application of various codes and decrees related to the different project components. In keeping with regulatory instruments governing classified forests, the national road network, etc., the proper mainstreaming of the provisions of the Forestry Code, the Environment Code, and Decree No. 1445 of 4 November 2010 is vital for guaranteeing the project’s compliance with regulations. These provisions must also be aligned with the African Development Bank’s operational policies.

**Relevant international conventions:** Senegal has signed and ratified most of the international conventions relating to environmental protection. Those that are most relevant to the project to construct a third drinking water treatment plant in Keur Momar Sarr and its downstream reinforcements are:

- the United Nations Framework Convention on Climate Change;
- the Rio de Janeiro Convention on Biological Diversity;
- the Bonn Convention on the Conservation of Migratory Species of Wild Animals which seeks to preserve migratory species and their habitats;
- the 1968 Algiers Convention adopted by OAU Member States within the framework of the conservation and rational use of soil, water, plant and animal resources;
- the 1997 Kyoto Protocol on the Reduction of Greenhouse Gases;
- the Ramsar Convention on the Conservation of Wetlands of International Importance, particularly waterfowl habitats, commonly referred to as the Convention on Wetlands, is an international treaty adopted on 2 February 1971.

### 3.3 Conservation Policies

The relevant conservation policies and instruments applicable to the project are those of the Bank and the World Bank, the French Development Agency’s environmental and social risk management processes and the European Investment Bank’s Social and Environmental Principles and Standards. Concerning the Bank, the Operational Safeguard 1, Operational Safeguard 2 and Operational Safeguard 5 are applicable.
4. DESCRIPTION OF THE PROJECT ENVIRONMENT

The description of the project’s physical environment focuses on general data on climate, geology, hydrology, hydrogeology and the human environment in the areas covered by the project.

4.1 General Data on Climate

**Climate:** in the Northern region (where Lake Guiers is located), the ocean influences the coastal climate. Temperatures are relatively cool and the dry season is fairly long (8 months). Further south, the regions of Thiès and Louga have a Sahelian climate. This area is influenced by continental trade winds, making it hot and dry with irregular rainfall.

**Winds:** wind conditions are influenced by seasonal variations. Thus, northerly winds carry dry air during the dry season, while moist air is transported by westerly winds to Saint Louis and Louga and by north-westerly winds to Thiès and Dakar during the rainy season.

The average wind speed between Dakar and Saint Louis is 2.30 m/s to 5 m/s. Winds cause haze and rising sand, resulting in atmospheric filth and/or wind erosion in the regions of Louga and Thiès. In this south-western region of Lake Guiers, wind conditions are generally bidirectional throughout the year. The prevailing winds are northerly winds (84% of records where wind blows WNW to ENE), while south-westerly winds (ESE to SSE) represent only 9% of the records.

The data below were recorded at the Saint Louis Weather Station. These are statistics based on daily observations carried out from 7.00 a.m. to 7.00 p.m. between October 2005 and April 2015.

**Temperature:** they are generally high with daily and seasonal variations. The monthly temperature reaches its peak from September to October (28° C), while the minimum temperature is observed from December to January (24° C in Louga and Thiès, and 22° C in Saint Louis). Temperatures around Lake Guiers in the Keur Momar Sarr area range from 12° C to 40° C, with wide variations from January to March. During the cool dry season from November to February, temperatures vary between 12° C and 34° C, with low relative humidity. During the hot dry season from March to June, temperatures vary between 26° C and 40° C.

Sunshine can exceed 3,000 hours annually, with high radiation throughout the year (10 hours per day on average) and low evaporation during the rainy season, reaching its maximum in May.

**Annual rainfall:** in Senegal, high annual rainfall increases from the North (260 millimetres) to the South (600 millimetres) with a scarcity of rainfall from the East to the West. There is a shortage of rainfall, which is more pronounced in the North, throughout the country. Thus, 300 millimetre isohyets, which were located at the Senegal River, are at present about 120 kilometres further south. The Keur Momar Sarr station indicates an average rainfall of about 385 mm/year over the past 15 years.

The stations of Kébémer, Louga, Tivaouane and Thiès confirm a very large inter-annual variation in rainfall with exceptionally wet years, that is, 2005, 2008 and 2010. Though the records of recent years suggest a return of the wet cycle, rainfall levels are still low.
4.2 The Geological and Geomorphological Framework

ALG3 pipelines cross different geological settings between the regions of Louga (from Keur Momar Sarr) and Dakar. The geology near the lake is dominated by Quaternary formations which, due to a deficiency of the Continental Terminal, directly lie on Eocene limestone and marl limestone formations. The Quaternary is represented in the Keur Momar Sarr area by dunes lying on gravelly ferruginous cuirass in some areas. The dunes are of two types: ogolian red dunes which are vestiges of the average great Quaternary erg that was significantly levelled and more recent yellow dunes. The Eocene is represented by marls, marl limestones and limestone.

Further south-west in Louga Region, the geology is dominated by Quaternary formations with the absence of the Continental Terminal. The Quaternary is represented by sand and sandy clay formations, while the Eocene in this area is dominated by Lutetian limestone with an average thickness of 70 metres and even forms a very large aquifer.

In the Thiès Region, Continental Terminal formations lie between Quaternary and Eocene formations. The area of Thiès also has a Tertiary sub-outcrop due to major tectonic action that brought into contact formations of different ages accompanied by major volcanic activity. Eocene formations are represented by marl, limestone and clay with frequent phosphate dales.

From a geomorphological standpoint, the area is characterized by a relatively flat relief. The only elevations are dunes and the Thiès Plateau.

4.3 Hydrogeological Context

There are abundant groundwater resources which are located in the different geological formations described above. Three major aquifer systems are found in this area, namely:

- The superficial system contained in Quaternary and Continental Terminal formations. This system is generally exploited as village wells throughout Senegal. The use of these aquifers in the lake area is limited by salinization. In Louga Region, this aquifer is located in the Quaternary sands of the Northern Coast and is therefore called “Northern Coast Sandy Water Table”. In Thiès Region, this system is represented by the sandy and clay formations of the Quaternary and Continental Terminal, forming an aquifer that is extensively used by the rural population for domestic water supply.

- The intermediate system represented by Tertiary limestone formations. In the Louga area, this system is represented by Lutetian limestone forming a very productive aquifer used by many boreholes. In fact, this water table can have flow rates of 150 m³/h for a groundwater lowering of 1 metre. In the Thiès Region, the Palaeocene and Eocene limestone formations are extensively used for DWS in the town of Thiès and its environs, but also to reinforce DWS in the city of Dakar.

- The deep system represented by Maastrichtian formations is by far Senegal’s most important aquifer. The aquifer consists of a chain of sand, sandstone and clay. This aquifer is utilised by many water works in the Louga and Thiès area.
4.4 Pedology

The project area has a great soil diversity. Thus, the landscape of Lake Guiers is characterized by two morphopedological entities mainly comprising Quaternary formations:

- Diéri, dewatered area which is a plain located on either side of the hydrographic axis. It supports sub-arid soils whose texture has a high proportion of sand on which thin thorny vegetation grows;

- Take, a frequently flooded zone, is a depression that is home to Lake Guiers. Take soils are waterlogged. They support herbaceous and shrub vegetation that is the main characteristic of hydroseres (vegetation of water-related ecosystems).

Soil formation around the lake is mainly influenced by the rise and fall of water levels and the different types of relief. In total, there are two main categories of soil around Lake Guiers: zonal soils and intra-zonal soils. Types of zonal soils mainly include tropical sub-arid soils which in turn comprise two sub-types:

- brown modal and waterlogged intergrade soils near Lake Guiers;

- red-brown sandy and sandstone soils overlying ogoliens dune ergs west of Lake Guiers.

Isohumic brown and red-brown soil is found north-east and west of Lake Guiers. Brown soils are characterized by a dark colour extending right to the parent rock with a low organic matter content of about 1%. Red-brown soils cover the Ferlo River and the north-eastern part of Lake Guiers. They are generally more than 2 metres thick. The south-eastern part of the lake is occupied by leached tropical ferruginous soils without concretions.

The main soil formations in the area crossed by pipelines between Louga and Tivaouane are red-brown soils found north-west of Louga and ferruginous tropical soils in the rest of the groundnut basin. However, between Tivaouane and Thiès, these soil units are intercalated by the hydromorphic soils found in the fossilized Car-Car valleys and the extensions of the Sine-Saloum. Near the town of Thiès and below the eponymous plateau, tropical ferruginous and waterlogged soils alternate. The Thiès Plateau is a large natural reservoir that is conducive to the development of this type of soil. Towards “Point K” in Sébikhotane, ferruginous soils still dominate with a strong presence of lithosols and vertisols.

4.5 The Hydrological System of Lake Guiers

Surface water resources are mainly represented by the Senegal River/Lake Guiers system. The Senegal River stretches over a distance of 1,800 kilometres from Guinea and its watershed covers an area of 268,000 square kilometres. OMVS, which has implemented major projects, including the Diama dam, the Manantali dam and the rehabilitation of delta embankments, has carried out many studies on its system.

Lake Guiers is a NNE-SSE depression some 50 kilometres along the left bank in the delta region. It is fed by river waters at Richard-Toll through a canal which replaced the old meandering backwater of the Taoué River in 1974. The lake is an important reserve of fresh water for irrigation and drinking water supply. The lake is 2.5 metres high at Ngïnth with a surface area of about 307 square kilometres and a volume of 781 million cubic metres.
The development of the water body led to rectification of the old marsh creek of the Taoué River, the construction of two bridge-dams in 1947 and 1980 and ring dikes. The dikes which cut off the lake from the Ndial depression were built in 1951 and later completed by dikes on the East banks constructed in 1981 by the Sugar Company to secure its 8 000 hectare sugarcane plantations (Cayor Canal Impact Assessment Report).

Lake Guiers can be divided into three main zones:

- the northern zone, diked at its northern end by CSS sugar-producing areas;
- the central zone where pumping by SONES is carried out and where some private farms have recently been established;
- the southern zone which is limited to its end by the Keur Momar Sarr dike, separating the lake from Ferlo Valley. This is where SONES’ water treatment plant, operated by the SDE, is located.

At present, the capacity of the lake’s hydrological system is being significantly increased from 1.2 billion cubic metres to 2.3 billion cubic metres to meet its various uses thanks to improvements carried out by the Project to Restore the Ecological and Economic Functions of Lake Guiers funded by the Bank. All the dikes and lake management structures have been fully rehabilitated, thus improving not only the lake’s storage capacity, but also the system’s hydraulicity and, hence, the water quality.

4.6 Human Environment

The project impact area cuts across rural and urban areas. Thus, there are big urban centres such as Louga, the regional capital, with a population of about 90,000, Kébémer with more than 17,000 inhabitants which polarizes a large neighbouring rural area, Mekhé with about 18,000 inhabitants, and Tivaouane council, a religious centre influenced by the Mboro industrial pole, with more than 50,000 inhabitants. For its part, the town of Thiès, which is Senegal’s fourth largest urban centre, is located in another demographic area with a population of about 350,000. The population of the area is mainly made up of the Wolof, but some areas are also inhabited by the Peul.

From the socio-economic standpoint, the project impact area is fairly homogeneous and helps to clearly distinguish rural areas where activities revolve around farming, livestock breeding and petty trade, and urban centres where a small industrial fabric is developing (Louga, Thiès and Tivaouane), but which is still dominated by tertiary activities such as trade and handicrafts. It is worth mentioning here that many human settlements along this route will be affected by the project due to the parallelism between the projected pipeline right-of-way and National Road No. 2 (RN2).
5. PRESENTATION AND SELECTION OF PROJECT OPTION

This section presents and analyses the different alternatives considered to achieve project objectives, including the “without project” option. The alternatives should be compared in terms of their technical, economic, environmental and social feasibility, including public concerns.

A comparative analysis of the “without project” and “with project” situations, and the different possible alternatives of reinforcing water supply in the Dakar Region was carried out through cross-sectional analysis of:

- the methods of transfer and in situ capture and treatment of water;
- the treatment alternatives planned for the Keur Momar Sarr treatment plant;
- alternatives for the chlorination of the reservoirs in Thiès;
- the right-of-way alternatives for the ALG pipeline.

5.1 Analysis of the “With Project” or “Without Project” Alternatives

In view of these two issues which could significantly affect the quality of life of the population, the implementation of the project to extend the Keur Momar Sarr treatment plant and its downstream reinforcements is easily justified because it will help to ease the drinking water shortage in the region through the additional production of 100,000 m³/day. Though this project is feasible in view of current challenges, the a priori environmental balance sheet of the implementation of this project suggests that it will have many negative impacts on the different ecosystems concerned the scale and scope of which should be mitigated through appropriate and efficient mitigation measures. Furthermore, the social impact of the project is real considering that 893 lots comprising farmlands, allotments and places of business will be affected by the project, hence the need to prepare a Resettlement Action Plan to compensate for the losses suffered.

In Situ Water Transfer and Treatment Alternatives

The options of supplying water in a locality are numerous and their relevance is subject to several factors, notably:

- the resource availability;
- the resource quality;
- investment and operating costs of facilities.

Transfer of Water from the Boreholes of Pout and Sébikhotane Alternative

This water quality problem is also real regarding the boreholes of Pout and Sébikhotane. The comparative analysis of the physical and chemical characteristics of the water with the WHO Guidelines for Drinking water quality shows that the iron content is well above the maximum acceptable limit of 0.3 mg/l.
**In Situ DWS Alternative**

Against this backdrop, the level of contamination of the water table compromises the sinking of boreholes to capture underground water, thus necessitating the adoption of a controlled urbanization policy, particularly regarding the construction of collective sanitation facilities which minimize the infiltration of wastewater into the table. This assessment currently explains why the boreholes of Thiaroye have been disconnected from the water supply system in the Dakar Region.

**Transfer of Water from Lake Guiers Alternative**

The Keur Momar Sarr water treatment plant, through its two production systems, satisfies 40% of the water needs of the Dakar Region. At present, this option of transferring drinking water from Lake Guiers is the best solution for meeting the water needs of Dakar.

**Seawater Desalination Alternative**

In its “Master Plan for the Mobilization of Water Resources in Dakar Region and Petite Côte” by 2025, SONES plans to build a 75,000 m³/day capacity desalination plant (reverse osmosis) on the Mamelles site in Dakar. This capacity will be developed according to the following phases: 40,000 m³/day in 2014, 60,000 m³/day in 2017 and 75,000 m³/day in 2020. It should be noted that this alternative requires specialized expertise and has not yet been tested in Senegal although the process of reverse osmosis has already been experimented in small-scale projects.

**DWS from the Tasset Well Field Alternative**

The hydro-chemical features of the Tasset zone were assessed based on previous data (during the acceptance) of facilities and data obtained from a network of 17 boreholes in March 2014. The chemical analyses conducted on the 17 facilities in the Tasset zone showed that water with a conductivity of less than 1500 μs/cm has a chloride value of less than 250 mg/l (standard limit value). The pH values vary between 6.3 and 8.2. Similarly, the fluoride value is very low, that is below 1 mg/l.

Studies carried out under the Integrated Water Resources Management Action Plan in the Groundnut Basin (PAGIRE-BA) have shown that the Tasset zone has a great potential, despite the occurrence of brackish water to the SE and NE. Its flow towards freshwater zones could damage freshwater within 30 years.

**5.2 Comparative Analysis of Various DWS Alternatives**

The various alternatives identified were analysed in terms of advantages and disadvantages from the technical and economic standpoints. The results of this analysis are presented below. The comparative analysis of the alternatives reveals two major findings:

- The in situ DWS option is limited by the high nitrate content of the Thiaroye water table due to the non-compliance of standalone sanitation facilities in the suburbs of Dakar. However, seawater desalination is an alternative that can be developed considering the large volume of water that can be collected to address the problem of water shortage in Dakar once and for all. Such a project, however, requires proven expertise which is not yet available in Senegal due to lack of a similar experiment. To this should be added high investment and operating costs, not to mention the environmental and social impacts of this option.
The surface water transfer option is well-tested in Senegal with the two systems being operated from Lake Guiers located in Keur Momar Sarr and in Ngnith. The development of a third system in the coming years will help to find a lasting solution to this nagging problem of water supply in the city of Dakar and also to contribute to water resource conservation. Compared with the transfer of water from the Tasset well field, the transfer of water from Lake Guiers seems to be the best option because:

- it helps to preserve water resources, in accordance with the relevant Government policy;
- it helps to mobilize larger volumes of water unlike in the Tasset well field where the volumes of water that can be mobilized are estimated at 20,000 m$^3$/day without the risk of affecting the piezometric level of the water table.

6. POTENTIAL IMPACTS AND MITIGATION AND COMPENSATION MEASURES

6.1 Positive Project Impacts

The implementation of this project will provide many positive benefits which will be visible during the works implementation and water supply facility operation phases.

During the works implementation phase, the project will have positive economic and social impacts. The project has a high capacity for the recruitment of skilled and unskilled workers whose number is estimated at about 800.

During the operation phase, the positive project impacts will be more visible during the functioning and operation of planned water supply facilities. One of the main benefits of the project is the significant reduction in drinking water shortage in the region of Dakar, and the rural and urban areas crossed by the pipeline. The regular supply and significant reduction in service disruptions will have a positive impact on social tension exacerbated by water shortage in the region, but also on the purchasing power of households which are often obliged to buy quality drinking water from private suppliers.

6.2 Negative Project Impacts

6.2.1 During the construction site building phase, the following impacts could occur:

- pollution of the water body by solid waste, hydrocarbons and wastewater;
- propagation of suspended particulates on the water body and in the settling and leaching tanks of KMS1 and KMS 2 plants which are not covered;
- contamination of the water table by domestic wastewater;
- the degradation of vegetation cover;
- exposure of workers to diesel explosion risks.

To mitigate these impacts, it will be necessary to take specific mitigation measures for the construction of the Contractor's workers’ camp.
6.2.2 During the construction phase, the potential impacts will be:

(a) **Pollution of the water body by works at the lake**: water intake installation works at the lake may lead to temporary disruption of the water body with the stirring of mud and phytoplankton. This impact will be temporary and much localized. It will be mitigated by using specific water intake installation techniques.

(b) **Soil contamination**: the risk of soil contamination by oil leaks which can be easily mitigated by strict compliance with machinery management rules.

(c) **Air pollution** with dust generation during the movement of machinery. It will be localized in work sites and may be mitigated by wetting sites.

(d) **Generation of waste**: bush-clearing, weeding, vacation of the plant’s right-of-way and platform preparation, excavation, earthworks, stripping, etc. will generate large amounts of waste. This waste may be of various types: inert rock waste, arable underlay, PVC piping residue, contaminated paint packaging, solvents, hydrocarbon tank, etc. The mitigation measures recommended are:

- recycling non-hazardous waste as backfill material;
- conveying non-recycled waste to disposal mounds;
- setting up garbage bins on the construction site;
- cleaning and restoring work sites;
- contracting an enterprise for the recovery of used oils and cartridges.

(e) **Sound nuisances**: the works implementation phase will certainly cause sound nuisances, particularly for construction site and KMS1 and 2 treatment unit operation workers. The sound nuisances will be caused by machinery (cranes, sawmilling machines, generators, rolling stock, generators, etc.). The noise and vibration associated with the project will be mainly generated during the following phases:

- vibratory driving works;
- foundation preparation and concrete unloading works;
- metal structure construction;
- the movement of construction equipment;
- the operation of generators; and
- surface compaction.

The following mitigation measures will be recommended:

- Selection of equipment that comply with the 85 dB to 1 metre standard;
- Wearing of noise-proof helmets by construction and operation workers;
- Use of generators that comply with the 85 dB to 1 metre standard;
- Planning site construction refuelling hours;
- Maintaining pneumatic tools, machines and equipment to limit the noise generated to acceptable levels.

(f) Risk of accidents: accidents involving the population may occur if appropriate measures to regulate vehicle traffic are not taken. Contractors’ workers also face the risk of accidents when operating heavy construction machines, handling sharp tools and flammable products. These accidents are mainly faced by workers recruited locally who are often inexperienced and are sometimes unaware of hazards in construction sites.

(g) Degradation of vegetation cover: the main species identified in the treatment unit right-of-way are thorny species dominated by Prosopis Juliflora which is an unprotected plant species. Bush-clearing and weeding will certainly result in the complete destruction of the existing vegetation cover of the site. The regeneration of the vegetation cover will be carried out to restore the local ecosystem after the completion of works.

(h) Increased risk of STD and HIV/AIDS infection: the workers of contracting firms often interact directly with the local population with the potential risk of either group transmitting sexually transmitted diseases, including HIV/AIDS. This risk is even higher as the local population or outsiders are not often informed about the methods of transmission and prevention. The population of the project area as a whole is not yet aware of the risks related to this pandemic and practically refuse to recognize its existence or simply tries to ignore it. The measures recommended include:

- the conduct of regular inspection of compliance with health, hygiene and safety measures;
- voluntary testing of foreign workers hired;
- raising the awareness of workers and the population about testing, protection, abstinence and the stigmatization of patients;
- distribution of condoms to workers.

(i) Temporary disruption of utility networks: the right-of-way of the ALG3 pipeline will cross several road and rail infrastructures between the Keur Momar Sarr plant and Point K in Sébikhotane, namely:

- National Road No. 2 (twice): first at Louga and again at Lam Lam;
- National Road No. 3 at the junction between the South Thiès bypass road and RN3;
- National Road No. 1 at Sébikhotane to “Point K”;
- The railway network (thrice) at the portions managed by Transrail, once at the portion managed by Industries Chimiques du Sénégal (ICS), and once at the Mineral Deposits Limited (MDL) junction in Mékhé.
The laying and removal of pipes on the pipeline right-of-way are governed by Decree No. 2010-1445 of 4 November 2010. This decree specifies the statutory provisions to be adopted by the Promoter, SONES, which are applicable to this project. These include the following measures:

- SONES will obtain an authorization issued by the Ministry of Transport, Infrastructure and Road Access;
- AGEROUTE will validate the consistency of works, the site plan, and the signage plan;
- Access to the property of local residents, runoff water and drainage in existing pipes will be constantly assured during and after the execution of works;
- Building materials (sand, concrete blocks, gravel, wood, iron, tiles, cement, etc.) will be stored outside the right-of-way;
- Regarding the railway, the legal provisions relating to crossing will be applied, in collaboration with the Ministry of Transport.

(j) Loss of assets: the vacation of the ALG3 pipeline right-of-way will lead to the loss of assets in terms of land along the pipeline between Keur Momar Sarr and Point K in Sébikhotane. The plot surveys carried out within the framework of the Resettlement Action Plan estimate the number of project affected persons (PAPs) at one thousand six hundred and six (1,606). These PAPs are mainly owners of farmlands, allotments and places of business. Most farmlands are partially affected, while many built-on plots will require full displacement to completely vacate the pipeline right-of-way for safety reasons.

The ALG3 pipeline right-of-way will also affect some sensitive institutions such as schools and health posts, but also three cemeteries and religious family homes. The sensitive nature of these infrastructures often requires optimization to avoid impediments to the vacation of rights-of-way.

Several mitigation measures are required to minimize socio-economic impacts, in accordance with national regulations and the African Development Bank’s conservation policies. To significantly reduce the project’s impact on the loss of assets and/or livelihoods by project affected persons, a Resettlement Action Plan (RAP) is being prepared in accordance with Operational Safeguard (OS) 2: Involuntary resettlement: land acquisition, displacement and compensation of the population. The RAP will help to accurately assess the loss of assets and determine the cost of compensating PAPs. It will also define conditions for assisting PAPs, particularly the most vulnerable ones so as to significantly minimize the social impacts of the project. Regional property development expenses assessment committees will be actively involved in this process in order to determine all social intermediation actions and define project rates and support for the vacation of the right-of-way. To ensure the proper mitigation of these impacts, it is recommended that the works should be limited in the rainy season to enable the cultivation of the land located on the ALG3 pipeline right-of-way.

6.2.3 Negative Impacts during the Project Facilities Operation Phase

(a) Water pollution: the operation of the drinking water supply system in itself will not affect the biological environment. Besides the impact of human activities, the environment’s biological trends are regulated by the method of managing the lake’s water level (constant level with continuous intake from the river, or annual sluice intake with episodic disconnection of River Senegal.
The real risks are:

- discharge of storm water containing hydrocarbons and other pollutants;
- direct discharge of wastewater onto the water body;
- discharge of oily substances, etc., from maintenance equipment and handling machines used; and
- discharges from sludge drying lagoons.

The following measures will be recommended:

- installation of separators to isolate hydrocarbons and other pollutants;
- management of hydrocarbons and other pollutants by an approved entity;
- building of tanks for collecting hazardous wastes;
- establishment of a wastewater management mechanism;
- creation of a settling basin for collecting non-compliant discharges.

(b) **Social conflicts:** public consultations held with the population of Keur Momar Sarr showed low access to drinking water in the municipal council, despite the presence of a plant which meets 40% of the water needs of the Dakar Region. This situation is considered by the population as lack of consideration. The project recommends the following solutions:

- reinforcement of the municipal council’s DWS network;
- rehabilitation of the school opposite the council building;
- construction of two public urinals in the council.

(c) **Industrial accidents:** many types of industrial accidents may occur during the Keur Momar Sarr water treatment plant operation phase. They include accidents related to handling operations and the movement of machines.

The following measures have been proposed:

- lighting of dark passages;
- cleaning and maintenance of work platforms;
- marking out risk areas;
- reducing the lengths of electric extension cables;
- building parapets;
- wearing of anti-skid shoes and protective helmets.

(d) **Flooding of facilities:** the Keur Momar Sarr water treatment unit could be exposed to floods in case the ALG3 pipeline breaks. The pressure of the pipeline leading from the plant is very high and often reaches 27 bars, that is, a waterhead of 270 metres. Any breaking of the pipeline could heavily flood the plant, affect the water treatment facilities and put the plant out of service.
Consequently, the design of KMS 3 should be consistent with the design approach developed in subsequent phases by boxing up the facilities. The raising of the facilities could substantially minimize the possible in situ breaking of the pipeline.

6.2.4 Cumulative Project Impacts on the Water Body

Discharges from the Keur Momar Sarr plant, combined with those from agricultural surface run-offs around the lake and plants X6 and X7 of the Senegalese Sugar Corporation (CSS) are sources of pollution of Lake Guiers. Thanks to the rehabilitation of the regulation structures of the Richard-Toll and Keur Momar Sarr plants under PREFELAG and the positive trends in the lake’s water properties in terms of volume, farms, especially in the area of agri-business, and some major agricultural projects such as PRODAC are being developed. These projects are heavy consumers of phytosanitary products, just like the facilities of the Senegalese Sugar Corporation and the Grands Domaines du Sénégal.

Drainage from these facilities towards the lake will be a real threat to the quality of the water body if appropriate mitigation measures are not taken to manage such drainage water. Consequently, to address the cumulative impacts of the various projects including the project to extend the Keur Momar plant, for which the quality of the lake’s water is of prime importance, the following measures are required:

- control of phytosanitary products used on the various farms;
- establishment of a system for pre-treatment of water at CSS’ plants X6 and X7;
- ensuring the impermeability of facility drainage canals;
- interception of drainage water at a collection point equipped with a unit for pre-treating water before discharge into the lake.

**Environmental pollution by sludge:** Two new lagoons will be built in the new Keur Momar Sarr treatment plant, in addition to those of the existing plants. As is the case with the existing unit, sludge is channelled to the lagoon and then dried. The dried by-products are subsequently stored within the plant premises. This approach is not viable environmentally and requires special measures for better management of these water treatment by-products. On the whole, sludge does not have a high fertilizing element content (carbon: 2%, nitrogen: 1% to 2% and phosphorus: 0.2% to 2%), but can, however, be used as manure in the form of liming material and for land restoration. The following measures must be taken:

- establishment of a sludge thickener;
- development of concrete-compartmentalized drying beds;
- making lagoons watertight;
- development of areas for movement of maintenance machines;
- construction of dry sludge storage sheds;
- physico-chemical analyses of sludge before any use as manure.
7. ENVIRONMENTAL RISKS AND CLIMATE CHANGE

7.1 Project-related Environmental Risks

The technological risk analysis was conducted systematically as indicated in the impact assessment report. It is aimed at identifying situations which can lead to an accident, and analysing related safety barriers (prevention measures, protection and intervention means, etc.). In fact, it entails:

- reviewing internal failures: product-related hazards, facility dysfunction-related intrinsic failures, poor design or operation of equipment;
- reviewing external failures (natural risks, etc.);
- identifying potential hazards;
- analysing experience feedback, notably accidents and incidents recorded, and the various risks identified.

The Senegal National Water Corporation (SONES), which is the project initiator, will update its safety, hygiene and environmental plan to better prevent and address any risk of accidents. The staff responsible for safety will also be trained in new emergency prevention operation techniques.

7.2 Climate Change

The project has been classified under Environmental Category 3 following the climate screening conducted by the Bank. This category comprises projects that are not vulnerable to climate change-related risks. The climate change impact on the lake water level is deemed low owing to far-reaching changes in the hydrological behaviour of Lake Guiers following the building of the Diama and Manantali dams. The lake water level is increasingly stable and level fluctuations are low. Since the building of the Diama and Manantali dams, the hydrology of the lake has continued to react to the new dynamics characterized by greater water intake. The Lake Guiers water level is progressing towards probable stability throughout the hydrological year. During an entire year, the lake water level stands at below or above 2.00 m, recording a height of over 2 m each month, except for August (1.97 m), with a maximum of 2.19 m in October. Very frequent fluctuations in water level in the past are now rare occurrences. There has been a sharp drop in the magnitude of seasonal water level fluctuations, with the level remaining constant and high almost throughout the year. Such a situation is characteristic of continuous flow of water into the lake from the river throughout the year.
8 ENVIRONMENTAL AND SOCIAL MONITORING PROGRAMME

8.1 Environmental Surveillance Mechanism

Environmental surveillance comprises all inspection, control and intervention activities aimed at ensuring that:

- all the environmental protection requirements and conditions are effectively fulfilled before, during and after works;
- the environmental protection measures prescribed or provided for are taken and enable the achievement of set objectives; and
- the risks and uncertainties can be managed and corrected in due course.

Environmental surveillance mainly concerns compliance with the environmental protection measures recommended in this study. Surveillance helps to control the effectiveness and efficiency of these measures. Surveillance activities must result in the production and dissemination of the surveillance report. In that connection, a surveillance programme will be prepared and implemented by SONES’ environmental monitoring official, with the support of control firms and the beneficiary population.

8.2 Environmental Monitoring Mechanism

To implement the ESMP, a multisector institutional arrangement will be established to take into account all project problems. To that end, an environmental monitoring committee comprising the following entities will be set up:

- the Directorate of Environment and Classified Establishments (DEEC);
- the Directorate of Water Resource Management and Planning (DGPRE);
- the Lake Guiers Authority;
- the Regional Hygiene Service; and
- the Directorate of Civil Protection.

The involvement of DGPRE and OLAG is all the more relevant as these entities are members of the Technical Committee of the National Strategy for Improving and Monitoring Water Quality in Senegal. This committee is governed by Order No. 08.04.2013 of the Ministry of Water Resources and Sanitation. DGPRE provides secretarial duties for the committee.

(a) Institutional Mechanisms and Capacity Building Needs

SONES’ organizational structure does not include an environmental unit to ensure the proper management of its major projects in line with the national regulations governing the environment sector. So far, the engineer in charge of environmental issues does not have all the tools and the organizational set up required to correctly address environmental issues. An environmental unit will be set up within SONES with the recruitment of an "environmentalist" with at least 10 years of experience to back the designated specialist in properly addressing environmental issues. In addition, the technical capacity of SONES’ engineer responsible for environmental issues will be built. The capacity of SONES’ Directorate of Studies and Planning to mainstream environmental issues will also be built.
9 PUBLIC CONSULTATIONS AND INFORMATION DISSEMINATION

A public consultation was conducted from 25 September 2015 to 9 October 2015 through collective information and discussion sessions with technical services and the population residing within the project area. It continued through individual discussions with the various institutions mentioned above.

The approach prioritized group and individual discussions with programme stakeholders. These types of individual or group discussions, conducted on the basis of a checklist prepared beforehand, foster the collection of in-depth elements of analysis. The flexibility and low directivity of the mechanism help to collect the testimonies and interpretation of stakeholders by respecting their own reference framework, their language and their education. The selection of the stakeholders consulted is based on their direct or indirect involvement at any level (national, regional, local, etc.) in the design and/or implementation of a programme for access to quality water in sufficient quantity. The entities and stakeholders met are numerous and varied, namely:

- the local governments concerned by the project, particularly the Keur Momar Sarr municipal council;
- regional and national technical services, including the Directorate of Water Resource Management and Planning (DGPRE), the Lake Guiers Authority (OLAG), the Directorate of Environment and Classified Establishments (DEEC) and its regional office, the Thiès Regional Inspectorate of Forestry, the Regional Directorate of Water Resources, the Regional Hygiene Service, AGEROUTE, Transrail, SENELEC, etc.;
- producer organizations, notably farmers and the Senegalese Sugar Corporation; and
- the population of Keur Momar Sarr municipal council.

The results of these discussions and meetings are contained in the impact assessment report.

10 SUPPLEMENTARY INITIATIVES

10.1 Resettlement Plan

The project will entail the resettlement of one thousand six hundred and six (1,606) affected persons (PAP) as a result of encroachment on farmlands, allotments and places of business. The project has prepared and will implement a Comprehensive Resettlement Plan, in compliance with the Bank’s Operational Safeguard 2 (OS2). Compensation measures and public consultations are being finalized. Before commencement of works, the process will be closed and property development expenses paid in total compliance with the provisions of OS2 and the regulatory instruments in force in the country. SONES will be responsible for monitoring and evaluating the process and settling disputes.

Details of the Resettlement Plan are contained in a summary attached to this document as annex.
10.2 Compensation Measures

The planned compensation measures primarily concern the reinforcement of the DWS network of the Keur Momar Sarr municipal council and the other localities crossed by the pipeline, the rehabilitation of the school opposite the council building and the construction of two public urinals in the council. In addition, special support will be provided for women (income-generating activities) as part of resettlement support.

11 CONCLUSION

The environmental management measures taken under this project meet country and Bank requirements. They take into account, in an exhaustive and concerted manner, the most appropriate solutions for achieving project environmental compliance.

12 REFERENCES AND CONTACTS

- The Environmental and Social Impact Assessment.
- The Resettlement Action Plan.
- The Project Preparation Document.
- Works-related technical studies.

Contact Persons

- Souleye KITANE, SNFO/AfDB, Ext. 6541 s.kitane@afdb.org
- Mahécor Ndiaye, Water and Sanitation Engineer, OWAS1, Ext. 2695 m.h.ndiaye@afdb.org
- Ada Ndao, SONES, Senegal,
- Papa Mamadou MANGANE, Consultant, H2O ENGINEERING: Tel. +221 33 832 00 8, Email: h20@orange.sn
## TABLE I
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF THE "TREATMENT UNIT" COMPONENT

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Environment</th>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Monitoring Indicators</th>
<th>Responsible Entity(ies)</th>
<th>Frequency</th>
<th>Overall Cost (CFAF)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Installation</td>
<td>Water body (Lake Guiers)</td>
<td>▪ Fecal contamination ♦ Increased water body turbidity</td>
<td>▪ Installation of public toilets without direct contact with the ground, at a rate of one toilet per 15 people, to be emptied outside the site by specialized companies ♦ Installation of a wash-hand basin ♦ Setting up of boards to raise awareness on hygiene and sanitation best practices ♦ Compliance with the statutory distance between sanitation facilities and catchment and storage areas</td>
<td>▪ The site has mobile toilets ♦ Toilets have a washbasin and a soap dish ♦ Awareness-raising boards are put up in the workers’ camp ♦ The distance between toilets and the lake is at least 15 metres ♦ Availability of tippers for storage of non-reusable debris</td>
<td>▪ Contractor ♦ Sub-contractors</td>
<td>▪ Control Mission ♦ Environment Monitoring Committee</td>
<td>▪ During the construction site installation phase</td>
<td>▪ 850,000</td>
</tr>
<tr>
<td></td>
<td>Air</td>
<td>▪ Emission of dust particles</td>
<td>▪ Regular watering of site access roads ♦ Protection ♦ tarpaulin on trucks transporting fine sand and materials ♦ Wearing of personal protection equipment by construction site workers ♦ Reduction of open-air sand storage or covering of sand with tarpaulin, if necessary</td>
<td>▪ Number of trips made by watering trucks ♦ Trucks transporting materials are equipped with tarpaulin ♦ Workers wear PPE</td>
<td>▪ Contractor ♦ Sub-contractors</td>
<td>▪ Control Mission ♦ Environment Monitoring Committee</td>
<td>▪ During the construction site installation phase</td>
<td>▪ 12,500,000</td>
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<tr>
<td></td>
<td>Soil</td>
<td>▪ Soil contamination by hydrocarbon products</td>
<td>▪ Regular maintenance of site machines in approved services</td>
<td>▪ Fact sheet for trucks ♦ Truck maintenance and servicing record</td>
<td>▪ Contractor ♦ Sub-contractors</td>
<td>▪ Control Mission ♦ Environment Monitoring Committee</td>
<td>▪ During the construction site installation phase</td>
<td>▪ 8,750,000</td>
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<td></td>
<td>Flora</td>
<td>▪ Degradation of vegetation cover</td>
<td>▪ Avoid felling partially or fully protected trees ♦ Beautify the workers’ camp by regenerating the vegetation cover</td>
<td>▪ Vegetation cover is observable in the workers’ camp ♦ Number of trees planted in the workers’ camp</td>
<td>▪ Contractor ♦ Sub-contractors</td>
<td>▪ Control Mission ♦ Environment Monitoring Committee</td>
<td>▪ During the construction site installation phase</td>
<td>▪ 8,900,000</td>
</tr>
<tr>
<td>Source of Impact</td>
<td>Environment</td>
<td>Impacts</td>
<td>Mitigation Measures</td>
<td>Monitoring Indicators</td>
<td>Responsible Entity(ies)</td>
<td>Frequency</td>
<td>Overall Cost (CFAF)</td>
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<tr>
<td><strong>Construction Phase</strong></td>
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<tr>
<td>Execution of earth works</td>
<td>Water body (Lake Guiers)</td>
<td>- Lake contamination</td>
<td>• Simultaneous evacuation of debris to authorized landfills</td>
<td>• Record of the dumping of debris in an official landfill</td>
<td>Contractor</td>
<td>Duration of works</td>
<td>6,500,000</td>
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<tr>
<td></td>
<td></td>
<td>- Increased turbidity on the banks</td>
<td>• Period of on-site storage of debris fixed at a maximum of two days</td>
<td>• Record of construction machine oil change</td>
<td>Contractor</td>
<td>22,000,000</td>
<td></td>
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<td></td>
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<td></td>
<td>• Prohibition of on-site changing of oil for construction machines</td>
<td>• Installation of at least four waste oil storage drums</td>
<td>Control Mission</td>
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<td></td>
<td></td>
<td></td>
<td>• Installation of on-site waste oil storage tanks</td>
<td>• Automatic shut-off on each supply pump</td>
<td>Environmental Monitoring Committee</td>
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<td></td>
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<td></td>
<td>• Management of waste oils by approved companies</td>
<td>• Construction of watertight slabs in compliance with construction workers' camp standards</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Site machine fuel supply pumps should be equipped with an automatic shut-off mechanism</td>
<td>• Stock of absorbents on the construction site</td>
<td>Environmental Monitoring Committee</td>
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<td></td>
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<td></td>
<td>• Any platform used temporarily to store hydrocarbons must be paved, watertight and comply with hydrocarbons storage standards</td>
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<td>• Absorbents (saw dust, leaves and strips which can absorb hydrocarbons) shall be stored on-site on the ground to contain any small- or medium-scale accidental pollution</td>
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<tr>
<td>Execution of lakeside works (water intake)</td>
<td>Water body (Lake Guiers)</td>
<td>- Lake contamination</td>
<td>• Absorbents (saw dust, leaves and strips which can absorb hydrocarbons) will be stored on the barge used for executing lakeside works to contain any small- or medium-scale accidental pollution</td>
<td>• Stock of absorbents on the construction site</td>
<td>Contractor</td>
<td>Duration of works</td>
<td>7,500,000</td>
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<tr>
<td></td>
<td></td>
<td>- Increased turbidity on the banks</td>
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<td>Sub-contractors</td>
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<tr>
<td>Excavation and earthmoving works</td>
<td>Soil</td>
<td>- Soil contamination</td>
<td>• Regular maintenance of machines</td>
<td>• Record of oil change in construction machines</td>
<td>Contractor</td>
<td>Duration of works</td>
<td>7,500,000</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>• Take measures to prevent the leakage of pollutants</td>
<td>• Installation of at least four waste oil storage drums</td>
<td>Control Mission</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Prohibit on-site oil change in construction machines</td>
<td>• Construction of watertight slabs in compliance with workers' camp standards</td>
<td>Environmental Monitoring Committee</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Install a tank for collecting waste oils</td>
<td>• Stock of absorbents on the construction site</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Environment</th>
<th>Action/Measure</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Air pollution</td>
<td>Regular watering of construction site, Protective tarpaulin on trucks transporting fine sand and materials, Wearing of dust-protection masks by construction site workers and plant personnel, Regular monitoring of air quality, Reduction of open-air sand storage or covering of sand with tarpaulin, if necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of trips made by watering trucks, Trucks transporting materials are equipped with tarpaulin, Staff wear PPE</td>
</tr>
<tr>
<td></td>
<td>Vegetation cover observable in the plant, Number of trees planted in the construction workers' camp, Amount of support from the Forestry Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contractor, Sub-contractors, Control Mission, Environmental Monitoring Committee, Duration of works (13,500,000)</td>
</tr>
<tr>
<td>Flora</td>
<td>Degradation of vegetation cover</td>
<td>Replant local ecosystem trees and recovered flora at the end of construction, Effective involvement of the Forestry Administration in project monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contractor, Sub-contractors, Control Mission, Environmental Monitoring Committee, Duration of works (4,800,000)</td>
</tr>
<tr>
<td>All works</td>
<td>Construction site environment</td>
<td>Waste production, Reuse of clean wastes as backfill material, Evacuate non-reusable wastes to waste land fills, Establishment of garbage bins on the site, Cleaning and restoration of construction sites, Record of waste discharge, Classified garbage bins available on the site</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contractor, Sub-contractors, Control Mission, Environmental Monitoring Committee, Duration of works (Included in the Contractor’s contract)</td>
</tr>
<tr>
<td>All works</td>
<td>Human</td>
<td>Sound nuisances, Wearing of ear protectors by construction site workers and operating staff, Use of generators that are compliant with the 85 dB at 1 metre standard, Maintaining air tools and equipment to keep the noise generated at an acceptable level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equipment fact sheet, Effective wearing of ear protectors by workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contractor, Sub-contractors, Control Mission, Environmental Monitoring Committee, Duration of works (15,800,000)</td>
</tr>
<tr>
<td>Supply of sundry materials to the construction site</td>
<td>Human</td>
<td>Disruption of road traffic, Establishment of a traffic plan within the plant, with the posting of a traffic control flag person, Construction of an initial road section to connect the main road and the construction site access road, Partial rehabilitation of the road, Traffic plan validated by MSC, Initial road section constructed on the junction road, Road partially rehabilitated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contractor, Sub-contractors, Control Mission, Environmental Monitoring Committee, Duration of works (8,500,000)</td>
</tr>
<tr>
<td>All works</td>
<td>Human</td>
<td><strong>Operation Phase</strong></td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| **Site accidents** | • Wearing of PPE (gloves, protective footwear)  
• Establishment of a traffic plan  
• Proper alignment of loads handled and recording of equipment and machines before intervention  
• Maintenance of traffic routes  
• Training in safe driving  
• Training of staff in handling operations  
• Limit manual handling in work stations  
• Effective wearing of PPE  
• Availability of a stock of PPE on the site  
• Safety signs placed  
• Parapets built  
• Number of site staff training sessions | • Contractor  
• Sub-contractors  
• Control Mission  
• Environmental Monitoring Committee  
• Duration of works |
| **Sexually transmitted diseases** | • Number of inspections conducted  
• Number of persons tested  
• Number of awareness-raising sessions | • Contractor  
• Sub-contractors  
• Control Mission  
• Environmental Monitoring Committee  
• Duration of works |
| **Water intake** | **Water contamination** | • Installation of separators to isolate hydrocarbons and other pollutants  
• Management of hydrocarbons and other pollutants by an approved entity;  
• Establishment of tanks for collecting hazardous wastes;  
• Establishment of a wastewater management mechanism;  
• Establishment of a sinking basin for collecting non-compliant discharge;  
• Monthly monitoring of the physical and chemical quality of discharge | • Separator outlets installed  
• Tanks for collecting hazardous wastes installed  
• Findings of counter-analysis of discharge by an approved external laboratory | • SDE (Operator)  
• OLAG  
• DGPRE  
• DEEC  
• SONES  
• Plant life span  
• Included in the lease agreement concluded with SDE |
| **Discharge of effluents** | **Water intake** | • Drop in lake piezometric level | • Piezometric monitoring | • Monitoring outcomes | • SDE (Operator)  
• OLAG  
• DGPRE  
• DEEC  
• SONES  
• Plant life span  
• Included in the lease agreement concluded with SDE | 75,500,000 |
| Use of sludge as manure | Soil | - Soil contamination  
|------------------------|------|-----------------------------------------------|
|                        |      | • Installation of a sludge thickener  
|                        |      | • Construction of a sludge digester for bio-electricity generation  
|                        |      | • Conduct of a detailed study to identify demand for the product and determine cost of supply  
|                        |      | • Conduct of physical and chemical sludge analysis before use as manure  
|                        |      | • Functionality of the sludge thickener  
|                        |      | • Market survey conducted by SONES  
|                        |      | • Findings of sludge counter-analyses by an approved external laboratory  
|                        |      | • SDE (Operator)  
|                        |      | • OLAG  
|                        |      | • DEEC  
|                        |      | • Regional Hygiene Service  
|                        |      | • SONES  
|                        |      | • Plant life span  
|                        |      | • Included in the lease agreement concluded with SDE  
| Plant operation | Human | - Social conflict  
|                        |      | • Reinforcement of the council’s DWS  
|                        |      | • Rehabilitation of the school opposite the council  
|                        |      | • Construction of two public urinals in the council  
|                        |      | • Length of the DWS distribution network established  
|                        |      | • School rehabilitated  
|                        |      | • Number of urinals constructed  
|                        |      | • SDE (Operator)  
|                        |      | • DEEC  
|                        |      | • SONES  
|                        |      | • Keur Momar Sarr Municipal Council  
|                        |      | • Plant life span  
|                        |      | • Included in the lease agreement concluded with SDE  
| Plant operation | Human | - Handling-related accidents  
|                        |      | • Proper alignment of loads handled  
|                        |      | • Maintenance of traffic routes  
|                        |      | • Training of staff in handling operations  
|                        |      | • Limitation of manual handling  
|                        |      | • Site marking  
|                        |      | • Preparation of an Internal Operation Plan (IOP)  
|                        |      | • PPE procurement order  
|                        |      | • Availability of a stock of PPE on the site  
|                        |      | • Number of staff training sessions organized  
|                        |      | • SDE (Operator)  
|                        |      | • DEEC  
|                        |      | • DPC  
|                        |      | • SONES  
|                        |      | • Plant life span  
|                        |      | • Included in the lease agreement concluded with SDE  
| Plant operation | Human | - Slip-and-fall accidents  
|                        |      | • Lighting of dark passages  
|                        |      | • Cleaning and maintenance of work platforms  
|                        |      | • Marking of risk areas  
|                        |      | • Reduction of the length of electric extension cables  
|                        |      | • Building of parapets  
|                        |      | • Wearing of anti-skid shoes and protective helmets  
|                        |      | • PPE procurement order  
|                        |      | • Availability of a stock of PPE  
|                        |      | • Number of markers put in place  
|                        |      | • Number of parapets built  
|                        |      | • SDE (Operator)  
|                        |      | • DEEC  
|                        |      | • DPC  
|                        |      | • SONES  
|                        |      | • Plant life span  
|                        |      | • Included in the lease agreement concluded with SDE  
<p>|                        |      | • Included in the lease agreement concluded with SDE  |</p>
<table>
<thead>
<tr>
<th>Plant operation</th>
<th>Human</th>
<th>Contamination by toxic products</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Use of professional clothing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cartridge mask against chemical and infectious products</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eye wash and safety shower in case of chemical hazards</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Hand protection cream</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gloves adapted to chemical and biological hazards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Training in safety signs and chemical hazard symbols</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Training for workplace first-aid representatives (OHS)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Demarcation of and safety signs in risk areas</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Establishment of safety instructions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proper ventilation and sufficient lighting of premises</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintenance of clean, non-skid and uncongested soil</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Storage of hazardous products in separate locations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PPE procurement order for</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Availability of a stock on the construction site</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of operating staff training sessions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Labelling posted on the construction site</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Premises for the storage of products secured</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant life span</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SDE (Operator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEEC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DPC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SONES</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Included in the lease agreement concluded with SDE</td>
<td></td>
</tr>
</tbody>
</table>
# Table 2

## Environmental and Social Management Plan of the “ALG Pipeline” Component

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Environment</th>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Monitoring Indicators</th>
<th>Responsible Entity(ies)</th>
<th>Frequency</th>
<th>Cost (CFAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Installation</td>
<td>Soil</td>
<td>Faecal contamination</td>
<td>Installation of health facilities on the site, Installation of a hand wash mechanism, Setting up of a board for awareness-raising on hygiene and sanitation best practices</td>
<td>Type and number of health facilities on the construction site, Wash-hand mechanism installed on the construction site</td>
<td>Contractor, Sub-contractors</td>
<td>During construction site installation phase</td>
<td>385,000</td>
</tr>
<tr>
<td>Site Installation</td>
<td>Water</td>
<td>Emission of dust particles</td>
<td>Regular watering of site access roads, Protective tarpaulin on trucks transporting fine sand and materials, Wearing of personal protection equipment by site workers, Reduction of open-air sand storage or cover sand with tarpaulin, if necessary</td>
<td>Number of trips made by watering trucks, Fine sand materials transportation trucks equipped with tarpaulin, Staff wear PPE</td>
<td>Contractor, Sub-contractors</td>
<td>During construction site installation phase</td>
<td>12,500,000</td>
</tr>
<tr>
<td>Site Installation</td>
<td>Air</td>
<td>Emission of dust particles</td>
<td>Regular maintenance of site machines in approved services</td>
<td>Fact sheet for trucks, Record of truck maintenance and servicing</td>
<td>Contractor, Sub-contractors</td>
<td>During construction site installation phase</td>
<td>8,750,000</td>
</tr>
<tr>
<td>Site Installation</td>
<td>Soil</td>
<td>Soil contamination by hydrocarbon products</td>
<td>Regular maintenance of site machines in approved services</td>
<td>Fact sheet for trucks, Record of truck maintenance and servicing</td>
<td>Contractor, Sub-contractors</td>
<td>During construction site installation phase</td>
<td>8,750,000</td>
</tr>
<tr>
<td>Flora</td>
<td>Degradation of vegetation cover</td>
<td>Avoid felling partially or fully protected trees, Beautify construction workers’ camp by regenerating the vegetation cover</td>
<td>Vegetation cover observable in construction workers’ camp, Number of trees planted in workers’ camp</td>
<td>Contractor, Sub-contractors</td>
<td>Control Mission, Environmental Monitoring Committee</td>
<td>During construction site installation phase</td>
<td>8,900,000</td>
</tr>
</tbody>
</table>
## Construction Phase

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Water</th>
<th>Contamination of the water table</th>
<th>Automatic backfilling of trenches</th>
<th>Systematic evacuation of non-reusable toxic debris</th>
<th>Systematic restoration of dug roads and paths at the end of works</th>
<th>Availability of tippers for storage of non-reusable debris</th>
<th>All trenches are refilled after laying of pipe</th>
<th>Contractor</th>
<th>Sub-contractors</th>
<th>Control Mission</th>
<th>Environmental Monitoring Committee</th>
<th>During works phase</th>
<th>55,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>Soil contamination</td>
<td>Regular maintenance of machines</td>
<td>Take measures to prevent pollutants from leaking</td>
<td>Prohibition of on-site machine oil change</td>
<td>Establish a tank for collecting waste oils</td>
<td>Installation of at least four waste oil storage drums</td>
<td>Automatic shut-off on each supply pump</td>
<td>Construction of watertight slabs in compliance with workers' camp standards</td>
<td>Stock of absorbents</td>
<td>Contractor</td>
<td>Sub-contractors</td>
<td>Control Mission</td>
<td>Environmental Monitoring Committee</td>
</tr>
<tr>
<td>Excavation, trenching and pipe laying works</td>
<td>Air</td>
<td>Air pollution</td>
<td>Regular watering of site</td>
<td>Protective tarpaulin on trucks transporting fine sand and materials</td>
<td>Wearing of dust-protection masks by construction site workers and works area operating staff</td>
<td>Regular monitoring of air quality</td>
<td>Reduction of open-air sand storage or cover sand with tarpaulin, if necessary</td>
<td>Number of trips made by watering trucks</td>
<td>Materials transportation tucks are equipped with tarpaulin</td>
<td>Staff wear PPE</td>
<td>Contractor</td>
<td>Sub-contractors</td>
<td>Control Mission</td>
</tr>
<tr>
<td>Flora</td>
<td>Degradation of vegetation</td>
<td>Replant local ecosystem trees and recovered flora at the end of works</td>
<td>Inventory of plant species affected by the project in the Thiès, Pire Goureye and Sébikhotane gazetted forest</td>
<td>Study and signature of a vegetation cover felling and regeneration protocol</td>
<td>Effective involvement of the Forestry Administration in project monitoring</td>
<td>Inventory of plant species is conducted before commencement of works</td>
<td>Protocol agreement signed between SONES and the Forestry Administration</td>
<td>Contractor</td>
<td>Sub-contractors</td>
<td>Control Mission</td>
<td>Environmental Monitoring Committee</td>
<td>During works phase</td>
<td>6,500,000</td>
</tr>
<tr>
<td>Site environment</td>
<td>Waste production</td>
<td>Use generators that are compliant with the 85 db at 1 metre standard</td>
<td>Maintain air tools and equipment to keep the noise generated at an acceptable level</td>
<td>Record of waste discharge</td>
<td>Classified garbage bins available on the site</td>
<td>Contractor</td>
<td>Sub-contractors</td>
<td>Control Mission</td>
<td>Environmental Monitoring Committee</td>
<td>During works phase</td>
<td>30,800,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Sound nuisances</td>
<td>Wearing of ear protectors by construction site workers and operating staff</td>
<td>Use generators that are compliant with the 85 db at 1 metre standard</td>
<td>Maintain air tools and equipment to keep the noise generated at an acceptable level</td>
<td>Equipment fact sheet</td>
<td>Effective wearing of ear protectors by staff</td>
<td>Contractor</td>
<td>Sub-contractors</td>
<td>Control Mission</td>
<td>Environmental Monitoring Committee</td>
<td>During works phase</td>
<td>23,560,000</td>
<td></td>
</tr>
</tbody>
</table>
### ESIA SUMMARY

#### Human
- Site accidents
  - Wearing of PPE (gloves, safety foot wear, etc.)
  - Establishment of a traffic plan
  - Proper alignment of loads handled and recording of equipment and machines before intervention
  - Maintenance of traffic routes
  - Training in safe driving
  - Training of staff in handling operations
  - Limit manual handling in work stations
- Establishment of a traffic plan
- Proper alignment of loads handled and recording of equipment and machines before intervention
- Maintenance of traffic routes
- Training in safe driving
- Training of staff in handling operations
- Limit manual handling in work stations
- Effective wearing of PPE
- Availability of a stock of PPE on the site
- Safety markers set up
- Parapets built
- Number of site staff training sessions
- Contractor
- Sub-contractors
- Control Mission
- Environmental Monitoring Committee
- During works phase

#### Social
- Loss of farmland and allotments
  - Initiation of a participatory approach for evaluating expenditure
  - Compensation for project affected persons ideally in kind
  - Support to PAPs in their resettlement approach
  - Execution of works during the dry season to avoid stoppage of farm work
- Social
  - Initiation of a participatory approach for evaluating expenditure
  - Compensation for project affected persons ideally in kind
  - Support to PAPs in their resettlement approach
  - Execution of works during the dry season to avoid stoppage of farm work
- PAPS are involved in defining compensation conditions
- All PAPS are compensated
- There is provision for a rainy reason break for all works
- SONES
- Decentralized services
- Councils
- Consultant
- Monitoring Committee
- Donors
- During works phase

#### Networks of concession holders
- Traffic disruption
  - Authorization to lay pipes on road and rail right-of-way
  - Storage of materials in workers’ camp
  - Crossing of national roads through culverts
  - Crossing of highways and railways through service galleries
- Networks of concession holders
- Traffic disruption
  - Authorization to lay pipes on road and rail right-of-way
  - Storage of materials in workers’ camp
  - Crossing of national roads through culverts
  - Crossing of highways and railways through service galleries
- Crossing plans are validated by the concession holders
- SONES
- DEEC
- DPC
- Pipe life span
- Included in the lease agreement concluded with SDE

#### Operation Phase

#### Functioning
- Human
  - Risk of explosion
    - Provide for a 15 metre-wide right-of-way on both sides of the pipeline
    - Secure the pipeline right-of-way
    - Constructive arrangements in sensitive areas prone to erosion
    - Declare the pipeline right-of-way as public utility area
  - Risk of explosion
    - Provide for a 15 metre-wide right-of-way on both sides of the pipeline
    - Secure the pipeline right-of-way
    - Constructive arrangements in sensitive areas prone to erosion
    - Declare the pipeline right-of-way as public utility area
    - Safety markers placed all along the pipeline
    - Decree declaring the pipeline right-of-way as a public utility
  - SONES
  - DEEC
  - DPC
  - Pipe life span
  - Included in the lease agreement concluded with SDE

#### Costs
- Human
  - Site accidents
    - Establishment of a traffic plan
    - Proper alignment of loads handled and recording of equipment and machines before intervention
    - Maintenance of traffic routes
    - Training in safe driving
    - Training of staff in handling operations
    - Limit manual handling in work stations
    - Effective wearing of PPE
    - Availability of a stock of PPE on the site
    - Safety markers set up
    - Parapets built
    - Number of site staff training sessions
    - Contractor
    - Sub-contractors
    - Control Mission
    - Environmental Monitoring Committee
    - During works phase
    - 18,750,000
- Social
  - Loss of farmland and allotments
    - Initiation of a participatory approach for evaluating expenditure
    - Compensation for project affected persons ideally in kind
    - Support to PAPs in their resettlement approach
    - Execution of works during the dry season to avoid stoppage of farm work
    - PAPS are involved in defining compensation conditions
    - All PAPS are compensated
    - There is provision for a rainy reason break for all works
    - SONES
    - Decentralized services
    - Councils
    - Consultant
    - Monitoring Committee
    - Donors
    - During works phase
    - To be costed in the ARP
- Networks of concession holders
  - Traffic disruption
    - Authorization to lay pipes on road and rail right-of-way
    - Storage of materials in workers’ camp
    - Crossing of national roads through culverts
    - Crossing of highways and railways through service galleries
    - Crossing plans are validated by the concession holders
    - Contractor
    - Control Mission
    - Monitoring Committee
    - During works phase
    - 287,000,000
- Human
  - Risk of explosion
    - Provide for a 15 metre-wide right-of-way on both sides of the pipeline
    - Secure the pipeline right-of-way
    - Constructive arrangements in sensitive areas prone to erosion
    - Declare the pipeline right-of-way as public utility area
    - Safety markers placed all along the pipeline
    - Decree declaring the pipeline right-of-way as a public utility
    - SONES
    - DEEC
    - DPC
    - Pipe life span
    - Included in the lease agreement concluded with SDE
    - 4,800,000
### Table 3
Environmental and Social Management Plan of the “Thiès Reservoirs” Component

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Environment</th>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Monitoring Indicators</th>
<th>Responsible Entity(ies)</th>
<th>Frequency</th>
<th>Cost (CFAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Implementation</td>
<td>Monitoring</td>
<td>Implementation</td>
<td>Monthly Monitoring</td>
</tr>
<tr>
<td>Construction Site Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil Water</td>
<td>• Faecal contamination</td>
<td>• Installation of health facilities in the site</td>
<td>• Type and number of health facilities on the construction site</td>
<td>Contractor</td>
<td>During site installation phase</td>
<td>385,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Installation of a hand wash mechanism</td>
<td>• Wash-hand mechanism installed on the site</td>
<td>Sub-contractors</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Installation of a board for awareness-raising on hygiene and sanitation best practices</td>
<td></td>
<td>Control Mission</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Environmental Monitoring Committee</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction of site base</td>
<td>Air</td>
<td>• Emission of dust particles</td>
<td>• Number of trips made by watering trucks</td>
<td>Contractor</td>
<td>During construction site installation phase</td>
<td>12,500,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Trucks transporting fine sand and materials equipped with tarpaulins</td>
<td>Sub-contractors</td>
<td></td>
<td>3,800,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Wearing of personal protection equipment by construction site workers</td>
<td>Control Mission</td>
<td></td>
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<td></td>
<td></td>
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<td>• Reduction of open-air sand storage or cover sand with tarpaulin, if necessary</td>
<td>Environmental Monitoring Committee</td>
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<tr>
<td></td>
<td>Soil</td>
<td>• Soil contamination by hydrocarbon products</td>
<td>• Availability of tippers for storage of non-reusable spoil material</td>
<td>Contractor</td>
<td>During construction site installation phase</td>
<td>8,750,000</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Regular maintenance of construction machines in approved services</td>
<td>Sub-contractors</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Fact sheet for trucks</td>
<td>Control Mission</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Truck maintenance and servicing record</td>
<td>Environmental Monitoring Committee</td>
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<tr>
<td></td>
<td>Flora</td>
<td>• Degradation of vegetation cover</td>
<td>• Vegetation cover observable in workers’ camp</td>
<td>Contractor</td>
<td>During site installation phase</td>
<td>8,900,000</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Avoid felling partially or fully protected trees</td>
<td>Sub-contractors</td>
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<td></td>
<td></td>
<td></td>
<td>• Beautify workers’ camp by regenerating the vegetation cover</td>
<td>Control Mission</td>
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<td>Environmental Monitoring Committee</td>
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<tr>
<td>Construction Phase</td>
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</tr>
<tr>
<td>Excavation, foundation and earthmoving works</td>
<td>Water</td>
<td>• Contamination of water table</td>
<td>• Availability of tippers for storage of non-reusable spoil material</td>
<td>Contractor</td>
<td>During works phase</td>
<td>4,600,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Automatic backfilling of trenches</td>
<td>• All trenches are refilled after laying of pipe</td>
<td>Sub-contractors</td>
<td></td>
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<td></td>
<td></td>
<td>• Systematic evacuation of non-reusable toxic spoil material</td>
<td></td>
<td>Control Mission</td>
<td></td>
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<td></td>
<td></td>
<td>Environmental Monitoring Committee</td>
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</tbody>
</table>

32
### Soil
- **Soil contamination**
  - Regular maintenance of machines
  - Take measures to prevent pollutants from leaking
  - Prohibition of on-site machine oil change
  - Establish a tank for collecting waste oils
  - Stock of absorbents on the site

### Air
- **Air pollution**
  - Regular watering of site
  - Protective tarpaulin on trucks transporting fine sand and materials
  - Wearing of dust-protection masks by site workers and works area operating staff
  - Regular monitoring of air quality
  - Reduction of open-air sand storage or cover sand with tarpaulin, if necessary

### Flora
- **Degradation of vegetation**
  - Replant local ecosystem trees and recovered flora at end of works
  - Inventory of plant species affected by the project in the Thiès, Pire Gouyeve and Sébikhotane gazetted forest
  - Study and signature of a vegetation cover felling and regeneration protocol
  - Effective involvement of the Forestry Administration in project monitoring

### Site environment
- **Waste production**
  - Reuse of clean wastes as backfill material
  - Evacuate non-reusable wastes to the waste disposal site
  - Establishment of garbage bins on the site
  - Cleaning and restoration of works sites

### Human
- **Sound nuisances**
  - Wearing of ear protectors by concluded site workers and operating staff
  - Use generators that are compliant with the 85 dB at 1 metre standard
  - Maintain air tools and equipment to keep the noise generated at an acceptable level

### All works
- **Record of construction machine oil change**
  - Installation of at least four waste oil storage drums
  - Construction of watertight slabs in compliance with workers’ camp standards

### Records
- **Record of construction machine oil change**
  - Contractor
  - Sub-contractors

### Control Mission
- **Environmental Monitoring Committee**
  - During works phase

### Contractors
- **Sub-contractors**

### Costs
- **All works**
  - Included in the Contractor’s contract

### Summary of Costs
- **Air**
  - During works phase: 750,000
  - Total: 18,500,000

- **Flora**
  - During works phase: 16,750,000

- **Site environment**
  - Equipment fact sheet
  - Effective wearing of ear protectors by staff
  - Equipment fact sheet
  - Effective wearing of ear protectors by staff

- **Human**
  - During works phase: 26,600,000
<table>
<thead>
<tr>
<th><strong>Human</strong></th>
<th><strong>Site accidents</strong></th>
<th><strong>Operation Phase</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Wearing of PPE (gloves, safety shoes, etc.)</td>
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</tr>
<tr>
<td></td>
<td>▪ Effective wearing of PPE</td>
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<tr>
<td></td>
<td>▪ Establishment of a traffic plan</td>
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<td></td>
<td>▪ Proper alignment of loads handled and recording of equipment and machines before intervention</td>
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<tr>
<td></td>
<td>▪ Maintenance of traffic routes</td>
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<td></td>
<td>▪ Training in safe driving</td>
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<td></td>
<td>▪ Training of staff in handling operations</td>
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<td></td>
<td>▪ Limit manual handling in work stations</td>
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<tr>
<td></td>
<td>▪ Contractor</td>
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<tr>
<td></td>
<td>▪ Sub-contractors</td>
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<td></td>
<td>▪ Control Mission</td>
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<td></td>
<td>▪ Environmental Monitoring Committee</td>
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<tr>
<td></td>
<td>▪ Number of training sessions organized for site workers</td>
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<td></td>
<td>▪ During works phase</td>
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<tr>
<td></td>
<td>▪ 15,000,000</td>
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</table>

**Operation Phase**

<table>
<thead>
<tr>
<th>Emptying of reservoirs</th>
<th>Soil</th>
<th>Soil contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Characterization of wash waters</td>
<td></td>
<td></td>
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<tr>
<td>▪ Indication of a discharge point in agreement with the Forestry Administration</td>
<td></td>
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<tr>
<td>▪ Findings on wash water conformity analyses</td>
<td></td>
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<tr>
<td>▪ SDE</td>
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<tr>
<td>▪ Control Mission</td>
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<tr>
<td>▪ Environmental Monitoring Committee</td>
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<tr>
<td>▪ Facility life span</td>
<td></td>
<td></td>
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<tr>
<td>▪ Included in lease agreement concluded with SDE</td>
<td></td>
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<tr>
<td>▪ 5,400,000</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation of reservoirs</th>
<th>Human</th>
<th>Handling-related accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Proper alignment of loads handled</td>
<td></td>
<td></td>
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<tr>
<td>▪ Maintenance of traffic routes</td>
<td></td>
<td></td>
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<tr>
<td>▪ Training of staff in handling operations</td>
<td></td>
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<tr>
<td>▪ Construction site marking</td>
<td></td>
<td></td>
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<tr>
<td>▪ PPE procurement order</td>
<td></td>
<td></td>
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<tr>
<td>▪ Availability of stock of PPE on the construction site</td>
<td></td>
<td></td>
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<tr>
<td>▪ Number of staff training sessions organized</td>
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<tr>
<td>▪ SDE (Operator)</td>
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<td>▪ DEEC</td>
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<tr>
<td>▪ DPC</td>
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<tr>
<td>▪ SONES</td>
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<tr>
<td>▪ Facility life span</td>
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<tr>
<td>▪ Included in lease agreement concluded with SDE</td>
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