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List of abbreviations

AIBD: Blaise Diagne International Airport

ANACIM: National Agency for Civil Aviation and Meteorology

ANSD: National Agency for Statistics and Demography

APR: Preliminary Risk Analysis

SCBA: SCBAs

ARIA: Accident, Research, and Information Analysis

ASECNA: Agency for the Safety of Air Navigation in Africa and Madagascar

ASER : Senegalese Rural Electrification Agency

BARPI: Office of Industrial Risk and Pollution Analysis

BGRM: Geological and Mining Research Bureau

Construction: Buildings and Public Works

ECOWAS: Economic Community of West African States

CEM: Middle School

CETUD: Executive Council of Urban Transportation of Dakar

CGEDD: General Council for the Environment and Sustainable Development

CGQA: Air Quality Management Center

CHST: Occupational Health and Safety Committee

UNCCD: United Nations Convention to Combat Desertification

COMASEL: Moroccan-Senegalese Electrification Company of Saint-Louis

CSS: Social Security Fund

BOD: Biochemical Oxygen Demand

DCPN: Division of Pollution Prevention and Control

DEEC: Directorate of Environment and Classified Establishments

DEIE: Environmental Impact Assessment Division

DMT: Declaration of Workers' Movements

DNAA: Directorate of Air Navigation and Aerodromes

DPC: Directorate of Civil Protection

ESD: Hazard Study

PPE: Personal Protective Equipment

MSDS: Safety Data Sheet

FOD: Foreign Object Debris

GTDLI: Working Group on Flammable Liquid Deposits

H2S : Hydrogen Sulfide

HAAS: High Authority of Senegalese Airports

HSE: Health, Safety and Environment

IATA: International Air Transportation Association

IC: Classified Installations

ICPE: Installations Classified for the Protection of the Environment

INERIS: National Institute for Industrial Environment and Risks

ARI: Acute Respiratory Infection

IREF: Regional Water and Forest Inspection

IRTSS : Regional Inspectorate of Labor and Social Security

JIG: Joint Inspection Group

LPD/SEDD): Environment and Sustainable Development Policy Letter

LPSGI: Sectoral Policy Letter on Internal Governance

MEDD: Minister of Environment and Sustainable Development

ICAO: International Civil Aviation Organization

OLAG: Office du Lac de Guiers *(Office of the Lake of Guiers)*

MDGs: Millennium Development Goals

ONAS: National Sanitation Office of Senegal

NGO: Non-Governmental Organization

PAN/LCD: National Action Programme to Combat Desertification

PAN/LCDGDT: National Action Programme to Combat Desertification and Sustainable Land Management

PAP : Priority Action Plan

IRAP: Action Plan for Industrial Redeployment

PAST: Sectoral Transportation Adjustment Programme

GDP: Gross Domestic Product

PIC: Municipal Investment Plan

PNACC: National Climate Change Adaptation Plan

PNAE: National Environmental Action Plan

POI: Internal Operation Plan

PSE : Emerging Senegal Plan

PTIP: Three-year Public Investment Programme

RESA : Runway End Safety Area

RGPHAE: General Census of Population and Housing, Agriculture and Livestock

RIA: Armed Fire Hydrant

SARL: Limited Liability Company

EDS: Senegalese Waters

SES: Economic and Social Situation

SNDD: National Sustainable Development Strategy

SNDES: National Strategy for Economic and Social Development

SRAT: Regional Spatial Planning Schemes

SRSD: Regional Service of Statistics and Demography

SSLI: Rescue and Firefighting Service

UNESCO: United Nations Educational, Scientific and Cultural Organization

EEZ: Exclusive Economic Area

I. NON-TECHNICAL SUMMARY

I.1. INTRODUCTION

With a privileged geographical position, Senegal aspires to become a reference platform in the field of air transportation. To this end, the State has initiated the regional air hub project, which involves the rehabilitation of five (05) airports (Saint Louis, Matam, Ziguinchor, Tambacounda and Kédougou).

The purpose of this report is to present the results of the Environmental and Social Impact Assessment of the Saint-Louis Airport Rehabilitation Project, which helps decision-making by providing a solid basis for managing the project's consequences on the biophysical, social and cultural environment and on the health of populations and workers.

To this end, an Environmental and Social Management Plan (ESMP) has been drawn up, which indicates, among other things, the measures to eliminate and/or mitigate negative impacts and the methods for implementing environmental and social management.

I.2. PROJECT DESCRIPTION

TRANSCON Electronic Systems, which is responsible for the implementation of the rehabilitation works, is an independent private Czech company founded in 1990 and specialising in electronic and electrical equipment for airports. It operates with its equipment consisting of hardware and software, prototype workshops, production workshops, maintenance and transportation services.

As part of the rehabilitation of Saint-Louis airport, various activities are planned. The renovation work will be carried out at various locations throughout the airport and will have an impact on the biophysical and human environment.

Regarding pavements, the project includes the extension of the existing runway by 600 m and its widening to 45 m, the widening of the old taxiway to 23 m, and the rehabilitation of the tarmac (parking area).

In the long term, the following will be implemented:

- a 2500 m x 45 m track;
- a 150 m x100 m tarmac;
- a 190 m x 23 m taxiway.

For security reasons, the airport right-of-way will be fenced off. The fence wall will be 2.50 m high with reinforced concrete components and above it, stainless concertina lines with a diameter of 0.5 m. Two terminals with a surface area of 1950 m^2 each will also be built.

These buildings, with a VIP lounge, will be equipped with smoke detectors, CO_2 extinguishers, offices, toilets, etc. In these terminals, it is planned, among other things, to have:

- a conveyor (departure/arrival) at the airport with a check-in counter;
- a departure/arrival room;
- offices for management, security, airlines;
- a compartment reserved for passenger information;

- detection equipment;
- luggage carts.

A modular hangar with a surface area of 400 ^{m2} and a height of 4 m will also be built, as well as a fire-fighting hangar consisting of a parking hall for fire-fighting vehicles, fire-fighting equipment with an area of 400 ^{m2} and a height of 5 m, a control tower combined with the technical unit with a total height of 21 m.

Other equipment will also be installed in connection with the use of high-intensity halogen lighting, a VOR-type navigation aid, a power plant with a 140 kVA generator set, a 1X400 KVA substation and current regulators.

I.3. POLITICAL, LEGAL AND INSTITUTIONAL CONTEXT

I.3.1. POLICY FRAMEWORK

Environmental protection has been a major concern for the Government of Senegal since the Earth Summit in Rio de Janeiro, Brazil, in June 1992. As a result, institutions and legal texts in the field of environmental protection in general and project impact assessment in particular have been set up.

This study will be governed on the one hand by the conventions, agreements and treaties ratified by Senegal and on the other hand by national regulations.

This project to rehabilitate the Saint-Louis airport will be carried out in accordance with the policies, directives and strategies planned at both the national and international levels in terms of environmental, social, economic, security and any other policies applicable to this project.

I.3.2. LEGAL FRAMEWORK FOR ENVIRONMENTAL AND SOCIAL MANAGEMENT

The legal framework applicable to this project includes national texts supplemented by international conventions ratified by Senegal.

At the international level: Taking into account the context, the characteristics of the area of influence and the nature of the project's activities, several international environmental conventions ratified by Senegal could be applicable to the project (Chicago Convention, United Nations Framework Convention on Climate Change (UNCAC), Montreal Protocol, Vienna Convention, RAMSAR Convention, etc.).

At the national level: In relation to the context and activities of the project, the national legal framework is marked by several texts that deal with environmental and social aspects (Constitution of Senegal, Environmental Code and its implementing texts, Environmental Standards, Texts on civil aviation, etc.).

I.3.3. INSTITUTIONAL FRAMEWORK

The institutional analysis allows for the identification of structures that are interested in their responsibilities, functions and roles, in the actions that will be carried out as part of the rehabilitation of Saint-Louis airport.

The environmental and social management of the project will involve national, regional and local institutions and structures as well as the technical services of the State and local authorities. The fields of intervention of these structures and institutions in terms of environmental protection will be diverse, at all stages of project implementation.

The environmental and social management of the project will be ensured at three levels:

- at the national level: through the DEEC, the National Technical Committee and the other national directorates and technical services involved in the management of the project;
- at the regional level through the Regional Environmental Monitoring Committee (CRSE);
- at the level of local authorities (Sub-prefect, Town Hall, municipal councils, etc.).

I.4. ENVIRONMENTAL AND SOCIAL SITUATION OF THE PROJECT AREA

I.4.1. PRESENTATION OF THE PHYSICAL ENVIRONMENT

The Saint-Louis airport is located on the edge of the Senegalese coastine, in the Sahel coastal climate domain subject to maritime and continental influences. It consists of three (03) soil types: raw mineral soils, reddish-brown soils and hydromorph soils.

The climate of the project area is characterised by the alternation of a long dry season, from October to June, marked by the predominance of trade winds, and a short rainy season from June to September/October, dominated by monsoon flows.

The evolution of the curve of the monthly average wind speed is unimodal with a maximum in April (5 m/s) and a minimum in September (3.1 m/s). The average annual speed from 1987 to 2016 is 3.8 m/s. The highest speeds are recorded between January and July (dry season) and the lowest between August and November (rainy season).

The average daily duration of sunstroke in Saint-Louis is fairly constant. It varies between 6 and 8 am from June to January and between 8 and 9 am from February to May.

Temperatures in the project area are relatively low overall with an annual average of 26.2°C from 1987 to 2016. The lowest average temperatures are recorded between December and June, when the highest temperature ranges from 10.2 to 15.2°C.

Rainfall is low and rarely exceeds 300 mm/year. Indeed, the norm from 1987 to 2016 is 270 mm.

I.4.2. PRESENTATION OF THE BIOLOGICAL ENVIRONMENT

The Commune of Saint-Louis is located in the eco-geographical area of Gandiolais. It contains important plant resources. The airport site is characterized by sparse shrub steppe vegetation overall and little bushes to the southwest. The closest classified forest to the airport site is Maka Diama (12 km from the airport) and the nearest park is Langue de Barbarie (19 km).

The Saint-Louis Region has significant potential in terms of wildlife resources. However, the airport site is not of particular interest in terms of wildlife resources. Nevertheless, its proximity to surface waters makes it an area of average environmental sensitivity because surface waters contribute to the physiological life of fauna and flora but also to the maintenance of biodiversity

I.4.3. PRESENTATION OF THE HUMAN ENVIRONMENT

The population of the Saint-Louis Region is estimated at 1,036,000 inhabitants in 2018 with a density of 49 inhabitants per km2. The region is characterized by a very young population. The Commune of Saint-Louis has 20 districts, including the Bango district where the airport is located. In 2017, the population of the Commune is estimated at 232,881 inhabitants including 116,990 men and 115,890 women[1].

The land use of Bango is characterized by three (03) dominant entities which are the Prytanée Militaire school of Saint-Louis (600 m from the airport), the Bango military barracks (located 190 m from the airport) and the Saint-Louis airport, the subject of this study. The latter is based on two (02) land titles (TF132 and TF107).

In addition to formal education, Koranic education is very developed in the municipality, which has many "*Daara*" Koranic schools. However, this model remains very informal so far. The Bango district, the airport's location area, has 04 schools

The Saint-louis airport is supplied with water by the Senegalese Water Network (SDE). The airport's electricity supply is provided by SENELEC. Rainwater drainage from the airport is provided by a functional ONAS drainage network.

The Saint-Louis Region has a strong agricultural vocation due to the water and land potential it has, in particular the availability of its irrigable land estimated at 172,800 ha[2]. Market gardening is practiced around Saint-Louis airport with crops like onions, cabbage, tomatoes, okra, carrots, turnips, peppers, aubergines, corn, etc. Livestock remains the second most important activity after agriculture and occupies an important place in the economic fabric of the area.

The fishing sector occupies a very important place in the Saint-Louis Region.

The majority of fishermen are located in the districts of ***Guet Ndar*** located in the center of the Langue de Barbarie and ***Goxu Mbacc***. There is currently no fishing port in Saint-Louis. Landings are made along the banks. No landing sites for fish products have been identified near Saint-Louis airport.

Trade in the Saint-Louis Region concerns the primary, secondary and tertiary sectors. There is no permanent or weekly market near Saint-Louis airport.

I.5. RESULTS OF THE PUBLIC CONSULTATIONS

Public consultation promotes the free expression of the perception of a project by representatives of all categories of stakeholders. The various administrative and local authorities as well as the competent technical services and the populations closest to the site

[1] ANSD: Census and Demographic Statistics Division Bureau of Civil Status and Demographic Projections: Demographic Projections of the Population of Senegal 2013-2025

[2] PRDI Saint-Louis 2013-2017: Perspectives Final version, January 2013

were consulted in order to collect their perceptions and recommendations concerning this project.

The administrative authorities, local elected officials and technical services in the Saint-Louis region have all welcomed the project, which they consider beneficial because it revitalizes air services to the region and encourages the development of tourism initiatives in the context of hydrocarbon discoveries. The stakeholders expressed their concerns about the safety of the local population living irregularly in part of the airport right-of-way.

The various categories of stakeholders interviewed highlighted the existence of constraints related to the different phases of airport upgrading. In addition, they believe that the advent of the renovated airports will generate new economic activities around these infrastructures.

The populations of the districts of Khor Usine, Khar Yalla, Ngallèle and Dakar Bango met, welcomed the project, and the promoter's approach to inform them and exchange with them.

At the end of these exchanges, it is clear that most of the populations met showed a reluctance to participate in this project. This reluctance is justified by the fear of being expropriated from their homes and losing their agricultural activities, which are their main source of income.

However, another segment of the population is ready to accept the project if the commitments made in 2002 to the population are respected and accompanying measures are proposed.

Recommendations to the promoter were made by all stakeholders met.

I.1. ANALYSIS OF VARIANTS

Several variants were studied to justify the reason for the project and to compare technological criteria in order to make the most optimal choice in terms of environmental, operational and safety standards.

The site variants have not been studied insofar as the project concerns the rehabilitation of Saint-Louis airport, whose right-of-way is already clearly defined.

The analysis of the "no project" option highlighted the critical strategic and socio-economic importance of this project.

Two refuelling techniques were compared and the choice was made for the one without a distribution network because the risks of induced underground pollution are lower. In addition, the vehicle used is simpler to use, easier to maintain and saves energy when transferring fuel from the vehicle to the aircraft.

Concerning the demolition techniques of existing buildings, deconstruction is the best method because it makes it possible to combine increased safety with the control of noise and vibration pollution. This option thus makes it possible to preserve the safety of buildings that are not concerned and people working around the airport demolition site.

I.2. RESULTS OF THE IMPACT ANALYSIS

The analysis covered the various environmental sensitivities that could be impacted and identified the possible adverse effects due to the rehabilitation and operation of the airport and the likely positive impacts that will be generated. Subsequently, mitigation measures based on codes of good practice and the various regulatory texts were proposed in order to minimize negative impacts. Improvement measures have also been proposed to consolidate and improve the positive effects of the project.

Table 1: Measures to improve positive impacts

Component	Impact-causing activities	Potential impact	Bonus measure
Improvement of positive impacts during the rehabilitation phase			
Socio-economic activities	Rehabilitation work	Direct job creation	• Recruit local workers as a priority • Set up a local recruitment committee • Pay decent wages to workers • Involve IWHSS in the declaration and identification of workers
		Indirect job creation Purchase of goods and services	• Develop and secure spaces around the airport • Define with the local populations the rules of good conduct for peaceful coexistence • Frame entrepreneurship ambitions around the airport perimeter • Raise awareness among workers, service providers and merchants of the importance of hygiene and safety instructions
		Business opportunities for SMEs	• Provide national companies with the opportunity to accelerate their development • Promote access by local companies to goods and services offers • Give first priority to national craftsmen, for office and other furniture • Develop subcontracting in favor of local medium-sized companies
Improvement of impacts during the operating phase			
Socio-economic activities	**Airport Operations**	• Job creation • Development of commercial activities • Purchases of goods and services	• Use local companies for outsourced services • Favor local companies for the purchase of goods and services • Focus on local employment • Promote the female workforce • Get closer to the SDDC for women's organisations and their socio-economic activities • Provide capacity building services for personnel involved after rehabilitation work
		Strengthening regional air services	• Rehabilitate and equip the airport with the most modern technologies • Revitalize and make pleasant the services provided to passengers on departure and arrival: waiting platform, passenger escort, cafeteria, wifi • Equip the airport with the latest generation of hygiene equipment • Assign qualified personnel and specialists to the various workstations • Authorize and make available vehicles for shuttle service between the airport and travellers' final destinations

		Revitalising tourism and economic activities	● Plan the construction of ramps to facilitate access for people with reduced mobility ● Create relaxation areas, dining areas for airport staff and airport users ● Create tours and tourist itineraries ● Initiate projects to develop and equip tourist sites in the Saint-Louis Region ● Create agencies and train tourist guides ● Develop the ground transportation network to facilitate access to the airport ● Strengthening the security, safety and protection of airport space

Table 2: Mitigation measures for negative impacts

Impacted component	Impact-causing activity	Potential impact	Mitigation measures
Mitigation of negative impacts during the rehabilitation phase			
Air quality	● Transportation, storage and use of construction materials and equipment ● Operation of construction machinery and vehicles ● Civil engineering works ● Demolition and reconstruction activities ● Waste generation	● Localized deterioration of air quality due to dust emissions ● Emissions of pollutants ● Olfactory nuisances	● Establish the initial state of air quality before starting work ● Water the site soil and traffic lanes to minimize dust generation ● Restrict the speed of vehicles and machinery in residential areas, sensitive areas and on the construction site ● Cover construction site material transportation trucks with tarpaulins ● Implement demolition methods that minimize dust emissions ● Reduce open sand storage to a strict minimum or cover it if necessary ● Stop unused vehicles and equipment by avoiding the standby position such as idling engine ● Ensure preventive and curative maintenance of exhaust emission equipment ● Ensure the control and maintenance of vehicles to minimize pollution related to combustion problems ● Inform and raise awareness among local populations
Soil	● Demolition activity, ● Civil engineering works ● Traffic and parking of vehicles and construction machinery ● Use of hazardous chemicals ● Waste generation	● Localized modification of the soil structure ● Erosion of the soil ● Soil waterproofing ● Soil compaction	● Conduct a soil survey ● Define heavy vehicle routes (work lanes) and work areas in such a way as to limit rolling surfaces and soil compaction ● Limit the site's footprint to the strictly necessary area ● Rehabilitate the site after the work

Impacted component	Impact-causing activity	Potential impact	Mitigation measures

Soil, surface and groundwater	• Storage and handling of construction materials
	• Use of hazardous chemicals
	• Generation of solid and liquid waste
		• Soil and surface water pollution
		• Groundwater pollution
		• Decrease in the rate and speed of infiltration of runoff water
			• Provide a water drainage system before the rainy season to ensure that runoff water flows to natural circuits
			• Ensure that no vehicle maintenance is carried out on site
			• Ensure that vehicles and construction machinery have a proper technical inspection
			• Take into account NS 05-061 on waste water before discharging effluents into the natural environment
			• Limit spills and accidental leaks by:
			  ○ the provision of anti-pollution kits
			  ○ storage of oils and other hazardous products in sealed retention basins
			• Collect solid and liquid waste according to a waste management plan in accordance with national and international regulatory provisions
			• Raise awareness and train staff on solid and liquid waste management
			• Limit the site's footprint to the strictly necessary area
			• Implement an HSE policy

Water resources used by the population	• Rehabilitation activities (civil engineering, soil watering, cleaning operation, etc.) • Health needs	• Decrease in the resource	• Collect and use rainwater to water the slopes if the work is carried out during the rainy season • Implement a rational water management policy • Repair in time any degradation that may cause water leakage • If necessary, use water tarpaulins in good condition to prevent water leaks. • Raise employee awareness of the importance of the resource and the need to preserve it
Fauna and flora	• Brushing • Excavation work • Use of hazardous chemicals • Presence and circulation of labor	• Loss of vegetation • Degradation or loss of wildlife habitat	• Limit the site's footprint to the strictly necessary area • Establish an effective system for the management of excavations and waste resulting from the work • Use machinery, vehicles and equipment that comply with noise emission standards • Prevent the wandering of animals inside the site • Implement an off-site reforestation plan and ensure follow-up, in collaboration with the Saint-Louis forest sector • Notify the IREF before any deforestation or clearing activity • Support community nature reserves in the project area

Impacted component	Impact-causing activity	Potential impact	Mitigation measures
			• Avoid killing species encountered on site
Land use and allocation	Release of the site	• Housing loss • Loss of market gardening land	• Relocate populations located on the airport right-of-way and ensure that they are relocated to a suitable site • Set up measures to support the populations affected by relocation • Comply with IFC Performance Standard 5 for involuntary movement of people and economic activities • Compensate the impacted people • Support populations in their relocation when releasing illegally occupied land bases • Secure and enhance these spaces for the airports concerned • Establish with the land registry the real boundaries of the airport and install a barbed wire fence
Living environment	Rehabilitation work	Noise pollution	• Establish the initial noise status before starting work • Use equipment and tools with low noise levels and respect the limit of 85 dB at 1 m • Carry out acoustic measurements in the noisiest areas and on the property line and implement corrective measures • Provide workers with adequate PPE to fight against noise pollution • Perform timely maintenance of pneumatic tools, machinery and equipment to keep the noise level generated at an acceptable level • Ensure that certain very noisy equipment such as site diesels, compressors, etc. is covered. • Set up a screen wall towards residential areas, especially in the nearest neighbourhoods
		Waste generation	• Set up a waste disposal center as soon as the rehabilitation site opens • Ensure that waste is not abandoned, released into the natural environment or burned in the open air • Draw up a waste tracking form for so-called hazardous waste • Collect separately and recover waste as much as possible • Ensure that mixed waste is placed in storage in "all coming" bins or containers and disposed of in authorized landfills

Impacted component	Impact-causing activity	Potential impact	Mitigation measures
			• Create a buffer area between the airport and the houses • Raise staff awareness of waste management
		Traffic densification	• Inform stakeholders (municipalities, populations, AGEROUTE, etc.) about the date of the convoy (by radio, newspaper, telephone, mail), routes, risks and measures to be taken to avoid accidents • Inform the DPC and use a professional escort between Dakar and the site • Use trucks in good working order for technical inspection for transportation to the site and suitable container platforms / doors • Limit speed to 30 km/h to the right of the population and make drivers aware of the importance of respecting the rules of good conduct
Cultural and historical heritage	Rehabilitation work	Moving cemeteries	• Communicate and consult with local populations (keep them informed) before starting work around cemeteries • Consult with the populations concerned about the new site chosen for the cemeteries
Mitigation of negative impacts during the operating phase			
Air quality	• Operation of equipment • Operating activities • Increase in road traffic • Increase in air traffic	• Impaired air quality • Global warming	• Identify emission sources and implement an air quality management system • Work on measures to reduce polluting emissions • Assess air quality in the area of influence of the project in the operational phase • Ensure long-term monitoring of ambient air quality in the various sites identified as potential receptors • Ensure the use of good quality fuel during the operating phase • Create green spaces (grass) away from the track • Conduct off-site reforestation campaigns • Ensure compliance with the requirements of current standards in terms of emissions • Minimize dust emissions
Soil and water resources	• Operating activities • Transportation and unloading of fuel • Storage and handling of polluting products (fuel, lubricants, oils, etc.)	• Soil pollution • Contamination of runoff and groundwater	• Implement a stormwater management plan • Comply with the NS 05-061 Wastewater Standard before any effluent discharge • Dispose of and handle fuel on prepared and sealed surfaces • Establish procedures for responding to accidental spills or leaks • Implement procedures and safety measures that must be followed for all refuelling operations

Impacted component	Impact-causing activity	Potential impact	Mitigation measures
	• Maintenance and cleaning activities for aircraft, pavements, etc. • Waste generation		• Implement an Internal Operation Plan (IOP) to deal with emergency situations • Sort and store waste in a sealed storage area • Find approved channels for the transportation, storage and disposal of waste in accordance with current standards • Perform periodic tests (hydraulic and watertightness) at regular intervals to check the condition of the tanks and the operation of the trucks • Provide anti-pollution kits
Water resources used by the population	• Airport Operations	• Waste of the resource • Increase in water requirements in the project area	• Collect and use rainwater to water green spaces (lawn, flowers) • Implement a rational water management policy • Put signs on toilets and sinks to raise awareness among employees and travellers about the importance of water conservation • Repair in time any failure that could cause a water leak • Favor preventive maintenance of pipes and water points (taps, flushes, washbasins, etc.) • Reuse treated wastewater if possible
Fauna and flora	• Noise generation • Light emission • Aircraft Overflight	• Wildlife Disruption • Collision between birds and aircraft	• Avoid the divagation of animals in the airport • Create a buffer area between the airport and natural areas • Avoid the development of vegetation in the airport and its surroundings • Ensure the reduction of engine noise through regular maintenance and technical visits • Taking noise control into account in airport management • Develop an action plan to reduce aircraft noise pollution • Act on flight schedules and/or limit night flights • Use machinery, vehicles and equipment that comply with noise emission standards
Living environment	Airport Operations	Noise pollution	• Carry out regular acoustic measurements in the noisiest areas and on the property line and implement corrective measures • Provide workers with adequate PPE to fight against noise pollution • Act on flight scheduling and choose time slots that limit night flights; • Favor airlines that regularly renew their fleets • Encourage airlines to raise awareness and train their pilots in flight techniques to

Impacted component	Impact-causing activity	Potential impact	Mitigation measures
			reduce noise emissions ● Create a framework for functional consultation between airport managers, local populations, administrative and local authorities, certain technical services
		Waste generation	● Set up a solid waste management procedure and provide all companies on the platform with an area dedicated to the sorting of non-hazardous and hazardous waste ● Optimize the recovery of different materials by sorting waste as much as possible at source ● Place garbage cans and skips within the airport and protect them from waste spills (lids, nets, screens, etc.) ● Inform and raise awareness among staff of airport infrastructure assistance and maintenance services about waste management ● Regularly empty septic tanks by an approved body ● Work to reduce waste at source and avoid landfilling of recoverable waste as much as possible
Water and energy consumption	Airport Operations	Excessive water and energy consumption	● Re-evaluate the files on the electrical energy needs of airports that will be shared with SENELEC's Distribution Department ● Set up a water storage device equipped with a booster for an autonomy of 3 to 4 days ● Choose water-saving equipment and install specific meters to monitor water consumption and detect any discrepancies ● Avoid the proximity of the SDE connection to the ONAS network, if it exists, as the latter could contaminate the SDE pipes in the event of a defect and install a non-return valve at the entrance to the airport's private network ● Disinfect the network set up in airports before it is put into service with concentrated bleach

I.3. RESULTS OF THE HAZARD STUDY

The hazard study was carried out in order to identify and characterize all the potential hazards that may be encountered on and around the project site, thus minimizing the consequences.

After a preliminary analysis of technological risks, it was revealed that there are risk situations. The establishment of accident scenarios is therefore necessary in order to be able to quantify their radius of action and their effects on the environment, people and structures, according to the flows emitted.

The most critical feared events that have deserved further study are:

- Jet A1 storage tank fire ;
- Jet A1 tank fire ;
- Boil over of thin layer of a Jet A1 tank.

Following the analysis of these scenarios, the effect distances of the different flows could be determined.

The layout of the various buildings and facilities at the airport should take into account the results of these models in order to establish a distance and safety barriers so that the radii of action of the flames cannot reach the targets, thus avoiding the consequences of such accidents as far as possible.

This hazard study also proposed preventive measures to reduce the occurrence of these accidents and means of controlling the consequences in order to deal with possible disasters and reduce the severity of the accident. These safety instructions, if applied, will considerably reduce, if not prevent, the occurrence of these accidents and the severity of the associated phenomena.

I.4. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The Environmental and Social Management Plan (ESMP) aims to ensure the correct and timely implementation of all measures to mitigate negative impacts and improve positive ones.

The ESMP relies on the regulatory measures in force concerning this project to establish guidelines that the promoter is required to comply with in order to comply with Senegalese legislation. The objectives of the ESMP include the following:

- ensure that project activities are undertaken in compliance with all legal and regulatory requirements;
- ensure that the environmental issues of the project are well understood by the promoter and implemented both in the construction and operational phases.

The environmental management plan includes various measures:

- those to be included in the various specifications of the contracting companies for the works as part of the contractual measures which will therefore not be evaluated financially because they are included in the works CADs;

- accompanying measures to be carried out in addition to the technical and/or environmental actions that will be evaluated financially, for example awareness-raising and training actions (institutional strengthening of the actors).

The ESMP will be reviewed as required to ensure its relevance and effectiveness. The proposed amendments will be discussed with the appropriate government authorities.

Monitoring plan

Environmental monitoring is concerned with the rehabilitation and operational phases of the airport. Its purpose is to ensure that the measures concerning the administrative, regulatory and environmental aspects recommended in the ESIA and ESMP are applied.

Table 3: Summary of monitoring measures

Components of the system	Recommended action	Implementation timescales	Cost[3]
Noise	• Check the sound power level of noisy equipment • Check the noise level at the airport property limits	From the beginning of the work and during operation	CFAF 2,000,000 (purchase of measuring equipment)
Waste products	• Collect and dispose of waste • Find an agreement with approved companies for waste disposal	From the beginning of the work and during operation	To be defined
Air quality	• Measure the concentrations of the main air and fine particulate pollutants	Before the work and during operation	CFAF 1,500,000 per measurement campaign
Sewage water	• Set up a pre-treatment system • Take samples and analyze them	During the construction phase and during operation	300 000 FCFA per sample
Water (use and consumption) and energy	• Install counters	During the construction phase and during operation	SDE, SENELEC rates
Local employment	• Monitor recruitment at the local level	Before the start of the work	No specific cost
Loss of housing and market gardening perimeters	• Ensure compensation for losses	Before the start of the work	To be defined with CDREI

Surveillance plan

[3] This cost is indicative and serves as a basis for determining the expenses to be incurred in connection with the environmental and social management of the project

Environmental surveillance makes it possible to assess the relevance and effectiveness of the measures implemented for environmental management. The observations made during the surveillance will make it possible to readjust, redefine if necessary the mitigation measures, and also to revise certain provisions taken concerning the management of environmental impacts, taking into account new developments on the site (if necessary) and the evolution of techniques.

Table 4: Summary of follow-up actions

Component	Type of follow-up	Monitoring location	Monitoring method/indicator	Frequency
Noise	• Noise measurements by integrating sound level meter • Noise mapping	On site and within property boundaries	• Number of measurements performed • Noise measurement results • Number of noise protection devices installed	Monthly
Waste products	• Level of implementation of the waste management plan	On site	• Quantity and type of waste generated • Volume of waste disposed of per day • Waste tracking forms	Weekly
Air quality	• Concentration measurement by diffusion tubes • Measurement of air quality at the edge of the runway, where reactor thrust is at its highest • Measurement of concentrations of the main pollutants	On site and in the vicinity of the airport	• Results of concentration measurements • Difference between the measurement results and the ELVs of the NS 05 062 Standard	Quarterly
Sewage water	• Sampling and analysis of pre-treated water	At the point of release	• Quantity of pretreated wastewater • Final processing report	Before wastewater discharge
Water (use and consumption) and energy	• Installation of the meters	On the site	• Quantity of water consumed • Energy consumed	Bi-weekly
Local employment	• Monitoring of local recruitment	Departmental/Municipal Council	• Number of local employees • Number of fixed-term and permanent contracts	Bi-weekly
Loss of housing and market gardening perimeters	• Monitoring of compensation payments	Prefecture	• PV of payment of indemnities • Number of persons compensated	-

II. INTRODUCTION

The purpose of this report is to present the results of the Environmental and Social Impact Assessment (ESIA) of the Saint-Louis airport rehabilitation project in the Commune of Saint-Louis, Department of Saint-Louis, Region of the same name.

This study, commissioned by TRANSCON, identified and analysed the potential positive and negative impacts inherent to the implementation of the various activities on the biophysical and socio-economic environment in the project area, in accordance with the legal and regulatory provisions in force in Senegal relating to the environment. Thus, an Environmental and Social Management Plan (ESMP) has been drawn up, which indicates, among other things, the measures to eliminate and/or mitigate negative impacts and the methods for implementing environmental and social management. This ESMP is accompanied by an environmental monitoring and surveillance plan with costs, indicators, actors involved, etc.

II.1. CONTEXT AND JUSTIFICATION OF THE STUDY

With a privileged geographical position, Senegal aspires to become a reference platform in the field of air transportation. To achieve this, the State, through the Ministry of Air Transportation and Airport Infrastructure Development (MTADIA), intends to deploy the regional air hub project of the Emerging Senegal Plan (PSE).

This project is structured around three major axes: the commissioning of Blaise Diagne International Airport (effective since 07 December 2017), the launch of the national fleet's activities under the supervision of Air Sénégal SA and the rehabilitation of five (05) airports (Saint-Louis, Matam, Ziguinchor, Tambacounda and Kédougou).

The rehabilitation of these five (05) airports, with an estimated cost of 176 million dollars or 100 billion [4]CFA francs, has the following objectives: bringing airports up to standard, increasing air transportation density and opening up inland regions.

It thus contributes to the creation of viable economic centers in the terroirs in order to stimulate their development throughout the territory. It will be a lever for economic growth and job creation, with the objective of reaching five million passengers and three million tourists by 2023.[5]

The Saint-Louis airport subject of this study is located in the Commune of Saint-Louis, Rao district, Saint-Louis department, region of the same name. It receives very few people and is mainly used by military aircraft, private jets and presidential convoys. Indeed, the analysis of aircraft and passenger movement statistics from 2006 to 2016 showed that these movements went from 824 to 577 for aircraft and from 14,835 to 2,329 for passengers.

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[4] https://www.lateranga.info/Aeroport-de-Dakar-Air-Senegal-ou-en-est-le-reve-aerien-de-Macky-Sall_a31058.html page consulted on 11/12/2017 at 16h00

[5] http://www.actu24.net/actualite/s%C3%A9n%C3%A9gal-journ%C3%A9es-du-transportation-a%C3%A9rien-ma%C3%AFmouna-ndoye-seck-ministre-%C2%ABle-projet-hub-a%C3%A9rien page consulted on 11/12/2017 at 16h00

This colonial-age airport was first used in 1927. Since then, no changes have been made. Only the construction of the terminal building began in 2006, resumed in 2009 and was interrupted in 2010.

The rehabilitation of the latter will bring it up to international standards and will contribute to the revitalisation of air traffic in this area, an appropriate market for the development of tourism.

The upgrading of the airport will thus boost the region's economy by offering attractive infrastructure, niches of opportunity for foreign capital. In addition, the airport will be able to meet the comfort and safety requirements in order to meet the transportation needs of foreign trade (sub-regional). In addition to creating jobs, this rehabilitated airport will have to perform several functions, including:

- meeting disaster relief needs;
- meeting the needs of postal services;
- being useful for national defence;
- contributing to national development by creating the necessary conditions for the development of a healthy and viable air transportation sector.

With the discovery of oil and gas off Saint-Louis, the renovation of the airport makes sense to facilitate international trade.

II.2. OBJECTIVES OF THE ESIA

The objective of this impact study is to identify, evaluate and measure the direct and indirect effects in the short, medium and long term of the Saint-Louis airport rehabilitation and operation project and to propose appropriate measures for managing the project's impacts on the biophysical and human environment.

It supports decision-making by providing a solid basis for managing the project's impacts on the biophysical, social, cultural, health and social environment of populations and workers. It proposes mitigation or compensation measures for potential negative impacts and enhancement measures for positive impacts of the project. The ultimate objective of the ESIA is to obtain an environmental compliance certificate issued by the Ministry of Environment and Sustainable Development (MEDD).

Specifically, the ESIA has the following objectives:

- To ensure that the constraints and opportunities inherent in the environment are integrated into the airport's rehabilitation process;
- To indicate the regulatory obligations to be respected during the development and operation phases of the airport;
- To describe the receiving environment of the project;
- To inform the authorities and the populations that could be affected by the project;
- To guarantee the rational use of resources;
- To provide strategies to improve the social aspects of the project;
- To provide guidance and recommendations to protect the health and safety of populations and workers;

- To identify and implement appropriate measures to avoid, eliminate, reduce, or compensate for major and irreversible negative impacts on the environment through an Environmental and Social Management Plan (ESMP).

II.3. METHODOLOGY FOR CONDUCTING THE ESIA

The impact assessment was guided by the requirements of the Senegalese Environmental Code and related texts, making it possible to identify and assess, to the best of our knowledge, the project's impacts on its environment. It also takes into account regulatory requirements expressed in sector codes, where applicable to the project.

In practice, the ESIA is carried out in four (04) main steps:

STEP 1: Study launch workshop

- Elaboration of maps of the project site and its immediate surroundings in collaboration with the Promoter;
- Identification of stakeholders (local authorities, government representatives, village groups, populations, etc.);
- Collection of documents relevant to the study from interested parties;
- Data analysis and preparation for the site visit.

STEP 2: Site visit

- Visit of the site that will house the project in Saint-Louis by the EES team;
- Identification of existing sensitive areas;
- Information gathering and further investigations;
- Consultation with the technical services of the State and the populations living near the site.

STEP 3: Drafting the interim report

- Identification and evaluation of impacts;
- Carrying out the hazard study and the preliminary risk study;
- Development of the ESMP;
- Discussions with the promoter on the content of the report.

STEP 4: Final Report

- Validation of the interim report with the promoter;
- Correction and issuance of the final report.

II.3.1. COLLECTION OF BASIC DATA

The collection was carried out through meetings with the promoter to obtain basic data relating to the project (plans, technical, legal, financial and other documents), documentary research, site investigations, consultations and interviews with the main actors likely to be involved.

The literature search consisted mainly of collecting information on the biophysical and socio-economic characteristics of the project's area of influence.

It also provided an opportunity to review the political, legislative and regulatory framework governing the environment and the aeronautics sector in Senegal. All the documents consulted are included in the bibliography which will be annexed to the report.

Subsequently, field visits were made to the site and its area of influence. These visits enabled the Consultant to identify the proposed site, assess and define the study area, verify and validate the information collected during the documentary research, collect other relevant information on biophysical and socio-economic characteristics and assess the environmental and social sensitivity of the above-mentioned areas.

Group and individual interviews were conducted with the actors involved, as well as the relevant technical services of the State in order to pass on information about the project and collect opinions, fears, recommendations and expectations (see list of persons met in Annex 3).

Taking into account the results obtained during the stakeholder consultation meetings enabled the consultant to identify sensitive points in relation to the environmental components identified in the study.

II.3.2. PROCESSING, DATA ANALYSIS AND REPORT WRITING

This step consists of processing, analyzing and synthesizing all the information collected in the previous step. To this end, an environmental analysis was carried out to identify and evaluate positive and negative changes in the project on the biophysical and human environment.

II.4. STRUCTURE OF THE ESIA

The presentation of this impact study will be as follows:

- Chapter 1: Non-Technical Summary
- Chapter 2: Introduction
- Chapter 3: Project Description
- Chapter 4: Political, legal and institutional framework
- Chapter 5: Description of the initial environment
- Chapter 6: Analysis of variants
- Chapter 7: Public Consultation
- Chapter 8: Analysis of Potential Environmental Impacts of the Project
- Chapter 9: Risk Assessment
- Chapter 10: Environmental and Social Management Plan
- Chapter 11: Conclusion
- Chapter 12: Annexes.

II.5. PRESENTATION OF THE FIRM

EES Sarl is a consulting and engineering firm for industry, local authorities, development organisations, administration, etc.

The firm is very oriented towards environmental assessments, training and, in general, everything related to the Environment, Health and Safety (HSE).

With the ministerial approval n°2147 of 18/02/2013 of the Ministry in charge of the Environment as well as that of the Directorate of Civil Protection for the realization of Hazard Studies (EDD) and Internal Operation Plan (POI), EES has carried out several activities validated by DEEC with the participation of DPC.

EES has a pool of high-level multidisciplinary experts in the fields of energy, chemistry, petrochemistry, agribusiness, food industry, pharmaceuticals and construction. The areas of intervention of EES concern the diagnosis of emissions and immissions, Engineering and consulting, Quality, Environment, Health and Safety, Training and Assistance.

II.6. COMPOSITION OF THE TEAM

The Environmental and Social Impact Assessment (ESIA) of the Saint-Louis airport rehabilitation and operation project is carried out by EES, whose multidisciplinary team is presented in the table below.

Table 5: Team of experts

Name and First Name	**Title**	**Tasks in the ESIA**
Serigne M. DIOP	Industrial pollution expert, certified environmentalist	ESIA Coordinators
Abdourahim BA	Industrial Engineer	
Seynabou DIATTA	Geographer/Environmentalist	Responsible for describing the physical and biological environment
Ndeye Marie LETTE	Geotechnical Engineer/HSE	In charge of the hazard study
Fatimata Samba	HSE Engineer	Responsible for the project description and public consultation
Mbaye Sarr	Socio-economist	Responsible for public consultation and the political and legal framework
Mourtalla Diop	Socio-economist	Responsible for socio-economic and human expertise
Ndèye Fatou MBOW	HSE Engineer	
Yacine DIOP	Socio-economist	

III. PROJECT DESCRIPTION

III.1. PRESENTATION OF THE PROMOTER

TRANSCON Electronic Systems is an independent Czech private company founded in 1990 and specialising in electronic and electrical equipment for airports.

The company operates with its equipment consisting of hardware and software, prototype workshops, production workshops, maintenance and transportation services.

The development, manufacture and maintenance of the equipment are certified in accordance with the CSN quality control system in ISO 9001 version 2009.

III.2. PROJECT ORGANIZATION

The Ministry of Air Transportation and Airport Infrastructure Development (MTADIA) has signed a commercial contract with the Czech company TRANSCON for the rehabilitation of five (05) airports (Saint-Louis, Matam, Ziguinchor, Tambacounda and Kédougou) for a period of 47 months. The amount of financing amounts to 100 billion CFA francs.

The first step consists of the rehabilitation of the Ourossogui airport (Matam) and then, of the Saint-Louis airport, which is the subject of this study. The rehabilitation of the airports of Kédougou, Tambacounda and Ziguinchor will follow.

Under the terms of the contract, TRANSCON is responsible for the rehabilitation and equipment of these airports. It will also be responsible for supporting the Ministry in its operating activities for a period of two years. However, the operation of the airports, including Saint-Louis, is the responsibility of the Senegalese Government through its supervisory ministry (MTADIA).

This project to rehabilitate the Saint-Louis airport will require the demolition of certain existing structures and the installation of new facilities and infrastructure to ensure adequate air traffic.

III.3. PROJECT LOCATION

The Saint-Louis airport is located in the northwest of Senegal, in the Commune of Saint-Louis. This commune is located in the district of Rao which is an integral part of the department of Saint-Louis located in the region of the same name. (See map 1: Location of the Commune of Saint Louis, page 104)

III.4. DESCRIPTION OF THE CURRENT STATE OF THE AIRPORT

III.4.1. IDENTIFICATION OF COMPONENTS

The airport consists of the following buildings:

a. a VIP lounge equipped with a gantry and an X-ray machine;
b. a terminal building under construction since 2006, taken over in 2009 and stopped in 2010;
c. an administrative and technical building that houses a technical block coupled with an 11 m high control tower, a safety and security office, a weather station, the Commander's office and the secretariat;

d. a tarred track 1.9 km long and 30 m wide with 2 Stop Extensions (PA) of 100 m each, the track is marked during the day with a white paint (18 and 36);
e. a 197.5m x18m taxiway and a 150m x100m tarmac that is well paved but whose joints are not in good condition;
f. a fuel storage area with two 50,000-litre tanks of Jet A1;
g. a service station for the refuelling of tanks to refuel aircraft;
h. a Fire Station with an extinguishing vehicle with an 8000-litre water tank;
i. an underground fire reserve with a capacity of 20,000 litres.

Water supply is provided by the SDE network via the Lac de Guiers. Electricity supply is provided by the SENELEC network, with a small power plant equipped with two (02) diesel generators (200-litre storage) as backup power source. This plant is commissioned in the event of load shedding and night flights that cause increased energy requirements. A 5000-litre tank (not functional) has also been installed for greater autonomy in the supply of diesel fuel.

Saint Louis airport operates from 7am to 7pm Monday to Saturday. For Sundays and public holidays, the opening is on request.

The airport fence wall is dilapidated and destroyed in places. This is not in conformity with the standards and exposes the establishment to permanent ramblings of domestic animals (cows, goats) and wild animals (warthogs).

Within the airport, there is an old cemetery with about twenty graves. Wild garbage dumps have also been identified in places.

III.5. PRESENTATION OF THE ACTIVITIES AND EQUIPMENT PLANNED BY THE PROJECT

As part of the rehabilitation of Saint-Louis airport, various activities are planned. The renovation work will be carried out at various locations throughout the airport and will have an impact on the biophysical and human environment. The planned activities can be divided into two main phases, namely civil engineering activities relating to the construction of pavements and buildings and airport equipment consisting of the development and installation of equipment to provide the service. At the end of the planned works, the airport's right-of-way will be 130 ha.

III.5.1. DEMOLITION AND CONSTRUCTION ACTIVITIES

III.5.1.1. EARTHWORKS

Earthworks operations include excavation, backfilling and material transportation. Excavation refers to the areas required to widen the runway, the parking area or tarmac and the old taxiway. At the same time, the wearing course of these infrastructures will be removed.

The excavation will be done with machines such as:

- the excavator for digging holes or foundations it can also be used in demolition operations;

- the loader for transportationing or moving a good quantity of material from one point to another;
- the bulldozer for scraping the ground for levelling the ground or for extracting materials from the ground like the scraper.

The backfill materials will come from quarries near the site and will be transported by trucks.

The excavation, backfilling and pickling operations will generate waste, most of which will be soil, plant debris and asphalt. These activities will also generate nuisances such as noise and dust emissions.

The activity should be carried out with great care to avoid the risk of accidents.

III.5.1.2. DEMOLITION OF STRUCTURES

As part of this rehabilitation project, the demolition of the passenger terminal building, the power plant, the fire hangar and the complex consisting of the control tower and the engineering block are planned.

This demolition can be done using mechanical equipment equipped with demolition tools such as buckets, hydraulic excavators, etc. This activity will generate dust and noise in addition to the waste, most of which is composed of rubble and scrap metal.

Preliminary studies and site preparation are necessary in order to carry out activities safely while preserving other structures not affected and the health of workers and people living near the site.

In order to ensure that the airport can continue to operate for as long as possible before the work is completed, the study recommends that the new technical and administrative block be put in place before demolishing the existing ones.

During the rehabilitation and extension of the runway, it is clear that no aircraft will be able to use the airport. However, helicopters may land in an area specially provisionally set up for this purpose.

III.5.1.3. PAVEMENT REHABILITATION

Concerning pavements, the project includes the extension of the current runway by 600 m and its widening to 45 m, the widening of the old taxiway to 23 m and the rehabilitation of the tarmac. In the long term, it will be implemented:

- a 2500 m x 45 m track;
- a 150 m x100 m tarmac;
- a 190 m x 23 m taxiway.

Given the boundaries of the airport and its immediate vicinity, the project plans to extend the runway by 450 m to the north and 150 m to the south. On both sides of the runway, a 7.5 m wide shoulder with lateritic material will be provided.

The expansion and renovation of these pavements will be carried out along their length and width and will require the laying of their wearing course, followed by the application of a binder course and a new wearing course made of asphalt concrete.

The rehabilitation of the pavements also concerns the rehabilitation of the service road. Its wearing course will be removed and then rebuilt, as well as the gutters for draining rainwater along its entire length. Ultimately, the service road will be 4m wide and 6250m long.

With a surface area of 9530 ^{m2}, the access road to the car park and platforms will also be rehabilitated; this will require excavation, backfilling, supply and installation of different materials for the different layers of the pavement. The access road will be 4m wide.

This work will require a fairly substantial supply of materials on site, will require labor and will be at the origin of the generation of noise, dust and waste. The risk of pollution is also present because of the possibility of seepage of engine oils, fuel spills and water from machine washing.

This exercise must be carried out in complete safety in order to comply with the requirements of the specifications in order to give the right bearing capacity to these different platforms but also to avoid the risks of accidents and pollution.

III.5.1.4. Fencing of the airport right-of-way

For security reasons, the airport right-of-way will be fenced off. The installation of the 6530 m long fence wall requires civil engineering work for the earthworks, the foundation of the wall and the elevation. It will be 2.50 m high with reinforced concrete components.

Above the fence wall and emergency exits, stainless steel concertina lines with a diameter of 0.5 m will be installed, which are mechanical deterrent devices to ensure the protection of the establishment.

Between the end of the runway and the fence wall or the first buildings, it is necessary to have a minimum distance of 150 m on either side of the runway axis.

The gate, made of stainless steel, will be double-winged with emergency exits. Ideally, it should open from the outside to allow easy evacuation in case of panic.

III.5.1.5. Construction of buildings

Passenger terminals

As part of this project, two terminals with a surface area of 1950 ^{m2} each will be built.

These buildings, with a VIP lounge, will be equipped with Schneider MTN5470-2119 30 m hydrants with a D25, $_{CO2}$ extinguishers, offices, toilets, etc. In these terminals, it is planned, among other things, to have:

- a conveyor (departure/arrival) at the airport with a check-in counter;
- a departure/arrival room;
- offices for management, security, airlines;
- a compartment reserved for passenger information;
- detection equipment: RTG HI SCAN 6046si, RTG HI SCAN 7555si, liquid detectors ;
- luggage carts.

Hall for service vehicles

A modular hangar with a surface area of 400 ^{m2} and a height of 4 m will also be built, as well as a hall for parking service vehicles and airport equipment.

Modular fire-fighting hangar

The fire hangar consisting of the parking hall for fire fighting vehicles and equipment will be built on an area of 400 ^{m2} with a height of 5 m.

Control tower

The control tower consists of the watchtower complex (the room where the airport controller is located) and its support, which is a structure on top of which the watchtower is placed. After reconstruction, it will have a total height of 21 m and is combined with the technical block that houses the organizations that provide air traffic and weather assistance, flight and ground safety. The control tower will include several modules with electronic equipment for control and monitoring, office furniture and sanitary equipment, etc. The equipment planned includes: consoles for operators, weather station with automatic indoor systems for measuring the cloud base (ceilometer), transmitter-receiver system, recording system, glass insulating glasses inclined at a specified angle to prevent sun reflection and pilot glare.

The construction of these buildings will require several expert assessments, which will lead to a co-activity on the site. It will also generate noise, dust and construction site waste that will have to be sorted, recycled if necessary or taken to the municipal landfills.

It is also essential to set up a planning of the various activities on the site in order to avoid accidents.

III.5.2. AIRPORT FACILITIES

III.5.2.1. BEACONING

The daytime marking of the runways will be done by:

- white retroreflective paint for runway axes, runway numbers and markings;
- yellow retroreflective paint for taxiway and tarmac;
- white non-reflective paint for continuous runway edge lines.

The lighting of the airport runway, which is the essential tool for the safety of aircraft and their passengers in the event of night flight, will be of the high-density halogen type on the runway edges, end of runway and threshold as well as on the edges of the taxiway and stop lines.

TRANSCON will provide these lights with all the necessary equipment for installation. The equipment and accessories required for lighting throughout the airport will be centralized in the power block, power plant and tarmac lighting system. The entire lighting system includes, among other things, a diesel emergency generator, a constant current regulator, apron headlamps with reflectors, etc.

The monitoring and remote control device for beaconing (lighting) includes an airport control and monitoring system with all the necessary equipment integrated. This control and monitoring system has a range of 10 km and allows remote maintenance supervision.

III.5.2.2. FUEL STORAGE AREA

The project plans to maintain the airport's existing fuel depot. The latter is equipped with two (02) 50,000-litre tanks of jet A1, one of which is functional and the other serves as a reserve.

These two (02) tanks, horizontal and cylindrical, are arranged on the same retention and are about 15 m from the first buildings.

The storage area has offices for staff.

The prohibition of telephoning and smoking are safety rules established in the storage area. A ground marking indicates the pedestrian areas inside. No accidents have been recorded since its commissioning.

The depot is managed by SMCADY, which is responsible for the distribution of aviation fuels at all airports in Senegal.

To fight fires, the depot has 12 ABC type extinguishers and two BC type extinguishers. The depot focuses on prevention and mitigation measures. It has the means to maintain the fire in a given environment (time delay). It has the means to maintain the disaster until help arrives (BNSP fire brigade).

The depot is inspected annually by the JIG (Joint Inspection Group) and the tanks cleaned every 3 years. The last inspection was carried out in March 2018 and the depot was awarded a "Good" rating, which attests to its operational and safety compliance.

The audit report is published on the website www.geathal.com. It is only available to JIG members, however, an extract of the audit results is included in Annex V of this report.

AVGAS 100 LL aviation gasoline used by small aircraft equipped with piston engines is not stored on site. As required, it will be ordered and delivered by SMCADY in 200-litre drums.

III.5.2.3. NAVIGATION AIDS DEVICES

The VOR, ILS (CAT I) NORMAC 7000 (locator and glide path) navigation aid device will be delivered and installed by TRANSCON. The package includes the complete design of the procedure and flight verification as well as the complete power supply and cabling with the necessary civil engineering work for the antenna foundations.

The remote maintenance control device consists of 3 RS232 interfaces for connection to the modem and provides event log, alarm log, self-diagnosis and historical data which are all fully electronic.

The VOR must be installed in a location that is free of obstacles within a 400 m radius.

III.5.2.4. FIRE WARNING AND EXTINGUISHING DEVICE

In terms of fire warning and extinguishing, the project provides for the installation of light and sound alarms and smoke detectors in places where their installation is necessary.

TRANSCON will equip the airport with 3 fire extinguishing vehicles, a 9,000-litre water tank and an 8,000-litre foaming agent reserve. These fire extinguishing vehicles will be equipped with pumps with a capacity of 3,000 l/min.

The fire hangar managed by the ASECNA Fire Brigade on site will be equipped with the following fire-fighting equipment:

- fire hydrants (2 rooms) ;

- special storage drums for fire-fighting foam (200% capacity inside fire-fighting vehicles);
- electrical distribution cable for permanent vehicle (charging system);
- shelves for storing fire hoses (inside the storage room);
- maintenance tools, spare parts (for vehicles and fire-fighting equipment), exit scissors, oxygen masks inside the working room;
- 6 fire protection suits;
- special coatings on walls near vehicles.

III.5.2.5. AMBULANCE

The project involves the acquisition of an ambulance for the airport. This medical assistance vehicle will be equipped with an alarm system consisting of two flashing lights, a radio antenna and fixed sanitary equipment.

III.5.2.6. SANITARY VEHICLE

A ZODIAC Truck TST 1820 medical vehicle will be made available to the airport for aircraft emptying needs. It will be equipped with a waste tank with a capacity of 1800 litres and a rinsing and disinfection liquid tank with a capacity of 200 litres. The waste will be sucked by a pump with a flow rate of 55 litres per minute.

III.5.2.7. DRINKING WATER TANK AND SUPPLY TANK

A 1800-litre drinking water storage tank with a pump capacity of 90 l/min is planned by the project. There is also a fuel tank with a lifting platform. This 35,000-litre tank will be made of a material made of an aluminium alloy. The manhole cover will be equipped with a quick action lock. The tank will be equipped with:

- a high level sensor acting on the bottom loading valve to prevent overfilling of the tank;
- a drain valve with sequential control;
- permanent flame arresters for fire protection;
- dips for manual fuel level detection;
- a level gauge of the float tank.

III.5.2.8. PATROL CARS

Skoda Yeti patrol cars are planned as part of this project.

They will allow the airport to be traversed throughout its right-of-way in order to detect any anomaly and secure the site.

III.5.2.9. AIRCRAFT DIMENSIONING AND AIRPORT REFERENCE CODE

The reference code of an airport is defined in Annex 14 to the Convention on International Civil Aviation and includes two elements related to the performance characteristics and dimensions of the aircraft authorised to use that airport or the dimensioning aircraft. The dimensioning aircraft is determined by the Civil Aviation Authority and in the case of the project, it is the A320 whose characteristics are presented in the table below.

Table 6: Characteristics of the reference aircraft

Aircraft type	Wingspan	Overall width	Take-off distance
A320	34,1 m	7,59 m	2180 m

- **Determination of the reference code**

As described above, this code is based on two elements.
The first element is a number based on the reference distance of the aircraft defined as the minimum length. It is indicated in the flight manual provided by the manufacturer.
The second element of the reference code is a letter based on the maximum values of the maximum spans and outside widths of the main landing gears of the aircraft for which the aerodrome is intended. The following table is used to determine the aerodrome reference code.

Table 7: Aerodrome Reference Codes

Code elements 1		Code elements 2		
Code number	Aircraft reference distance	Code letter	Wingspan	Overall width of the main gear
1	Less than 800 m	A	Less than 15m	Less than 4.5 m
2	800 m to 1200 m excluded	B	15m to 24m excluded	4.5 m to 6 m excluded
3	1200 m to 1800 m excluded	**C**	**24 m to 36 m excluded**	**6 m to 9 m excluded**
4	**1800 m and more**	D	36 m to 52 m excluded	9 m to 14 m excluded
		E	52 m to 65m excluded	9 m to 14m excluded
		F	65 m to 80 m excluded	9 m to 16 m excluded

The analysis of the table shows that the Saint Louis airport after the upgrade work will be of category 4C.

III.6. AIRPORT OPERATIONS

The airport's role is to ensure and control take-off, landing, taxiing and passenger departures and arrivals.

In the operational phase, the planned activities revolve around airport assistance.

III.6.1. AIRPORT ASSISTANCE ACTIVITIES

Airport assistance includes assistance to the aircraft and passengers.

In accordance with Ministerial Order No. 3483 MATA-ANACS-DTA-DTAR dated 17 April 2008, the provision of airport handling services requires an approval issued by the Ministry of

Civil Aviation (MTADIA) and an operating licence issued by the National Civil Aviation Agency of Senegal, which has merged with ANACIM.

Thus, the services provided at an airport cover the following activities[6]:

- ground administrative assistance and supervision;
- passenger assistance;
- luggage assistance;
- freight and mail assistance;
- assistance in ramp operation;
- assistance in cleaning and service of the aircraft;
- online maintenance assistance;
- assistance in flight operations and crew administration;
- ground transportation assistance;
- sales service assistance;
- assistance in bunkering.

III.6.2. FUEL SUPPLY

This supply will be made by tank trucks with a capacity of about 40,000 litres from Dakar. At this time, the frequency of refuelling is an average of 10 trucks per year.

As soon as the tank trucks arrive in the depot, the transportation documents are checked and the vehicles are driven to the unloading area. They are left to rest for a while and then purge.

❖ **Unloading procedures**

Before any unloading operation, the operator checks the quality of the fuel. For this purpose, a sample is taken to determine its physico-chemical characteristics (its density at room temperature, etc.). It also ensures that the product contains no water or impurities and only allows disposal when the product is in compliance. Thus, the acceptability test done on the fuel includes the following actions:

- to detect water traces, use the Shell water detector (equipment for detecting water traces);
- to check that it is not charged or to eliminate static electricity, measure the electrical conductivity;
- to identify the presence of sediments, carry out a visual inspection;
- to check that the quality of the product has not changed, carry out a density check.

In addition, the water detector test is carried out daily on the tanks to detect traces of water. Other tests are also carried out periodically to detect the presence of impurities. These are:

- the millipore test (colorimetric membrane) performed every month;
- the gravimetric millipore test performed every 3 months.

[6] Ministerial Order No. 3483 MATA-ANACS-DTA-DTAR dated 17 April 2008

The gravimetric millipore test is performed on the vehicles that directly power the aircraft. In the case of Saint-Louis, it is carried out at the service station.

After checking the fuel quality, the ground wire is connected to the truck to eliminate static electricity accumulated on the walls. Subsequently, the pipes are connected to the tanks and the liquid is transferred to the tanks.

There is almost no possibility of overflowing the 50 ^{m3} tank during unloading because:

- a gauging is done before unloading;
- the level alarm sounds at a certain level of the load (about 45 ^{m3});
- the pumps automatically shut down at nearly 48 ^{m3}.

The retention tank is connected to a settling tank that recovers the fuel spilled in the tank and separates it from the water (rainwater, if necessary).

SMCADY, which is responsible for the installation and management of fuel storage tanks (Jet A1), must install permanent safety storage to avoid any stock shortage that could have a negative impact on the management of flight hours.

III.6.2.1. AIRCRAFT REFUELLING

The refuelling of aircraft includes all delivery operations aimed at filling the tanks of an aircraft with the quantity and quality of fuel required by the aircraft operator.[7]

As part of the project, aircraft will be refuelled with kerosene on the parking lot using a refuelling truck equipped with a lifting platform. The refuelling truck is filled from a service station connected to the kerosene tanks via an underground pipeline.
This service station, which is directly supplied by the kerosene tanks, is in good condition and is equipped with a pump.

Before refuelling aircraft, strict safety and quality procedures are followed. Static electricity is cancelled by grounding and fuel quality is checked again (Shell water detector).

The flow rate and pressure of kerosene when filling the aircraft's tanks are also controlled to avoid disasters in the event of high pressure.

It is important to be more vigilant in drafting procedures and implementing safety measures for any fuelling operation.

III.6.2.2. CLEANING AND SAFE SEARCH OF AIRCRAFT

Between flight arrivals and departures, aircraft cleaning can be carried out by airport service providers. This cleaning process includes many tasks that can be summarized as collecting the waste found on the aircraft floor, vacuuming carpets, changing the headrests on each seat, repositioning seat belts, cleaning shelves and portholes, etc.

Internal training of staff on good practices, health and safety rules to be applied is required for the correct performance of these tasks.

A security search may be carried out in parallel with the cleaning operations. To this end, the agents in charge of cleaning operations must be trained in the control and application of security rules. The staff dedicated to this purpose will then be made aware of the national regulations in terms of excavations and the risks of critical situations and the action to be taken in the event of the discovery of a prohibited object in the cabin.

III.6.2.3. MAINTENANCE OF AIRPORT INFRASTRUCTURE

These activities include the cleaning and maintenance of airport pavements (runway, taxiway and aircraft parking area), buildings (airports and administrative buildings) and roads (access and service roads).

Night markers and the various networks must be regularly maintained.

III.6.3. AIRPORT SECURITY AND SAFETY

The drafting of a security programme leading to the establishment of an airport security system is essential.

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[7] Definition of the Order of 23 January 1980 on precautions to be taken for the refuelling of aircraft at aerodromes**:** Consolidated version as at 17 January 2008

Airport access controls must be regulated. They concern the following areas:

- access to the airport
- access to the terminal building;
- access to the operating buildings of airport companies and services;
- access to the dressing rooms of diplomatic entities and State authorities;
- etc.

These controls will be facilitated by the installation of surveillance equipment (cameras, X-rays for hand luggage, hold baggage, metal detectors, hand detectors, explosive detectors, etc.).

In addition, airport security requires rigorous screening and inspection of passengers, baggage and personnel. It also handles passport, passenger ticket and cabin baggage gauge control for airlines.

A focus is placed on the strict control and inspection of passengers and baggage to prevent explosive devices, weapons or dangerous goods from being loaded onto aircraft.

With regard to airport security, an airport fire brigade called the Rescue and Firefighting Service (SSLI) is being set up.

Its main task will be to respond as quickly as possible to aircraft-related incidents or accidents and to provide rescue, evacuation and first aid. To carry out its mission successfully, this service must be equipped with emergency resources adapted to the risks it must defend. As part of the project, it will be equipped with three fire-extinguishing vehicles, each equipped with a 9,000-litre water tank and 800 litres of foaming agent in addition to costumes and other accessories.

As part of the fight against animal and particularly avian risk, a service for the prevention of animal risk must be set up. This service will contribute to flight safety and reduce the risk of collision between aircraft and animals (especially birds) during take-off or landing. To do this, the service officers will have to rely on various frightening techniques (based on pyrotechnics, acoustics, laser flare, rifle, etc.) in order to make the site hostile to the use of animal species.

III.7. RESOURCES REQUIRED TO CARRY OUT THE PROJECT

III.7.1. LAND ACQUISITION AND SECURITY

With regards to the land aspect, ASECNA has two land titles registered under TF 132 dated 1961 with an area of 104 ha and TF 107 dated 1956 with an area of 60 ha. The former airport runway, registered TF No. 28 BS, is still owned by ASECNA and is partially occupied by the Khar Yalla district.

However, it should be noted that the fence in question is located well before the airport's land base limits, which has resulted in human settlements mainly south of the site in the airport right-of-way.

The urgency consists in the acquisition of an updated cadastral plan by the competent services in order to define the exact limits of the airport and to see the modalities of movement of the populations settled within the defined perimeter.

III.7.2. HUMAN RESOURCES MANAGEMENT (JOBS)

The number of staff required for the construction and operation phases is not yet defined. However, it should be pointed out that these recruitments should be mainly local, especially for the rehabilitation phase.

For operations, staff are already in place for the current operation of the airport. The study recommends the training of these personnel through a capacity building program to ensure that they are up to date with the new technologies that will be installed after the work is completed.

In addition, the start of operations could undoubtedly lead to the recruitment of new profiles needed to develop the airport's new functionalities. In this particular case, it is advisable, for equal competence, to give priority to the local population.

It is also recommended for some expertise areas, to train the local population, as far as possible, and to recruit them for these positions.

At the level of airport hubs, there is a wide range of professions listed below:

- operating agent;
- chief aircraft;
- bunker;
- airport security agent;
- aircraft cleaning agent;
- tractor baggage handler;
- baggage handler sorting correspondence;
- driver / loader ;
- employee of food services;
- freight forklift operator;
- sorter handler ;
- guide for travellers with reduced mobility;
- etc.

III.7.3. TRANSPORTATION OF MATERIALS AND EQUIPMENT

Construction materials such as sand, gravel, basalt and laterite will come from the authorized quarries closest to the site. They will be transported to the site by road via trucks. The necessary quantities cannot be estimated at this stage of the project because the company in charge of the work is not yet selected. Nevertheless, with regard to resource management, the shuttle service for trucks and construction machinery, the emission of pollutants and noise pollution, management measures will have to be taken.

The contracting company must draw up a notice of environmental and social clauses on the site, which will serve as a code of good practice in the execution of the work.

III.7.4. WATER REQUIREMENTS FOR THE PROJECT

III.7.4.1. WATER NEEDS IN THE CONSTRUCTION PHASE

Water requirements during the construction phase are not yet estimated at this planning stage of the rehabilitation works. However, it is likely that water supply during this phase will be provided through the SDE network serving the current airport.

In addition, there are other sources of supply near the site, namely the Bango water reserve located in the lower estuary of the Senegal River, less than ten kilometres from the northeast exit of the city of Saint-Louis and the arm of the Senegal River. A permit issued by the Office du Lac de Guiers is required before considering connecting to these water points.

III.7.4.2. WATER REQUIREMENTS IN THE OPERATIONAL PHASE

The water supply system for the future airport will always be provided by the SDE network.

Water requirements in the operating phase are linked to several uses, which are:

- water for domestic use (drinking and sanitary);
- water for cleaning and maintenance activities;
- water for the fire-fighting system.

The installation of a large capacity reserve sized according to needs is necessary to ensure its autonomy in water and avoid any inconvenience related to a possible interruption of the water supply.

III.7.5. ENERGY REQUIREMENTS

The power supply source will be the SENELEC network which provides the electricity supply for the current airport.

A power plant will be installed for emergency power supply and night lighting of the aircraft parking area or tarmac. The system includes a 140 kVA diesel generator set and a 1X400 KVA substation and current regulators.

III.8. CHEMICALS MANAGEMENT

During the rehabilitation work, the chemicals will mainly consist of:

- oils and greases for the lubrication of engines and rolling stock;
- fuel for diesel generators, vehicles and construction machinery;
- solvents and resins present in paints and varnishes.

A storage area will be set up near the workplaces where all these products will be centralized. In addition, storage must comply with the rules of good practice in this area in order to minimise the chemical risks to which workers will be exposed.

The operation of the airport does not require the use of chemicals in addition to infrastructure maintenance products.

In addition to fuel and foam reserves, only cleaning products from the facility will be stored on site. These products, for cleaning purposes (offices, halls, toilets, etc.) will be supplied periodically and stored in dedicated stores.

However, their use will have to be regulated with stock management manuals, operating procedures, etc.

III.9. WASTE MANAGEMENT

III.9.1. LIQUID WASTE MANAGEMENT

Liquid waste in the construction phase is mainly water from sanitary facilities, machine washing water, cloudy water containing cement or oil. In case of rain, by leaching process, runoff water can be loaded with suspended solids.

When in contact with cement, mortar and fresh concrete they become alkaline (pH above 9). In addition, these waters may be mixed with hydrocarbons (from construction machinery and equipment) or contain dissolved substances and toxic metals.

During the operating phase, wastewater can come from a variety of sources:

- sanitary facilities;
- the emptying of aircraft toilets;
- technical workshops.

It should be noted that the ONAS (national concessionaire) sewerage network does not cover the airport area. However, there are still possibilities to connect to it while respecting the limit values at the connection point. In all cases, TRANSCON must propose an autonomous management system for these liquid discharges that is adapted and sized according to the nature and quantity of the liquid effluents to be treated.

For surface water drainage, it is recommended to design a separate sewer system to discharge runoff water from the airport platform taking into account the constraints imposed by the outlets and the drainage constraints. The maintenance of this network must also be ensured in order to guarantee its hydraulic and purification performance for a long time.

III.9.2. SOLID WASTE MANAGEMENT

III.9.2.1. CONSTRUCTION SITE WASTE MANAGEMENT

During the construction phase, the waste will be generated by the various activities of the airport rehabilitation site. Good waste management practices, namely the principle of collection, sorting, recycling and disposal by appropriate and appropriate means, will be applied.

It is important to note in this part that the work on the site will begin with the demolition of the buildings mentioned above.

The study recommends that this demolition should be carried out according to the deconstruction principle, which makes it possible to separate the different categories of materials, remove hazardous waste and recover certain elements. According to this approach, the buildings to be demolished are not considered as future waste but as resources of materials to be recovered. The ultimate objective is to reduce the quantities of waste produced at source and to promote its recovery and recycling in order to limit landfilling.

The deconstruction is thus organized in three phases: decontamination, dismantling of the materials used in the finishing work (non-hazardous waste) and finally the removal of the structure (inert waste).

From this perspective, two main types of waste are identified during the construction phase. These are waste from the demolition of existing buildings and pavement and construction waste (structural and finishing waste).

The waste thus produced can be classified into three categories:

- **mineral or inert waste**: concrete, bricks, tiles, rubble, glass, excavation materials (topsoil);
- **non-hazardous waste**: plastics, PVC, scrap metal, natural wood, paper, cardboard, various packaging, pallets, etc;
- **hazardous waste**: soil polluted by hydrocarbons, tar and associated products, waste electrical and electronic equipment, household appliances, computer equipment, light bulbs, neon lights, waste hydrocarbons and oils, paints, varnishes, solvents, batteries, batteries.

For each type of waste, the possible recovery methods are reuse, material recovery or energy recovery. In the absence of possible recovery, the waste is considered to be final and must be landfilled or incinerated in a cement plant.

The table below is a summary of the various types of waste produced and their proposed recovery method.

Table 8: Construction site waste and method of recovery

Type of waste	Valuation method
Excavation materials and excavated material	Reuse on site
Pavement demolition materials	Recycling possible in hot or cold bound form, reuse on site
Concrete, tiles, rubble, cement	Recycling in bound form with hydraulic binder, recycling in unbound form, on-site reuse
Glass	Recycling possible with a specialized transferee
Packaging, pallets	Reuse, recycling, energy recovery
Natural wood, wood residues	Composting, energy recovery
Plastics, PVC	Recycling with a specialized buyer
Paints, varnishes, solvents	Incineration in cement works
Bulbs, neon lights, batteries, batteries, batteries	Recycling possible with a specialized transferee
Waste hydrocarbons, waste oils	Incineration in cement works
Scrap metal	Recycling with specialized structures
Electrical appliances, household appliances, electronics	Reuse where possible or disassembly into spare parts to be recycled

III.9.2.2. WASTE MANAGEMENT IN THE OPERATIONAL PHASE

During the operational phase, the airport activity includes several entities on the same site. Each company produces a different type of waste. The waste produced according to the nature of the activities of these airport entities is summarized in the table below.

Table 9: The different types of waste produced during the operating phase

Types of activities	Types of waste
Industrial activities (freight, maintenance, workshops).	- packaging waste (including a significant proportion of soiled packaging), - more special waste such as oils, solvents, - electrical waste (cables, different types of lighting, etc.),

Types of activities	Types of waste
	- toxic waste in dispersed quantities (DTQD),
Customer Services	- waste similar to that of industrial activities (vehicle rental companies), - food waste, - paper (newspapers...), - unbleached packaging waste (cardboard boxes, glass bottles, cans, etc.) for restaurants and shops,
Administrations and Managers	- paper waste,
Ground assistance and supplies	-food, oil and packaging waste,
Works	- inert waste, - non-hazardous industrial waste (HIW), - packaging waste, - special industrial waste.

The principles of good waste management involve the sorting of waste at source by its producers. To this end, airport managers must provide all companies on the platform with an area dedicated to the sorting of non-hazardous and hazardous waste.

A management system will be implemented, which takes into account:

- compliance with regulations;
- waste reduction at source and;
- material recovery (recycling, reuse) and energy recovery (incineration with energy recovery).

This system, based on regulations, formally prohibits burning waste, abandoning it or discharging it into wastewater systems. It will not allow the mixing of waste (e. g. hazardous and non-hazardous) or the landfilling of recoverable waste.

III.10. SOURCES OF NUISANCE

The nuisances identified in the framework of this project are related to air pollution and noise pollution during the construction and operation of airports.

III.10.1. AIR POLLUTION

During the operational phase, pollutant emissions contribute to the deterioration of air quality in the airport area. Several activities are at the origin of this air pollution.

Aircraft and their daily activities

The combustion of fuel (Jet A1 or AVGAS) in an aircraft engine releases carbon dioxide (CO_2), water vapour, nitrogen oxides (NO_x), carbon monoxide (CO), unburned hydrocarbons (HC), sulphur oxides (SO_x) and soot particles.

Studies have shown that air traffic contributes to the formation of oarea (O_3), which is not produced directly by aircraft operation but is a secondary pollutant.

Air quality will be assessed at a height of 3000 feet above ground level. The emissions identified during these activities are therefore a function of air traffic density. The figure below summarizes the daily activities of the aircraft and the percentage of maximum engine thrust during each activity.

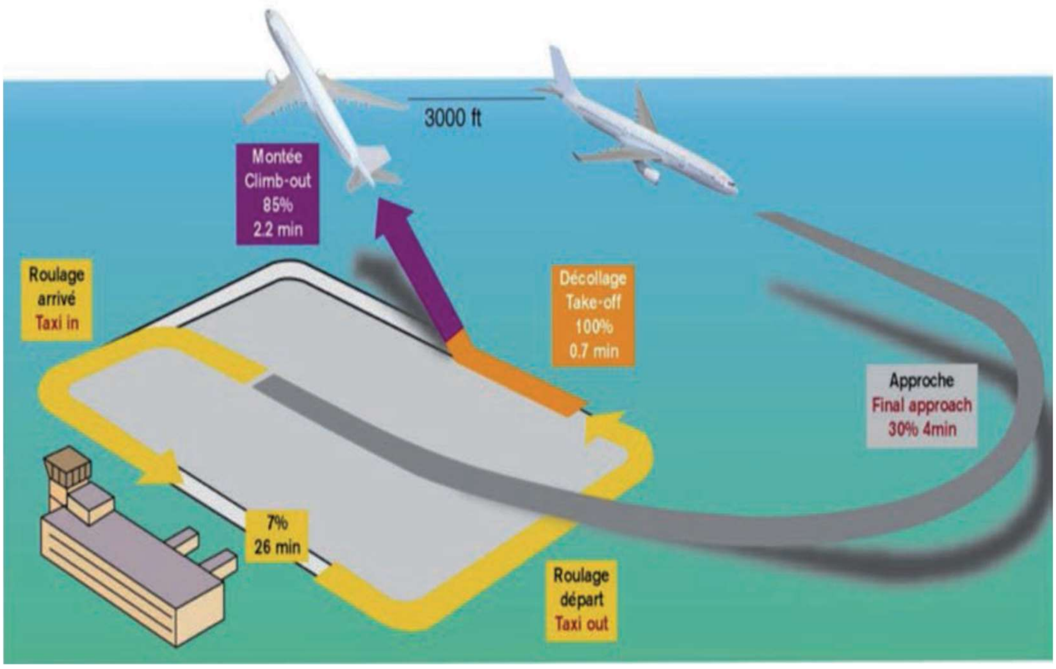


Figure 1: Daily aircraft activities

Source: Air quality assessment around an airport - Technical guide

The operation of the auxiliary power engine (APU), a small turbine powered by the fuel of the aircraft used, is also a source of air pollution. It provides both electrical energy and high-temperature compressed air when aircraft start up.

Other sources of air pollution have been identified in the airport area:

- fuel storage, aircraft refuelling and fuel distribution station;
- the renovation of buildings;
- of the power plant running on a diesel-powered generator set;
- road traffic in and around the airport with private vehicles, taxis, buses and coaches, light commercial vehicles, heavy goods vehicles used for freight.

The table below is a summary of the pollutants and their sources at the airport during operation.

Table 10: Pollutants emitted in the airport area and their sources

Sources		Main pollutants emitted
Air traffic	Aircraft movement Engine tests Operation of the Auxiliary power units	Nitrogen oxides (NOx) Carbon monoxide (CO) Unburned hydrocarbons (HC) Sulphur dioxides (SO2) Smoke
Land traffic	Service vehicles Employee transportation Passenger transportation	Nitrogen oxides (NOx) Carbon monoxide (CO) Unburned hydrocarbons (HC) Sulphur dioxides (SO2) Smoke Lead (Pb), depending on fuel

Sources		Main pollutants emitted
Energy	Oil-fired power plant	Nitrogen oxides (Nox) Unburned hydrocarbons (HC) Carbon monoxide (CO) Nitrogen oxides (Nox) Unburned hydrocarbons (HC) Sulphur dioxides (SO2) Smoke
Procurement	Provisioning Fuel storage (evaporation)	Volatile Organic Compounds (VOCs)
Maintenance	Painting Other operations	Volatile Organic Compounds (VOCs)

It should be recalled that the airport manager must put in place an air quality management system by first identifying the sources of emissions and assessing the airport's contribution to air pollution in the area. In addition, it must work on measures to reduce its polluting emissions and ensure compliance with the requirements of the standards in force.

III.10.2. NOISE POLLUTION

Noise generated by the operation of aircraft is the main source of discomfort felt by workers and residents of the airport. It is produced by three (03) sources:

- aerodynamic noise caused by air friction on the aircraft. This type of noise is observed during the approach and landing phases, which cause turbulent air flows in addition to the noise caused by the landing gear and speed brakes, producing a loud hum;
- engine noise generated by turbojet engines that produce a roar during take-off when operating at full power
- rotating parts that also generate noise. The higher the speed of rotation of the propellers, the higher the sound emitted becomes and therefore annoying.

It should be noted that noise control is a major issue to be taken into account in airport management by developing an action plan to reduce aircraft noise pollution.

It should be noted that the control of noise risks can only be effective with the assistance of aircraft manufacturers, who can act to improve the acoustic performance of aircraft, and airlines, who can work to regularly renew their fleets and raise awareness and train their pilots in techniques to reduce noise emissions.

Knowing that noise levels are higher at night than during the day, these airlines will also be able to influence flight scheduling and choose slots that limit night flights.

III.11. ICPE CLASSIFICATION OF THE FACILITIES REQUIRED FOR THE PROJECT

The airport's rehabilitation involves earthworks, demolition and reconstruction. With regard to the Senegalese nomenclature on BPIs, the activities and substances targeted by the project are summarized in the table below:

Table 11: Administrative classification of therehabilitation work at Saint-Louis airport

Heading	Title	Characteristics of the project	Classification scheme and type of EIA
A 1705	**Construction of an aerodrome or airstrip** Regardless of the size	The project consists of reconstruction of the aerodrome and extension and widening of the runway.	A
A 1402	**Electricity production and distribution by combustion - thermal power plants, generators, etc.)** If the maximum thermal power is greater than 50 kW less than 500 kW	A power plant will be installed with a 140 kW generator set	D
S 702	**Flammable and combustible liquids (storage of)** With a flash point above 23°C and below 60°C (category C - flammable liquids) and with a storage capacity of More than 10 ^{m3} but less than 100 ^{m3}	A Jet A1 storage facility is to be installed (2*50 ^{m3})	D
S 704	**Flammable liquids (filling or distribution installation)** Installation for loading tank vehicles, filling mobile containers or motor vehicle tanks, the maximum flow rate being: Greater than or equal to 20 m3/h Greater than or equal to 1 m3/h but less than 20 m3/h	A tank vehicle loading facility will be set up for refuelling aircraft.	D

The analysis of the table above shows that under Senegalese legislation on BPIs (see Environmental Code), the rehabilitation and operation of Saint-Louis airport is classified in category I. The project is therefore subject to **authorisation and its implementation requires a thorough impact assessment beforehand.**

III.12. PROJECT IMPLEMENTATION SCHEDULE

The duration of the work is estimated at 10 months from the start date of the work.

The table below is a summary of the different stages of the project and their duration.

Table 12: Duration of the different phases of the construction site

Phase of the work	Duration (days)
Earthworks	90
Demolition of structures	10
Roadway	60
Day beaconing (marking)	7
Service road	122
Fencing of the airport right-of-way	122
Access road	22
Buildings	100
Beaconing	100
Navigation	60
Ground service	22

IV. POLITICAL, LEGAL AND INSTITUTIONAL FRAMEWORK

IV.1. POLICY FRAMEWORK

Environmental protection has been a major concern for the Government of Senegal since the Earth Summit in Rio de Janeiro, Brazil, in June 1992. As a result, institutions and legal texts in the field of environmental protection in general and project impact assessment in particular have been established.

It is within this framework that it has also signed or ratified several international legal instruments aimed at protecting the environment and urged the entire government to put them into practice.

Policies, programmes, legislation, regulations and standards for environmental protection and economic and social development have also been adopted.

This study will be governed on the one hand by the conventions, agreements and treaties ratified by Senegal and on the other hand by national regulations.

This project to rehabilitate the Saint-Louis airport will be carried out in accordance with the policies, directives and strategies planned at both the national and international levels in terms of environmental, social, economic, security and all other policies that apply to this project.

IV.1.1. AIRPORT TRANSPORTATION POLICY

In Senegal, air transportation plays an important role in economic and social development. The development of this sector requires the development of sectoral policies underpinned by massive investments in infrastructure and services. Thus, the government has put in place an integrated strategy, accompanied by structural reforms, aimed in particular at increasing the quality of transportation services in order to support the accessibility and mobility of goods and people under the best possible conditions and, beyond that, socio-economic development and the preservation of the environment.

IV.1.2. TRANSPORTATION SECTOR POLICY LETTER

This policy is implemented through the Transportation Sector Adjustment Programme (PAST), which aims to reduce transportation costs, privatise the sector and ensure the administrative and financial autonomy of transportation organisations. In this perspective for domestic air transportation, a network of secondary airports will be established in line with international standards. This network should facilitate the implementation of a dynamic domestic air transportation policy, at competitive prices, which will significantly improve population movements. The rehabilitation of Saint-Louis airport is an implementation of this perspective. However, this project must take into account environmental concerns as indicated in the policy letter.

IV.1.3. NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT POLICIES

The promoter must be in line with the ideologies of these programmes in order to be part of the environmental protection dynamic. Some economic and social development policies and programmes in line with the context and objectives of the project are listed below.

IV.1.3.1. EMERGING SENEGAL PLAN (PSE)

The PES is the medium- and long-term reference for economic and social policy with the aim of promoting economic growth with a strong impact on human development. Hence the vision of ***"a Senegal that will emerge in 2035, with a society based on solidarity and the rule of law".*** For the implementation of the PES, in addition to major reforms to be carried out in 27 flagship projects, drivers of activities and employment have been identified.

In this context, the PES aims to improve the business environment and competitiveness by making significant progress in the field of energy, road, rail, port and airport infrastructure.

The transportation sector plays an important role in the PES with the establishment of a regional air hub. The objective "is to make Dakar a reference air platform to serve Senegal's ambitions, to become a hub of services (medical, tourism, regional headquarters of companies and international institutions, education and training) with the commissioning of the AIBD and the rehabilitation of airports by 2018. The aim is to increase capacity to 6 million passengers by 2020 and 10 million by 2035.

The rehabilitation of airports, including Saint-Louis, is part of the "***sub-regional air hub project***", which is one of the PES projects in the field of transportation.

IV.1.3.2. THREE-YEAR PUBLIC INVESTMENT PROGRAMME (PTIP) 2016-2018

The projects and programmes identified under the PES are subject to programming in the rolling Three-Year Public Investment Programme (PTIP), which can be reviewed annually.

The Three-Year Public Investment Programme (PTIP) is a document that highlights the strategic axes of the economic and social policy defined within the framework of the Emerging Senegal Plan (PSE). The 2016-2018 PPTIP is the main milestone in the implementation of the Priority Action Plan (PAP) of the Emerging Senegal Plan (PSE). It makes it possible to align programmed investments with the sectoral objectives and lines of action as well as the Millennium Development Goals (MDGs). The PTIP gives an important place to the sustainable management of the environment and natural resources by focusing on the following areas:

- mitigation of the effects of climate change on ecosystems;
- capacity building for environmental and natural resource management;
- promotion of the green economy and creation of green jobs;
- improving the resilience of ecosystems to the effects of climate change;
- conservation and enhancement of biodiversity.

The PTIP takes into account the projects set up in the air transportation sector.

The implementation of the government's policy in this area is reflected, among other things, in a dynamic of reforms promoting the construction of airport infrastructure equipped with the latest generation of air navigation equipment with the completion of the AIBD's work and the rehabilitation of airports, including that of Saint-Louis.

IV.1.3.3. ACT III OF DECENTRALIZATION

It is built around the following vision: "to build, within the framework of a consensual and forward-looking dialogue, the renewal of the modernization of the State, through a decentralization that is coherent in its principles and effective in its implementation". The aim is to implement a coherent spatial planning policy, with a global vision of development, taking into account equity and solidarity, particularly in the treatment of cities, rural, cross-border and eco-geographical areas.

The rehabilitation of airports, including Saint-Louis, is part of the State's decentralization policy.

IV.1.4. STRATEGIC FRAMEWORK AND ENVIRONMENTAL POLICIES

Table 13: Environmental Policy Texts

Political texts	Content and objectives of the text	Application in the context of the project
Environment and sustainable development		
Environment and Sustainable Development Sectoral Policy Letter (LPS/EDD) (2016-2020)	The objective of the LPS/EDD is to "create a national momentum for improving the management of the environment and natural resources, integrating the principles of sustainable development into policies and strengthening people's resilience to climate change". The Letter provided for two strategic axes, namely the management of the environment and natural resources and the promotion of sustainable development. Strategic objective 2 focuses on the integration of sustainable development principles into public policies, management of the living environment, promotion of livelihoods, resilience of vulnerable groups and production and consumption patterns.	Currently, environmental protection is a concern of the Government of Senegal. This explains why, within the framework of the objectives of the HPA/SEDD, it is requested that projects targeted in all sectors, such as transportation, develop in a sustainable manner, taking into account, in particular, the integration of the environment and sustainable development.
National Sustainable Development Strategy	According to the World Commission on Environment and Development, in the 1987 Brundtland Report, *Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*. By 2020, Senegal's institutional, economic and social actors will adopt the principles of sustainable development and reflect this paradigm in their modes of action. The objective is to "create an environment conducive to reconciling the need for strong and sustained growth with the preservation of ecological, social and territorial balances. »	The promotion of balanced and harmonious development referred to in Axis 3 requires the construction of infrastructure in the various regions. This project to rehabilitate Saint-Louis airport is in line with this sustainable development policy because it will improve air transportation in this region. However, this project will have to be carried out in accordance with the objectives of the NSDS in relation to

	It is divided into six major axes or orientations, including the promotion of balanced and harmonious development (axis 3) and the strengthening of measures and actions that can contribute to the achievement of the Millennium Development Goals (MDGs), axis 6.	environmental policy while ensuring the proper management of natural resources.
National Environmental Action Plan	National Environmental Action Plan (NEAP) adopted in September 1997, constitutes a strategic framework that allows the Senegalese State to identify environmental priorities and define the basis for effective planning and management systems for natural resources and the environment. The NAEP implementation system includes a series of measures based on seven major axes: (i) poverty alleviation, (ii) population policy and environmental management, (iii) women, youth and environment, (iv) health and environment, (v) environmental education and communication information, (vi) decentralized environmental management and financing of local initiatives, and (vii) environment and subregional and regional cooperation.	To comply with this environmental policy, the promoter in the different phases of the project must take into account the measures put in place by PNAE in terms of natural resources and environmental management.
	Biodiversity and ecosystem	
National Action Programme to Combat Desertification and Sustainable Land Management	In order to take into account measures for the adoption and scaling up of sustainable land management actions that effectively contribute to the implementation of the UNCCD, the State of Senegal has updated the NAP/CAD to become the NAP/CAD TDG. The overall objective is to combat land degradation, ensure the improvement of ecosystem resilience and the living conditions of populations.	Construction work is a source of solid and liquid waste. The rehabilitation of the airport must be carried out in accordance with the objectives of this programme to avoid land degradation.

The National Strategy and Action Plan for the Conservation of Biodiversity	The national strategy aims to preserve the achievements of biodiversity conservation in Senegal while involving the populations and the various stakeholders in sustainable management by integrating it into their production activities (agriculture, livestock, fisheries, etc.).	The rehabilitation of the airport and the creation of access runways will require clearing work. The promoter must comply with the requirements of this policy by implementing measures to preserve the natural resources of the project area.
Spatial planning		
National Spatial Planning and Development Plan (PNADT)	It is a forward-looking document for 2021 based on the "sustainable and harmonious development" scenario and aims both at the optimal exploitation of resources and potential where they are located, decentralization and the search for a better balance between regions. The specific objectives are to: • promote a network of hierarchical and well-distributed development poles; • develop networks of communication infrastructure and public facilities that are structuring and properly distributed throughout the national territory; • promote the rational management of natural resources and the living environment; • develop the national economy in a sustainable way through its various sectors.	This project is in line with this spatial planning policy because it will make it possible to expand the air transportation sector by setting up an airport in a local community.
Regional Land Use Planning Frameworks (SRAT)	They are variations of the strategic orientations of the National Spatial Planning Plan at the regional level. The main objectives of the Regional Land Use Planning Frameworks for the Saint-Louis Region are to: • promote human settlements; • strengthen basic socio-economic infrastructure and facilities;	The construction of the Saint-Louis airport will contribute to the region's economic development and strengthen the air transportation sector.

	• develop communication networks; • improve the territorial framework; • develop regional economic activities; • strengthen environmental management.	
The Master Plan for the Development and Planning of the Great Coast (SDADGC)	• The SDADGC's vision is to make the Grande Côte a sustainable development hub open to the world. To this end, the strategic objectives selected are: • the protection and development of the Niayes coastal territory; • support and modernisation of the economic sector; • improving access to basic social services; • the development of structuring transportation infrastructure.	The completion of this project will reinforce the SDADGC's objectives in the field of transportation infrastructure.
National Wetland Management Policy (NWMP)	• The NWMP aims to contribute to the articulation of spatial planning, conservation and production policies in a perspective of sustainable development, according to the principles of consensus, shared responsibility and good governance through results-based management.	In the Saint-Louis area there are wetlands such as the Djoudj Birds National Park and the Ndiaél Reserve, and the rehabilitation of the airport and its operation must take these concerns into account and therefore not affect wetlands.
Climate Change		
Planned and Determined Contribution at the National Level (PDCN) of Senegal to be integrated into the strategic and environmental policy framework	It is a strategic document setting out the specific commitments to reduce greenhouse gas (GHG) emissions for Senegal by 2035 under the Paris Climate Agreement in 2015. In view of the country's strong dependence on climate change and in line with its tradition of international cooperation, the Government of Senegal intends to contribute to the collective effort through the implementation of GHG emission mitigation and adaptation measures in its sectors of activity.	In accordance with this PDCN, construction activities must not be a source of greenhouse gas emissions.

Others	• Senegal's Forest Policy (PFS) (2005-2025) • The Sectoral Policy Letter on Internal Governance (LPSGI); • The national sanitation strategy	The implementation of the project must, comply with the guidelines established by these strategies and policies.

IV.2. INSTITUTIONAL FRAMEWORK

The institutional analysis allows the identification of structures that are interested in their responsibilities, functions and roles, in the actions that will be carried out as part of the rehabilitation of Saint-Louis airport.

The environmental and social management of the project will involve national, regional and local institutions and structures as well as the technical services of the State and local authorities. The fields of intervention of these structures and institutions in terms of environmental protection will be diverse, at all stages of project implementation.

These interventions will take the form of environmental compliance monitoring and verification, assistance and support in the implementation of measures to remove, reduce and compensate for the project's harmful impacts on the environment.

The environmental and social management of the project will be ensured at three levels:

- at the national level: through the DEEC, the National Technical Committee and the other national directorates and technical services involved in the management of the project;
- at the regional level through the Regional Environmental Monitoring Committee (CRSE);
- at the level of local authorities (Sub-prefect, Town Hall, municipal councils, etc.).

IV.2.1. AT THE NATIONAL LEVEL

IV.2.1.1. MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT (MEDD)

At the national level, environmental management is the responsibility of the Ministry of Environment and Sustainable Development (MEDD), which is responsible for developing and implementing environmental policy. The Directorate of the environment and classified establishments (DEEC) is the structure of the MEDD mainly involved in the implementation of this project.

The MEDD will ensure the project's environmental compliance before issuing the operating permit. To carry out the tasks assigned to it, the MEDD relies on the technical departments.

IV.2.1.2. DIRECTORATE OF THE ENVIRONMENT AND CLASSIFIED ESTABLISHMENTS (DEEC)

The DEEC plays an important role in the implementation of the Senegalese government's development policy.

Under the authority of the MEDD, the DEEC is responsible for the implementation of the government's environmental policy, in particular the protection of nature and people against pollution and nuisance. To implement the State's environmental policy, the DEEC has the following missions:

- the prevention and control of pollution and nuisances;

- the follow-up of the actions of the various services and organisations working in the field of the environment;
- the preparation of legal texts concerning the environment;
- the monitoring of agreements related to its missions;
- the integration of the environmental dimension into development policies, programmes and projects through environmental assessment;
- the control of the installation classified for environmental protection;
- coastal management.

In the conduct and monitoring of ESIA procedures, the MEDD relies on the Directorate of the environment and classified establishments (DEEC) and the Technical Committee. In the field of ESIAs, the mission of the EDEC is to ensure the application of the provisions relating to ESIAs. It prepares opinions and decisions on ESIAs for the Ministry responsible. In this context, she:

- validates the specifications or terms of reference specifying the content of the environmental assessment;
- assesses the admissibility of studies;
- ensures the control and monitoring of measures taken to protect the environment.

DEEC also has decentralized services at the regional level to ensure close monitoring of environmental issues (the Regional Divisions of Environment and Classified Establishments (DREEC).

These different missions of DEEC are divided between the following divisions and structures:

- Environmental Impact Assessment Division (EIAD);
- Classified Installations Division (CID);
- Division of Pollution and Nuisance Prevention and Control (DCPN) ;
- Coastal Management Division (DGL);
- Administrative and Financial Division (DAF);
- Sustainable Development Unit;
- Planning and Monitoring Unit - Evaluation;
- Legal Affairs Unit;
- Communication Unit ;
- Air Quality Management Center;
- Basel Convention Regional Center;
- Environmental Emergency Management Center;
- Fourteen regional divisions throughout the country.

The Environmental Impact Assessment Division (EISD), Classified Facilities Division (CID), Pollution and Nuisance Prevention and Control Division (PCPD) and Air Quality Management Center (AQMC) are more involved in this study.

DEEC, through its various structures, monitors the implementation of this project (from the project notice to the issuance of the environmental compliance certificate).

IV.2.1.3. TECHNICAL COMMITTEE

It is established by Ministerial Order No. 009469 of 28 November 2001 and supports the MEDD in the validation of impact study reports. It brings together all the technical services of the State in addition to local authorities and certain associations. Its secretariat is provided by the DEEC and the presidency changes according to the nature of the project.

The technical committee will participate in the validation of the Environmental and Social Impact Assessment report and in the monitoring of the implementation of the environmental and social measures of this project in relation to the DEEC.

IV.2.1.4. Ministry of Air Transportation and Airport Infrastructure Development (MTADIA)

In Senegal, the civil aviation sector is placed under the supervision of MTADIA, which defines the specific missions of the various structures that make up the sector. The services of the Ministry involved in the management of this project are presented below.

Agence Nationale de l'Aviation Civile du Sénégal et de la Météorologie (ANACIM)

Created by decree 2011-1055 of 28 July 2011, ANACIM replaced the Agence Nationale de l'Aviation Civile du Sénégal (ANACS) and the Agence Nationale de la Météorologie du Sénégal (ANAMS). This substitution occurred in a context where the strengthening of air transportation safety and security requires the control of meteorology, which is an element of the security system both at the airport platforms and on the routes used by aircraft. ANACIM is the contact person for the International Civil Aviation Organization (ICAO) in Senegal. It is responsible for promoting, regulating and controlling all activities that can contribute to the development of civil aviation. It is the competent authority for civil aviation in Senegal.

ANACIM's objective is to offer operators in Senegal an environment that meets international requirements with relevant regulations, efficient administration and modern and appropriate infrastructure. It is also its way of actively participating in the development of the national economy and in improving the safety, security, efficiency and regularity of international air transportation.

The role and responsibilities of ANACIM through its directorates such as the Direction Navigation Aérienne et des Aérodromes (DNAA) in this project, whether in the rehabilitation and operation phase, is to:

- participate in the assessment of the airport inventory;
- participate in the validation of the offers of the companies' proposals;
- validate the work schedule before starting the work;
- validate the work;
- certify the airports of Saint-Louis, Ziguinchor, Tambacounda, Matam and Kédougou;
- issue the decree opening the airport. If necessary, the decree is also issued by ANACIM;
- carry out inspections of the works in the rehabilitation and operation phase.

Agency for the Safety of Air Navigation in Africa and Madagascar (ASECNA)

It provides air traffic control, air navigation services, aircraft guidance, technical and traffic messages, flight information, data collection and weather forecasting and transmission.

Agence des Aéroports du Sénégal (ADS)

It was created by the Government of Senegal by Decree No. 2008-460 of 09 May 2008. Its role is to ensure, in conjunction with ANACIM and HAAS, that safety requirements are integrated into the design and construction of new installations and into modifications to existing installations. It is also responsible for the operation and maintenance of these facilities.

Special Police Station of the Airport

The Special Airport Police Station is responsible for protecting the public and regulated areas of the passenger terminal from acts of unlawful interference. It also controls access to regulated areas within its area of competence.

Its main tasks revolve around the inspection and screening of passengers and their cabin baggage, surveillance and regular patrols. To this end, it shall maintain or restore order and the proper functioning of traffic in the airport area.

Mobile Intervention Group (MIG)

The Mobile Intervention Grouping (MIG) unit at the airport is attached to HAAS. It is responsible for controlling access to the check-in, sorting and baggage dispute areas, as well as access control to the "Arrival" area. Thus, any person accessing the airline baggage dispute area or the checked baggage sorting area from the passenger terminal undergoes a security check carried out by elements of this unit. The baggage that this person carries will also be inspected and screened.

The main purpose of this formality is to maintain the level of security, but also to prevent the occurrence of illegal acts or the introduction of prohibited items into these areas.

Security and Document Control Companies

They are approved by the Agence Nationale de l'Aviation Civile et de la Métrologie du Sénégal after having completed the administrative formalities. In accordance with the provisions of the specifications, they perform, among other tasks:

- the control of travel documents before passengers access check-in counters;
- monitoring checked baggage and cargo after screening and escorting them to aircraft for loading;
- escorting baggage from the aircraft to the carpets in the baggage delivery area;
- the guard of the aircraft security perimeter;
- the additional security check by means of a cut-off on persons authorised to access on board.

There are four (04) such companies, namely: AMARANTE INTERNATIONAL, EAS, SPR, SEN SICASS.

Support groups

These are the Air Force Task Group, the Air Force Support Group and the Explosive Ordnance Disposal Unit. The first two groups are located in Ouakam, the explosive ordnance disposal unit is located at Camp LEMONIER. They contribute to the protection of civil aviation against acts of unlawful interference. As such, they provide assistance in the following areas, among others:

- detection and removal of explosive devices;
- armed intervention upon request in case of emergency.

In short, all the services detailed above have tasks to perform. And in the exercise of their missions, they are led to lend their experience and expertise. Thus, they all have a single objective: to ensure air transportation security.

IV.2.1.5. OTHER STRUCTURES INVOLVED IN PROJECT MANAGEMENT

At the national and regional level, the other institutions that will be involved in this project and their roles are presented in the following table.

Table 14: Other structures involved in project management

Entities	**Sub-entities**	**Areas of involvement in this project**
National Services		
Ministry of the Interior	Civil Protection Department	It is responsible for the prevention of risks of all kinds, as well as the protection of people, property and the environment against all disasters and catastrophes. In this respect, it proceeds, among other things, to: • the drafting of texts governing the field of civil protection • the general design of contingency plans • the identification and mobilization of additional disaster plans for logistical support to relief teams • the organisation of prevention visits, the monitoring of the application of the security requirements of the establishments concerned. The CPD must ensure that an adequate and sufficient security system is in place during the commissioning of the airport.
Ministry of Environment and Sustainable Development (MEDD)	National Committee on Climate Change	This Committee was set up in 2003 by Order No. 1.220 of 7 March 2003 of the Ministry of the Environment. Within the framework of this project as in all national, subregional and regional projects relating to the priority areas referred to in Article 3 of this Decree, it plays a role of information, awareness-raising, training and facilitation in the design, financing, implementation, validation and monitoring of the various activities identified in the context of the implementation of greenhouse gas (GHG) reduction and adaptation measures and in the fight against the negative impacts of climate change.

Entities	Sub-entities	Areas of involvement in this project
Ministry of Hydraulics and Sanitation	Sanitation Department Office National de l'Assainissement du Sénégal (ONAS)	Ensure compliance of wastewater management strategies by ensuring compliance with regulations
Primature	Directorate of Land Use Monitoring and Control	Its mission is to prevent and combat irregular occupations and constructions as well as to manage the related litigation. In this case it is loaded: • monitoring and controlling land use in urban areas and agglomerations as well as on-site interventions; • the verification of land use; • assistance to local authorities for the control of irregular occupations and constructions; • the recording of land use offences. As part of this project, this department is responsible for verifying the land use of the airport site.
Ministry of Urban Renewal, Housing and Living Environment	Department of Urban Planning and Architecture	This department is responsible for the study, design and implementation of urban plans and schemes as well as detailed urban plans, urban development and subdivision plans, the preparation of urban planning and architectural regulations, and the monitoring of travel and relocation operations. Obtaining these urban plans will allow the developer to have information on past and future projects closest to the site. In the case of construction of buildings, the developer must file a building permit in accordance with the provisions of the Urban Planning Code.
Ministry of Economy, Finance and Planning	Directorate of Land registry	It is responsible for all matters relating to land development and land registry. As such, it is responsible for land organization and

Entities	Sub-entities	Areas of involvement in this project
		organization, land registry management, evaluation and census review. The Land registry Department must prepare the cadastral plan at the request of the developer.
Ministry of Health and Social Action	National Hygiene Service	Ensure that hygiene measures are applied at the airport.
	Public Hygiene Department	It is responsible for monitoring the implementation of the hygiene and sanitation policy. It has decentralized services and sworn officials to control the effectiveness of the application of the provisions of the hygiene code. As part of this project, it is the Service Régional de l'Hygiène de Saint-Louis which is responsible for monitoring the implementation of hygiene measures at site level.
Ministry of Local Governance, Development and Land Use Planning	National Agency for Spatial Planning (ANAT)	Ensures the coherence of national planning policies and programs. ANAT must provide information on the land use of the site and the development of the project area. In addition, it makes available to the consultant all available planning documents for the areas concerned by the project (e.g. PLDs).
Regional and local services		
Ministry of Environment and Sustainable Development (MEDD)	Regional Divisions of Environment and Classified Establishments (DREEC of Saint-Louis)	It is responsible for carrying out the actions, activities and missions of the Environment Department and the Classified Establishments at the regional level. Its organization and functioning are defined by a memorandum from the Director of Environment and Classified Establishments. DREEC also validates the terms of reference and organizes the technical committee and public hearing in the regions.

Entities	Sub-entities	Areas of involvement in this project
		DREEC provides the secretariat and coordinates the activities of the regional environmental monitoring committee. It must support local communities in building the capacity of stakeholders in environmental and social assessment.
Ministry of Local Governance, Development and Land Use Planning	Regional Development Agency	In the monitoring of projects such as this one, one of the ARD's missions is to: • facilitate the integration of general and specific environmental requirements (including possible management plans and standard specifications) into tender documents (DAO/DRP) and contracts of the companies in charge of the works; • ensure the strict application of environmental and social measures by the actors concerned.
Regional Environmental and Social Monitoring Committees (CRSE)	Regional Environmental Monitoring Committees (CRSE)	The CRSE for local development projects was initiated at the regional level (within the framework of the PNDL) to better take into account the decentralization and local development processes. It is made up of the technical services (Environment, Water and Forestry, Community Development, etc.) of the region. In the implementation of this project, as in any other project, CRSE must participate in the validation of the ESIA report and verify the integration of ESMP measures and other environmental and social clauses in the tender and work documents.
Ministry of Health and Social Action	Regional Hygiene Service	As part of the activities of this project, this service is involved in monitoring the implementation of hygiene measures at site level, etc.

Entities	Sub-entities	Areas of involvement in this project
Ministry of Environment and Sustainable Development (MEDD)	Regional Water and Forest Inspections (IREF)	Present in each region, the IREF is the technical transmission link between the central level and the decentralized entities of the DEFCCS. Each Regional Service is responsible for: • represent the DEFCCS at the regional level; • develop regional forest programmes for forest protection and management, hunting and protected area management; • carry out the forestry programme and enforce forestry and hunting regulations; • carry out forest police and hunting actions and prosecutions in accordance with the regulations in force. In implementing the project, the Saint-Louis IREF will ensure the protection of plant species and compliance with the provisions of the Forest Code before construction work begins.
Network concession companies	EDS SONES SONATEL ONAS	For the implementation of the project, the promoter must coordinate with those companies that have facilities on the right-of-way of the public road and that may be involved in the implementation of the airport works.
Local authorities	Department of Saint-Louis, municipality of the same name	Local authorities play an important role in the economic and social development of their entity and also in the field of the environment and the management of natural resources. The Saint-Louis Departmental Council and the Saint-Louis Municipal Council must be informed of the project. In accordance with the provisions of the General Code of Local Authorities and in relation to the project, they

Entities	Sub-entities	Areas of involvement in this project
		must ensure the protection of the environment of the Commune of Saint-Louis. To do this, the following measures must be taken: • prevent or remove pollution and nuisances; • ensure the protection of green spaces; • contribute to the beautification of the municipality. The Commune of Saint-Louis must also be involved in recruiting the necessary manpower to carry out the project if necessary. Local authorities, being members of the CRSE, are also involved in monitoring the application of the measures in the Environmental and Social Management Plan (ESMP).

IV.3. LEGAL FRAMEWORK FOR ENVIRONMENTAL AND SOCIAL MANAGEMENT

The legal framework applicable to this project includes national texts supplemented by international conventions ratified by Senegal.

IV.3.1. AT THE INTERNATIONAL LEVEL

Taking into account the context, the characteristics of the area of influence and the nature of the project's activities, several international environmental conventions ratified by Senegal could be applicable to the project. The following table presents the main ones.

Table 15: International conventions applicable to this project

Texts	Objectives/ Regulated areas	Application in the context of the project
Civil aviation texts and conventions		
Chicago Convention of 07 December 1944 on International Civil Aviation and its Annexes 2, 6, 9, 10, 11, 13, 14, and 17	The objectives of this agreement are: • to work for the future development of international civil aviation to help create and preserve friendship and understanding between the nations and peoples of the world; • to avoid any misunderstanding between nations and peoples and to promote among them the cooperation on which world peace depends; • to work for the safe and orderly development of international civil aviation; • to develop international air transportation services that can be established on the basis of equal opportunities and operated in a sound and economical manner; • minimise the environmental impacts of civil aviation activities and improve the environmental performance of aviation	This project is in line with the objectives of this convention and must be carried out in accordance with its provisions
Convention on Offences and Certain Other Acts Committed on Board Aircraft, signed at Tokyo on 14 September 1963 and entered into force on 4 December 1969	This Convention concerns civil aviation safety and applies: • offences and criminal laws;	Airport security must be ensured in accordance with the provisions of this Convention.

Texts	Objectives/ Regulated areas	Application in the context of the project
	• acts which, whether or not constituting offences, may endanger or compromise the safety of the aircraft or persons or property on board, or compromise good order and discipline on board	
Convention for the Suppression of Unlawful Seizure of Aircraft, signed at The Hague on 16 December 1970 and entered into force on 14 October	Concerns aircraft hijackings	Airport security must be ensured in accordance with the provisions of this Convention
Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, signed at Montreal on 23 September 1971 and entered into force on 26 January 1973	Concerns acts of sabotage committed against aviation, such as bomb attacks in aircraft in flight	
Convention on the Physical Protection of Nuclear Material, signed at Vienna on 26 October 1979 and entered into force on 8 February 1987	Aims at the illicit procurement and use of nuclear materials	These materials must not be used in this project
Protocol for the Suppression of Unlawful Acts of Violence at Airports Serving International Civil Aviation, supplementary to the Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, signed at Montreal on 24 February 1988 and entered into force on 6 August 1989, which amplifies and supplements the	Concerns the repression of acts of violence at airports and the repression of all unlawful acts against the safety of civil aviation	Airport security must be ensured in accordance with the provisions of this Convention

Texts	Objectives/ Regulated areas	Application in the context of the project
Montreal Convention on the Safety of Civil Aviation		
Convention on the Marking of Plastic Explosives for the Purpose of Detection, signed at Montreal on 1 March 1991 and entered into force on 21 June 1998	Provides for the chemical marking of targeted explosives to facilitate their detection, for example to combat aircraft sabotage	The promoter must comply with the provisions of this agreement to ensure airport security.
Combating climate change and protecting the oarea layer		
United Nations Framework Convention on Climate Change (UNFCCC) signed by Senegal in June 1992 and ratified on 14 June 1994	Management and adaptation to climate change. Stabilize greenhouse gas concentrations to avoid dangerous disruptions to the climate system	Construction activities (clearing, use of products containing VOCs, etc.) and equipment (generators, machinery, etc.) can generate greenhouse gases (CO_2) that are linked to climate change. The promoter must take into account the objectives of these agreements to avoid greenhouse gas emissions and contribute to the achievement of sustainable development objectives.
The Kyoto Protocol to the United Nations Framework Convention on Climate Change signed on 11/12/1997 and ratified on 20/07/2001	Combating climate change by reducing carbon dioxide emissions	
The Paris Agreement on Climate Change	Aims to strengthen the global response to the threat of climate change, in the context of sustainable development and poverty reduction	
Montreal Protocol on Substances that Deplete the Oarea Layer, which entered into force on 1 January 1989	Preservation of stratospheric oarea. Regulation of activities that may cause damage to the oarea layer	The project must take into account the provisions of this protocol during the

Texts	Objectives/ Regulated areas	Application in the context of the project
Law No. 2003-07 of 28 May 2003 authorizing the President of the Republic to ratify the Amendment to the Montreal Protocol to the Vienna Convention on the Protection of the Oarea Layer in Beijing (People's Republic of China) in December 1999		rehabilitation and operation phase (possibility of oarea generation) by ensuring that these emissions comply with the provisions of this protocol.
Vienna Convention for the Protection of the Oarea Layer adopted in Vienna on 22 March 1985, ratified on 19 March 1993.	Protect human health and the environment from the adverse effects of oarea layer degradation and regulate emissions of depleting substances	
Law No. 2003-07 of 28 May 2003 authorizing the President of the Republic to ratify the Amendment to the Montreal Protocol to the Vienna Convention on the Protection of the Oarea Layer in Beijing (People's Republic of China) in December 1999	Preservation of stratospheric oarea. Regulation of activities that may cause damage to the oarea layer	
Management of natural resources and protection of fauna and flora		
African Convention on the Conservation of Nature and Natural Resources, Maputo, Mozambique, adopted in Algiers on 15 March 1968, ratified by Senegal in 1971. Law No. 71-66 of 30 November 1971 authorizing the President of the Republic to	To improve environmental protection, promote the conservation and sustainable use of natural resources, and harmonize and coordinate policies in these areas with a view to putting in place development policies and programmes that are environmentally sound, economically sound and socially acceptable	There will be clearing work to free the site's right-of-way. During the execution of this work, the promoter must comply with this agreement.

Texts	Objectives/ Regulated areas	Application in the context of the project
ratify the African Convention on the Conservation of Nature and Natural Resources, adopted in Algiers on 15 March 1968		
International Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, signed in Paris on 14 June 1994 and ratified on 14 June 1995. Act No. 95-09 of 7 April 1995 authorizing the President of the Republic to accede to the International Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, signed in Paris on 14 June 1994	Combat desertification and mitigate the effects of drought in countries seriously affected by it	The project will impact some plant species through tree cutting. In order to comply with the objectives of this Convention, these activities must not be a source of degradation of natural resources such as vegetation and soils.
United Nations Convention on Biological Diversity, signed in June 1992 and ratified on 14 June 1994 The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising out of Their Use in Relation to the Convention on Biological Diversity (2010)	Conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilization of genetic resources	The project must not destroy neighbouring biodiversity either by pollution or by the discharge of waste.

Texts	Objectives/ Regulated areas	Application in the context of the project
RAMSAR Convention on Wetlands of International Importance, especially Waterfowl Habitat, UNESCO, February 1971	Conservation of wetlands and their flora and fauna	The project must not impact on the wetlands in the project area.
Cultural Heritage		
Convention concerning the Protection of the World Cultural and Natural Heritage adopted in Paris on 16 November 1972. Law No. 75-110 of 20 December 1975 authorizing the President of the Republic to ratify the Convention for the Protection of the World Cultural and Natural Heritage adopted in Paris on 16 November 1972	This convention specifies the conditions under which cultural heritage must be protected	The site is not a cultural heritage, but if remains are found, the national procedure must be followed.
Human Rights		
African Charter on Human and Peoples' Rights adopted in Nairobi on 23 September 1981	Article 24 which enshrines the right of peoples to a healthy environment	The project must respect the right of the population to live in a healthy environment.
Chemicals management		
Stockholm Convention on Persistent Organic Pollutants (POPs) - 22 May 2001	Management of products containing persistent organic pollutants.	If the products to be used contain such waste, their disposal must be ensured in order to protect the health of the population.
Act No. 2003-08 of 28 May 2003 authorizing the President of the Republic to	Protect human health and the environment from persistent organic pollutants.	

Texts	Objectives/ Regulated areas	Application in the context of the project
ratify the Convention on Persistent Organic Pollutants, adopted in Stockholm, Sweden, on 22 May 2001		
Health, Safety and Hygiene		
ILO Convention No. 120 concerning Hygiene in Trade and Offices, ratified by Senegal in 1966	Hygiene at work and in infrastructures. This agreement regulates hygiene in certain infrastructures.	Occupational health and safety are cross-cutting to all project activities.
Convention No. 14 on weekly rest in industrial establishments of 17 November 1921 Convention No. 18 on Occupational Diseases of 10 June 1925 Convention No. 100 on Equal Remuneration for Men and Women Workers for Work of Equal Value, adopted at Geneva on 29 June 1951 Convention No. 100 on Equal Remuneration for Men and Women Workers for Work of Equal Value, adopted at Geneva on 29 June 1951	Health, Safety and Hygiene	

IV.3.2. NATIONAL LEGAL FRAMEWORK

In relation to the context and activities of the project, the national legal framework is marked by several texts that deal with environmental and social aspects.

IV.3.2.1. CONSTITUTION OF SENEGAL

The Senegalese Constitution, adopted on 22 January 2001 and revised on 20 March 2016 by referendum, introduced important environmental provisions that must be taken into account in the various phases of the project's implementation.

Thus, article 25.1 provides that "Natural resources belong to the people". They are used to improve their living conditions.

The exploitation and management of natural resources must be transparent and in such a way as to generate economic growth, promote the well-being of the population in general and be environmentally sustainable. The State and local authorities have an obligation to ensure the preservation of land assets".

Article 25-2 guarantees the right to a healthy environment and obliges public authorities to preserve, restore essential ecological processes, provide for the responsible management of species and ecosystems, preserve the diversity and integrity of genetic heritage, require environmental assessment for plans, projects or programmes, promote environmental education and ensure the protection of populations in the development and implementation of projects and programmes with significant social and environmental impacts. Such provisions encourage the integration of environmental protection into the project implementation process by all stakeholders.

The national legal framework is marked by several other environmental texts concerning the management of the living environment, in particular pollution and nuisances, natural resources (fauna, flora, water), the institutional framework for the management of the environment and natural resources, etc.

IV.3.2.2. ENVIRONMENTAL CODE AND ITS IMPLEMENTING REGULATIONS

Act No. 2001-01 of 15 January 2001 on the Environmental Code makes the environment a national heritage that must be protected and the general principles of prevention and precaution established. The Environmental Code governs all sectors of the environment and sets out the guiding principles of good management, compliance with which is necessary in all areas. All these provisions contribute to the effective protection and management of the environment.

The various projects requiring an ESIA are defined by article R40 of the decree implementing the Environmental Code.

This code was supported by regulatory provisions, including Prime Minister's Circular Letter No. 009 PM.SGG/SP of 30 July 2001 reminding all structures of the need to comply with the provisions of the Environmental Code to ensure effective environmental protection and management.

- **Regulations under the Environmental Code**

Decree No. 2001-282 of 12 April 2001 implements the Environmental Code by stipulating, in particular, the need to carry out an environmental assessment before the development of any activity likely to affect the environment. The decree defines the scope of the environmental impact assessment. Depending on the potential impact, nature, scale and location of the project, project types are classified into one of the following categories:

- **Category 1:** projects are likely to have significant impacts on the environment; an environmental impact assessment study will integrate environmental considerations into the economic and financial analysis of the project; this category requires a thorough environmental assessment.
- **Category 2:** projects have limited environmental impacts or impacts can be mitigated by applying measures or design changes; this category is subject to a summary environmental analysis.

The Saint-Louis airport rehabilitation project is classified in category 1 of projects subject to a thorough environmental assessment, in accordance with the decree implementing Act 2001-01 of 15 January 2001 on the Environmental Code (article R40 and annex 1).

The following orders were issued shortly thereafter by the Ministry of Environment to regulate the procedures and modalities for carrying out an EIA:

- Order No. 009471 on the content of ESIA terms of reference. The Promoter has complied with this requirement;

- Decree n° 009470 fixing the conditions for issuing approval for the exercise of activities relating to ESIAs;

- Order No. 009468 regulating public participation in environmental impact assessment. This text specifies the procedure for the participation of the population;

- Decree n° 009469 on the organization and functioning of the technical committee. This text supports the Ministry of Environment in the validation of the environmental impact assessment report

- Order No. 009472 on the content of the ESIA report. This text specifies that the impact study report must contain, in particular, a description and analysis of project variants, an assessment of the potential impacts of the project, the risks of technological accidents, measures to mitigate and compensate for adverse effects and a framework for an environmental monitoring and follow-up plan.

The validation of the impact study must be carried out by a technical committee in support of the Ministry of the Environment and Sustainable Development, as specified in Order No. 9469 of 28 November 2001. This decree defines the members and responsibilities of the committee.

The secretariat of the committee is provided by the Directorate of the environment and classified establishments (DEEC).

On the basis of the final study (containing any comments received during the public consultation), the technical committee will have to submit a decision to the Ministry at the request of the Promoter. The Department must then report the decision (positive or negative).

The table below provides a summary of the Environmental Code laws involved in this project.

Table 16: Some basic articles of the Environmental Code in relation to the project

Themes	Main content related to the project	Articles	Summary of the application text	Relevance to the project
Technological risks, Chapter I (TITLE II Prevention and control of pollution and nuisance)	Management of establishments with technological risks	Article L9	Describes facilities classified for environmental protection.	The project is a classified facility
		Article L10	Classified facilities are divided in two.	Some of the facilities present risks to the biophysical and human environment, so the airport is in first class.
		Article L11	"The first class shall include installations which present serious dangers or inconveniences to the interests referred to in Article L 9[...] the second class shall include installations which, without serious inconveniences to the interests referred to in Article L 9 [...]"	
		Article L12	"The categories of installations subject to the provisions of this Act and the classification of each of them shall be defined by order of the Minister for the Environment, after consulting the Ministries of Industry and Civil Protection. ».	This project must comply with this article.
		Article L13	"Installations classified as first class must be subject, before their construction or commissioning, to an operating permit issued by order of the Minister for the Environment under the conditions laid down by decree. This authorisation must be subject to their removal, within a radius of at least 500 m, from dwellings, buildings usually occupied by third parties, establishments open to the public and areas intended for habitation, a watercourse, a lake, a road or a water catchment area;	The project will comply with this provision before commissioning. However, this report focuses first on obtaining the environmental discharge before obtaining the certificate of conformity.
		Article L14	"Authorizations are granted without prejudice to the rights of third parties. They do not prevent the application of the	

			provisions of the Town Planning Code regarding building permits. ».	
		Article A16	"The application for authorization of a first-class installation must be the subject of a public inquiry prescribed by decision of the State representative under conditions set by decree;	
		Article A23	"Where the operation of classified installations presents, for the interests mentioned in Article L 9, serious dangers or disadvantages which the measures to be taken under the provisions of this Law are not likely to eliminate, the closure or removal of such installations shall be ordered by order of the Minister for the Environment....".	The operator will implement all measures to control risks that may affect its personnel and the environment around the site.
Waste management, Chapter III (TITLE II: Prevention and control of pollution and nuisance	This chapter sets out the conditions for solid waste management. It will cover general information on waste, discharge conditions and solid waste treatment.	Article L30	"Waste must be disposed of or recycled in an environmentally sound manner in order to eliminate or reduce its harmful effects on human health, natural resources, fauna and flora or the quality of the environment. The provisions of this Chapter shall apply to all categories of waste, including biomedical waste. ».	Waste from the rehabilitation phase must be managed by the promoter and waste from the exploitation phase by the operator.
		Article L31	"Any person who produces or holds waste must himself ensure its disposal or recycling or have it disposed of or recycled by companies approved by the Minister of the Environment...".	
		Article A37	"Disposal of waste by industrial, producing and/or processing structures must be carried out with the authorization and supervision of	

			the Ministry of the Environment, which sets requirements".	
		Article A38	"Where waste is abandoned, deposited or treated contrary to the provisions of this Act and the regulations made for its application, the authority holding the police power shall, after formal notice, automatically ensure the disposal of such waste at the expense of the person responsible. [...] ».	
Pollution and degradation of soils and subsoils, Chapter III (TITLE III Protection and enhancement of receiving environments)	Management of contaminated soils.	Article A81	The protection of the soil, subsoil and the resources it contains, as limited resources, renewable or not, against all forms of degradation is ensured by the State and local authorities.	The project must not result in soil pollution.
Air pollution and unpleasant odor, Chapter II	Air Pollution Prevention	Article A78	In order to avoid air pollution, buildings, agricultural, industrial, commercial or craft establishments, vehicles or other movable objects owned, operated or held by any natural or legal person shall be constructed, operated or used in such a way as to meet the technical standards in force. They are all subject to a general obligation to prevent and reduce harmful impacts on the atmosphere.	The project must not be a source of air pollution or odor nuisances that inconvenience surrounding populations and compromise public health or safety.
Sound Pollution, Chapter IV Impact Assessment	Noise pollution prevention	Article A84	Noise emissions that could harm human health, cause excessive inconvenience to the neighbourhood or harm the environment are prohibited. The natural or legal persons issuing such issues must take all necessary measures to remove them. When the urgency so warrants, the Minister of the Environment, in conjunction with the	Rehabilitation and exploitation works must not emit noise that could affect populations and workers.

			Minister of the Interior and the Minister of the Armed Forces, shall take all enforcement measures ex officio to put an end to the disturbance.	
	Impact study devices	Article L. 48	"Any development project or activity likely to affect the environment, as well as policies, plans, programmes, regional and sectoral studies, shall be subject to an Environmental Assessment (EA). The impact assessment is part of an existing authorisation, approval or concession procedure; the main actors involved in the environmental impact assessment procedure are the promoter and the competent authorities. The impact assessment is prepared by the promoter and submitted by him to the Ministry of the Environment, which issues a certificate of authorization after technical advice from the Directorate of the Environment and Classified Establishments.	Compliance with this provision is the result of this study.
		Article L51	The environmental impact assessment shall include, as a minimum, an analysis of the initial state of the site and its environment, a description of the project, a study of the modifications that the project is likely to generate, and the measures envisaged to remove, reduce or compensate for the negative impacts of the activity and their cost before, during and after the project is carried out. A decree issued on the basis of a report by the Minister of the Environment	

			specifies the content of the impact assessment.	
		Article L52	The public hearing procedure is an integral part of the environmental impact assessment.	
		Article L53	The participation of the population is a response to the desire to democratize the decision-making process and is guaranteed by the State in the sense of decentralization and regionalization.	
		Article L56	The operator of any classified installation subject to authorisation is required to draw up an internal operating plan to ensure that the competent authorities and neighbouring populations are alerted in the event of a disaster or threat of a disaster.	

Environmental standards

- **Air Quality Protection (NS 05-062)**

The NS 05-062 standard is a document setting the standards for atmospheric emissions in Senegal according to environmental principles. Its purpose is to protect the environment and people from harmful or uncomfortable air pollution. It applies to existing and new fixed installations and vehicles likely to generate gaseous effluents. It includes the maximum emission limit values, including for fixed combustion engines.

According to the standard, air pollution must be reduced at the source with appropriate devices. To do this, emissions must be captured as close as possible to their source.

For any operation or construction of facilities emitting air pollutants, the standard requires the promoter to provide the competent authority with information on the nature and quantity of the emissions; the location of the release, the height from the ground at which it occurs and its variations over time; and any other characteristics of the release necessary to assess the emissions.

The regulations require that before any construction or installation likely to pollute the atmosphere, the holder must make forecasts of his share of emissions production. These forecasts should provide information on the type of programming, its scope and frequency.

Dispersion conditions and the nature and intensity of emissions must also be included in the forecast.

According to the standard on atmospheric emissions, site emissions must be limited by reducing emissions from machinery and equipment and by using operating procedures that take into account the size, duration, nature of the site, etc.

This standard is applicable to the project because in the rehabilitation phase, there will be dust and exhaust emissions caused by the works and equipment (machinery, cars, etc.) and atmospheric emissions due to Volatile Organic Compounds (VOC).

The release limit value for the main air pollutants is presented in the following table.

Table 17: Limit values for air emissions

Substances	Flow rate	Discharge limit values
Total dust	D <= 1 kg/h D> 1 kg/h	100 mg/m3 50 mg/m3
Carbon monoxide: The authorisation order shall, if necessary, set a release limit value for carbon monoxide		
Sulphur oxides (expressed as sulphur dioxide)	D > 25 kg/h	500 mg/m3
Nitrogen oxides excluding nitrous oxide, expressed as nitrogen dioxide	D > 25 kg/h	500 mg/m3

Water Quality Protection (NS 05-061)

The Senegalese standard NS 05-061 published in July 2001 sets the limit values for wastewater quality before discharge into the natural environment and before connection to a collective wastewater treatment plant. The standard also sets out the conditions for spreading effluent and sewage sludge.

This standard is applicable to this project because the works will generate wastewater discharges during the construction and operation phases.

The following are also prohibited:

- any spills of hydroxylated cyclic compounds and their halogenated derivatives, regardless of the receiving environment;
- any spills of substances likely to promote the development of abnormal odors, flabors or colors in natural waters when used for human or animal consumption or other purposes;
- any spills of hydrocarbons or other chemical products, toxic by ships or other means of transportation and by pipelines etc.....;
- any spills from septic tank emptying trucks in unauthorized locations. In each Commune and Local Community, spill locations must be indicated;
- any use of raw waste water for spreading on food and feed crops: **Annex III ;**
- any spills into lakes, ponds and ponds.

Protection against noise

There are no specific standards regulating noise emissions as such, but protection against noise is regulated in the Environmental Code in article L84, which stipulates that: "Noise emissions that could harm human health, cause excessive inconvenience to the neighbourhood or harm the environment are prohibited".

Limit values for human health (corresponding to the limit values measured in the nearest dwellings) are defined in the regulatory part of the Environmental Code:

- **55 dB(A) to 60 dB(A) during the day;**
- **40 dB(A) at night.**

Decree No. 2006-1252 of 15 November 2006 laying down minimum requirements for the prevention of certain physical environmental factors (Chapter IV. - Noise).

These include Articles 13 and 14:

- favor the least noisy manufacturing processes;
- reduce at source the noise emitted by professional equipment and, in particular, machines;
- isolate, in specific premises, noisy equipment whose operation requires only a limited number of workers;
- avoid the diffusion of noise from one workshop to another;
- arrange workspaces to reduce noise reverberation on glass walls or ceilings;
- organize work so that employees are protected from noise.

Art. 14. - The daily sound exposure level received by a worker throughout his working day must not exceed eighty-five (85) A-weighted decibels (dB (A)). If it is not technically possible to reduce the daily noise exposure level below 85 dB (A), the employer must provide employees with suitable personal protective equipment. He must ensure that they are actually used. This limit of 85 dB (A), required for the use of personal protective equipment, may be lowered depending on the nature of the work, intellectual or otherwise, requiring concentration.

In addition, inter-ministerial orders relating to measures to reduce noise pollution sources are notified to operators of noise emission sources.

These requirements must be respected in the implementation of the project. Indeed, the installations must be constructed, equipped and operated in such a way that their operation cannot be at the origin of airborne or solidified noise likely to compromise the health or safety of the neighbourhood or to constitute an obstacle to its tranquillity.

Transportation vehicles, handling equipment and construction machinery used inside the installation, and likely to be an inconvenience to the neighbours, must comply with these regulations, as well as construction machinery.

Other legislative texts also concerning the environment and the management of natural resources, which may affect the project, are listed below.

IV.3.2.3. TEXTS ON CIVIL AVIATION

Civil Aviation Code

Act No. 2015-10 on the Civil Aviation Code is the regulatory basis for civil aviation in Senegal and contains two hundred and eighty-nine (288) articles divided into seven books. The articles of this law and other texts concerning civil aviation are given in the following table:

Book III of this code concerns aerodromes. Title I deals with the aerodrome regime. And Chapter 1 of the title describes, through Articles 137 to 145, the creation, certification and commissioning of aerodromes.

According to article 137 of the Code, "any surface on land or water, including buildings, installations and equipment, intended to be used, in whole or in part, for the arrival, departure and evolution of aircraft at the surface, shall be considered as an aerodrome "Article 142 states that " the ***Civil Aviation Authority shall certify Senegalese aerodromes such as that of Saint-Louis used for international flights and shall certify landing strips***".

The classification of aerodromes is described in Articles 146 and 147 of Chapter 2. Chapter 3 deals with the conditions for the operation and management of aerodromes. The general provisions (Section I) are described in Articles 148 and 149. Articles 150 to 153 provide information on fees (Section II). Article 150 provides that "at any aerodrome open to public air traffic, services rendered to users and the public shall give rise to remuneration in the form of charges levied for the benefit of the person providing the service, in particular for the following operations:

- aircraft landing and take-off;
- use of air navigation assistance devices;

- use of aeronautical telecommunications networks;
- parking and aircraft shelters;
- use of the facilities provided for the reception of passengers and goods;
- use of various installations and tools;
- occupancy of building land;
- visit some or all of the reserved areas of the airport".

Title II of the Code deals with aeronautical easements and the protection of operations and the environment. Chapter 1 deals with aeronautical easements. Articles 154 to 164 set out the provisions to be taken for this chapter. "In order to ensure the safety of aircraft traffic, special easements known as "aeronautical easements" are instituted. " (Article 157).

The protection of operations and the environment are described in Chapter 2 and Section I deals with general provisions (Articles 165 to 169). Article 168 states that "aviation operators are required to comply with applicable environmental protection standards.

To this end, they are subject to the general obligation to maintain aerodromes, including in particular the disposal or recycling of waste and the fight against pollution.

"The participation of local communities and people living near airports such as Saint-Louis and Matam in environmental management is organized and encouraged, in particular through

- free access to information on nature protection, without prejudice to the requirements of national defence and state security;
- consultative mechanisms to obtain the opinion and input of local communities and populations;
- awareness, training, research and education in environmental protection".

Section II of this Title deals with criminal provisions (Articles 170 to 175).

Article 170 provides that "anyone who stays, enters or carries a weapon without legal authorization in land prohibited by the regulations and general instructions of aerodromes assigned to a public service, or leaves draught, load or horse cattle or animals, shall be punished by a penalty of six months to two years' imprisonment and a fine of CFAF 20,000 to 200,000 and may, in addition, be forfeited any right to compensation in the event of an accident. The procedures for investigating and recording infringements shall be those laid down in this Code.

"Violations of the provisions concerning aeronautical easements for alternate use and beaconing instituted in the interest of air traffic shall be punishable by a fine of between 250,000 and 7,500,000 CFA francs.

In the event of a repeat offence, the offences are punishable by a fine of 500,000 to 15,000,000,000 CFA francs. " (Article 171). "Violation of the provisions of article 170 of this Code shall be punished in accordance with the provisions of the Environmental Code. " (Article 175).

During the rehabilitation and operation phase, the promoter must take into account all these provisions, particularly those concerning aerodromes.

This code is supplemented by regulatory provisions set out below:

- **Ministerial Order No. 10284 MTTTA-ANACS-DTNA-PDS dated 19 November 2007 on the composition of the file to be attached to an application for authorisation to create an aerodrome or to open an existing aerodrome, whether or not open to public air traffic.** Any application for an authorisation to establish an aerodrome or to open an existing aerodrome, whether or not it is open to public air traffic, shall be made in accordance with the provisions of this Order in Articles 1 to 5. The application for authorisation to create an aerodrome must be submitted by public authorities, public establishments or natural or legal persons governed by private law wishing to create the aerodrome or by their duly accredited representative. Natural or legal persons governed by private law must prove in their application that they meet the conditions set out in Article 2 of Decree No. 64-503 of 3 July 1964 and those set out in the Senegalese Civil and Commercial Obligations Code. The application must specify the full name or designation and the address of the applicant. Article 2 of this Order states that an environmental impact assessment shall be attached to the application file for the creation of an aerodrome;
- **Order n°03038 of 29 February 2016 approving the aeronautical regulations of Senegal (RAS).** The purpose of this Order is to approve the aeronautical regulations of Senegal (RAS), pursuant to the provisions of Article 3 of Decree No. 02015-1968 of 21 December 2015 establishing the framework for the supervision of civil aviation safety in Senegal (Article 1). The provisions to be taken into account in Senegal's aeronautical regulations are described in Articles 2 to 4 of this Order.
- **Order n°007200/MICITIE/ANACS/DG/DNAA of 12 July 2011 fixing the composition of the weight plan of an aerodrome.** Article 1 states that "this Order determines the composition of the mass plan of an aerodrome. "The mass plan drawn up on a scale of at least 1/10,000th shall include:
  - the aerodrome boundaries;
  - the implantation of the axes of the strips;
  - the distribution of the different operating areas;
  - road links with neighbouring centers;
  - possibly, the land to be reserved for extension. " (Article 2);
- **Decision n°000266/ANACIM/DG of 01 February 2017 on the development and implementation of an animal impact risk management procedure by the aerodrome operator/manager**. This Decision requires any aerodrome operator/manager to develop and implement an animal impact risk management procedure in accordance with the applicable regulatory provisions. The measures taken to implement this decision are described in Articles 2 to 8 of this Order;
- **Decree n°64-503 of 03 July 1964 relating to the conditions for the establishment, use and classification of aerodromes open or not to public air traffic as well as aeronautical easements and State control;**
- **Decree n°2015-1968 establishing the framework for the supervision of civil aviation safety in Senegal**;

- **Aerodrome Certification Process, May 2016 edition**. This process outlines the certification steps and applies to all international flight aerodromes;
- **Senegal Aeronautical Regulations No. 14 (RAS 14), Aerodrome, Volume 1: Aerodrome Design and Technical Operation**. It includes standards prescribing the physical characteristics and obstacle limitation surfaces to be provided by aerodromes, as well as certain installations and technical services normally provided at an aerodrome. It also contains specifications for obstacles outside obstacle limitation surfaces. These specifications are not intended to limit or regulate the operation of an aircraft;
- **Senegal Aeronautical Regulations No. 14 (RAS 14), Aerodrome, Volume II: Helicopters**. It includes standards (specifications) prescribing the physical characteristics and obstacle limitation surfaces that helipads must have, as well as certain installations and technical services provided in principle on a helipad. These specifications are not intended to limit or regulate the operation of an aircraft. In designing a helipad, account shall be taken of the critical theoretical helicopter, which has the largest dimensions and maximum take-off weight, for which the helipad is intended. It should be noted that SIR 6, Part 3, contains provisions for helicopter flights.

The memorandum of understanding between the National Civil Aviation Agency and the Directorate of the Environment and Classified Establishments. The purpose of this memorandum of understanding is to establish coordination between ANACIM and DEEC for the management of any conflict situation that may arise in the implementation of air traffic management and environmental protection measures. Articles 1 to 6 give all the necessary measures to be taken for the implementation of this Protocol. Article 2 of this Protocol provides that "any conflict situation arising from air traffic management requirements in the face of aspirations for a healthy environment and good control of major hazards shall be submitted to an ad hoc committee comprising experts from the civil aviation administration and those from the environmental administration.

The rehabilitation of Saint-Louis airport must be carried out in accordance with the Civil Aviation Code and its related texts.

IV.3.2.4. CODE OF HYGIENE

Act No. 83-71 of 5 July 1983 on the Code of Hygiene essentially regulates individual public or collective hygiene and environmental sanitation. The law defines, among other things, the hygiene rules relating to the control of epidemics as well as those applicable to dwellings, industrial installations, public roads and waste conditioning. The code provides for a real hygiene police force to ensure the effectiveness of its application.

Title II of this Code deals with public health. Chapter 1 describes through articles 2 to 13 all the devices to be taken into account in the context of hygiene on public roads. Chapter 2 regulates hygiene in the home (Art. L14 to L35). Chapter 3 provides guidelines on food hygiene.

In the construction and operation phase, populations that will engage in small-scale trade, catering and catering activities should comply with the hygiene rules in Chapter III of this code for hygiene in classified establishments, markets and outdoor commercial activities.

Within the framework of this project, all the measures set up by this code must be taken into account to ensure rational waste management as well as hygiene and health at site level.

IV.3.2.5. FORESTRY CODE

The Forest Code is based on Act No. 98-03 of 8 January 1998, supplemented by its implementing decree No. 98-164 of 20 February 1998. The code governs plant resources and protected areas. Clearing procedures are described in Chapter 2 of the decree implementing the Forest Code in Art. R. 47 to Art. R. 55.

Any request for clearing must be examined by the legislative bodies of the local authorities concerned, which send their detailed opinion on the request to the departmental council (Art. R47.). The land clearing permit is issued by the Departmental Council on the advice of the relevant Municipal Council.

However, this authorization cannot be granted on a strip of fifty metres on either side of the main roads under the terms of Article R. 50 paragraph 2 of the Code.

The Code fully or partially protects certain plant species. Derogations from the slaughter of fully protected species can only be obtained for scientific or medicinal reasons (art R 61).

On the other hand, partially protected species may be felled with the authorization of the Water and Forestry Services.

For protected species, the regulations are defined in the Hunting and Wildlife Protection Code for wildlife species and in the Forest Code for flora.

Under this project, rehabilitation work will require tree cutting and clearing. These activities will be carried out in accordance with the provisions of the Code.

IV.3.2.6. SANITATION CODE

It is described in Act No. 2009-24 of 08 July 2009 on the sanitation code and the implementing decree No. 2011-245 of 17 February 2011 on the implementation of the Act on the sanitation code. This law defines a single, harmonized sanitation code, which provides access for all to the rule of law on sanitation in Senegal.

For the treatment of domestic water and industrial waste water, the airport must be equipped with a drainage system for such water established in accordance with the provisions of this code, its implementing regulations and other texts in force (Art. L. 15).

IV.3.2.7. THE WATER CODE AND ITS APPLICATION TEXTS

Act No. 81-13 of 4 March 1981 on the Water Code provides for the various provisions to combat water pollution while reconciling requirements relating in particular to drinking water supply and public health, agriculture, the biological life of the receiving environment and fish fauna, site protection and water conservation. Title II of this text (Articles 47-63) on water quality protection deals in particular with water pollution. The various provisions make it possible to combat water pollution while reconciling requirements relating in particular to drinking water supply and public health, agriculture, the biological life of the receiving environment and fish fauna, site protection and water conservation.

For this reason, no spill, flow, discharge, direct or indirect deposit into a groundwater table or a watercourse likely to change its characteristics may be made without the authorization of the Minister in charge of hydraulics and sanitation (Article 49).

The implementing regulations for the Water Code have been published relatively recently:

- **Decree No. 98-555 of 25 June 1998 implementing the provisions of the Water Code relating to water policing**, which concerns both surface and groundwater. The decree provides for measures to combat water pollution and its regeneration to meet certain demands, including those relating to the supply of drinking water to the population, the biological life of the receiving environment and especially fish fauna, site protection and water conservation;
- **Decree No. 98-556 of 25 June 1998** implementing the provisions of the Water Code relating to authorizations for the construction and use of water catchment works;
- **Decree No. 98-557 of 25 June 1998 establishing the Higher Water Council**.

A Technical Committee on Water was created by Order No. 9060 of 14 December 1998.

The Promoter must avoid any uncontrolled use, waste, voluntary action or pollution of the water resources in the project area and the rational use of groundwater.

IV.3.2.8. LABOR CODE AND ITS IMPLEMENTING REGULATIONS

In the implementation of the Saint-Louis airport rehabilitation project, various texts relating to workers' health must be respected. Among these texts, we have:

- **Act No. 97-17 of 1 December 1997** on the Labor Code, which sets out working conditions, in particular with regard to working hours, which may not exceed 40 hours per week, night work, women's and children's contracts and compulsory weekly rest periods. The text also deals in its title 11 (art. L.167 to 187) with health and safety in the workplace and indicates the measures that any activity must take to ensure health and safety, guaranteeing a healthy environment and safe working conditions.
- **Act No. 73-37 of 31 July 1973** on the Social Security Code, as amended by Act No. 97-05 of 10 March 1997, which deals with accidents at work and occupational diseases in its Title II. The code gives guidance on all the measures relating to the prevention of accidents at work and occupational diseases that must be taken during the implementation of the project;
- **Act No. 2010-03 of 9 April 2010** on HIV AIDS, which emphasizes information on HIV AIDS, particularly in the workplace and for people involved in transportation;
- **Decree No. 67-1359 of 29 December 1967 repealing and replacing articles 25 and 30 of Decree No. 62-146 of 11 April 1962** organizing the labor service. It stipulates that: "For equal professional qualifications, priority for recruitment must be reserved for workers of Senegalese nationality who are habitually resident in the place of employment in the department of the place of employment or in the region of the place

of employment". The decree only applies to positions that do not require a high level of qualification: laborers and other trades in the same category.

In 2006, new decrees were added to the provisions put in place:

- Decree No. 2006-1249 of 15 November 2006 laying down the minimum safety and health requirements for temporary or mobile construction sites;
- Decree No. 2006-1250 of 15 November 2006 on the circulation of vehicles and machines within companies;
- Decree No. 2006-1251 of 15 November 2006 on work equipment;
- Decree No. 2006-1252 of 15 November 2006 laying down minimum requirements for the prevention of certain physical environmental factors;
- Decree No. 2006-1253 of 15 November 2006 establishing a medical labor inspectorate and establishing its powers;
- Decree No. 2006-1254 of 15 November 2006 on the manual handling of loads;
- Decree No. 2006-1256 of 15 November 2006 laying down the obligations of employers with regard to safety at work;
- Decree No. 2006-1257 of 15 November 2006 laying down minimum requirements for protection against chemical risks;
- Decree No. 2006-1258 of 15 November 2006 laying down the missions and rules for the organisation and operation of occupational medicine services;
- Decree No. 2006-1260 of 15 November 2006 on the conditions for ventilation and sanitation of workplaces;
- Decree No. 2006-1261 of 15 November 2006 laying down general health and safety measures in establishments of all kinds.

Texts relating to occupational medicine

- Decree No. 2006-1253 of 15 November 2006 establishing a medical labor inspectorate and establishing its powers;
- Decree No. 2006-1258 of 15 November 2006 laying down the missions and rules for the organisation and operation of occupational health services;
- Decree No. 2006-1255 of 15 November 2006 on the legal means of intervention of the Labor Inspectorate in the field of occupational health and safety.

During the construction and operation phase, the promoter must comply with the provisions of the Labor Code for labor management**.**

V. DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL CONDITIONS IN THE PROJECT AREA

V.1. GEOGRAPHICAL AND ADMINISTRATIVE LOCATION

The airport site is located in the Commune of Saint-Louis, Rao District, Department of Saint-Louis, Region of the same name. The region is located in the north of Senegal and covers 19,034 km². It has three departments: Saint-Louis, Dagana and Podor.

The Saint-Louis Region is limited:

- to the north by the Senegal River and the Republic of Mauritania;
- to the west by the Atlantic Ocean;
- to the east by the Matam Region;
- to the south by the Louga and Matam Regions.

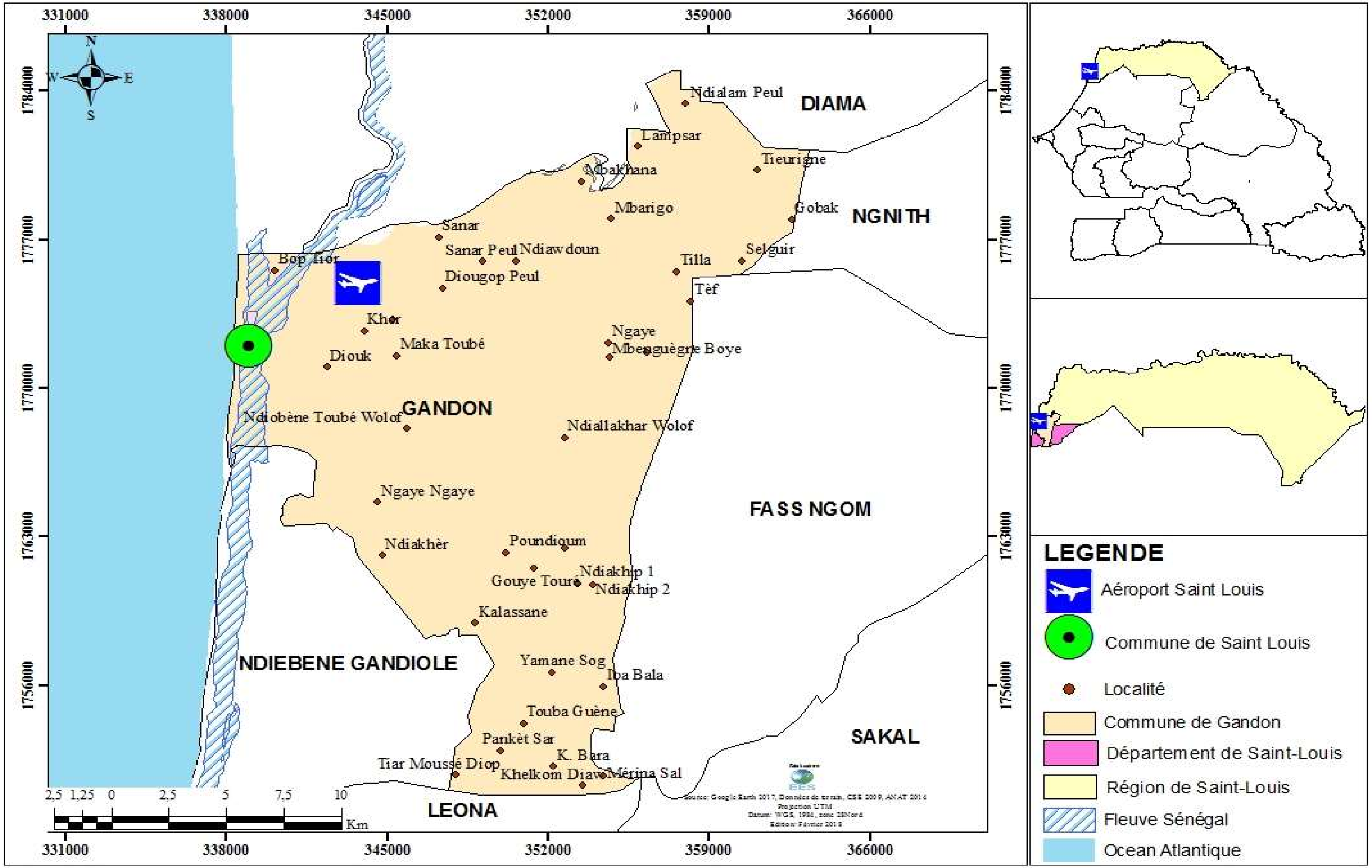
Located in the southwestern part of the Saint-Louis Region, the Commune of Saint-Louis was built in 1872. It covers an area of 19,241 km2 with an estimated population of 220,981 in 2015 (RGPHAE 2013). In 2018, this population would reach 239,075 inhabitants, 120,102 men and 118,972 women according to ANSD estimates. The Commune of Saint-Louis, located to the west of the Commune of Gandon, is surrounded by the latter. The municipality is thus limited:

- to the north, east and south by the Commune of Gandon;
- to the west by the Senegal River and the Atlantic Ocean.

V.2. LOCATION OF THE AIRPORT IN THE COMMUNE OF SAINT-LOUIS

Located northeast of the Commune of Saint-Louis, Saint-Louis airport is limited:

- to the north by the Senegal River;
- to the south by houses and the N2 national road;
- to the east by houses, market gardens and the Bango/Khor road;
- to the west by a natural vegetation composed mainly of mangroves and the Senegal River.



Map 1: Location of the Commune of Saint-Louis

V.3. ACCESSIBILITY OF THE SITE

Saint-Louis airport is accessible by the N2 national road, Dakar-Thiès-Louga-Saint-Louis. The section that leads from the city of Saint-Louis to the airport crosses the districts of Ngallèle, Khar Yalla and ends at the Bango district. From Camp Dakar Bango, the first crossing with the paved road leads directly to the airport. The latter is located about 240 m from this crossing.

V.4. LOCATION AND LAND USE OF AREAS OF INFLUENCE

V.4.1. LOCATION OF AREAS OF INFLUENCE

The area of influence corresponds to the space on which the potential impacts (dust, noise, releases into the natural environment, etc.) of a project can be perceived.

It depends on the nature of the project and the natural (habitats of fauna, flora, etc.) and human environments surrounding it on which the project is likely to have an influence.

Depending on the potential sources of impact resulting from the project, two (02) areas of influence can be distinguished.

V.4.1.1. AREA OF DIRECT INFLUENCE

It corresponds to the right-of-way that will house the rehabilitation and operation of the Saint-Louis airport. This area corresponds to the area on which the project is technically feasible (direct right-of-way area).

V.4.1.2. EXTENDED AREA OF INFLUENCE

It can be compared to all the surrounding localities (districts, towns, villages, etc.), to the establishments and activities adjacent to the airport, to the biophysical, river and marine environment. It also includes the roads and hydraulic infrastructures located in the area where the airport is located.

This extended area of influence is divided into close and remote study areas. The extent of these areas is defined according to their physical, human or biological components concerned.

- **Nearby study area**

It corresponds to the immediate environment of the site. The biological and river environment included in this nearby study area can be circumscribed within 500 m around the airport's right-of-way area. This delimited radius makes it possible to take into account the ecological complexes of interest potentially present near the airport but also the hydrographic network.

The human environment identifiable in the nearby study area is limited to the populations directly concerned, which are mainly located in the districts of Bango, Cité Ngallele, Khar Yalla, Tiang Island and Saint-Louis.

- **Remote study area**

The physical environment within the remote study area is defined according to the specificities of each parameter studied. Thus, hydrography, climate, geology and morphopedology are presented on a large scale covering the normal variations of each parameter and according to the data available as close as possible to the project area.

The biological environment extends 1 km from the project area. This circumscribed radius makes it possible to take into account biological homogeneity/specificity on a macroscopic scale.

The human environment extends to the scale of the Commune of Saint-Louis, the Rao district, Department of Saint-Louis, Region of the same name and the country according to the themes addressed. Public consultations also follow this pattern.

V.4.2. LAND USE OF THE IDENTIFIED AREAS OF INFLUENCE

V.4.2.1. AREA OF DIRECT INFLUENCE

Corresponding to the site's right-of-way, this area is made up of several land titles belonging to ASECNA. This land base is occupied by: (a) some sparse acacia shrubs; (b) a seasonal herbaceous mat around the runway; (c) trees and shrubs mainly composed of acacia to the east of the airport, more precisely behind the power plant; (d) mangroves to the north.

Apart from these acacias, a mango tree and a partially protected plant species, *Adansonia digitata* (baobab), have been identified on the site.

The following were also identified in the airport's direct area of influence: a cemetery on the northern edge of the runway, a non-functional hydrant, an aircraft wreckage and local garbage piles.

Throughout the airport, rainwater is evacuated:

- on areas not built by natural networks;
- on built surfaces via a functional drainage network.

The components of the current identified airports are:

- a collapsed fence wall that encourages animals to wander inside the airport;
- an abandoned hangar;
- a terminal building under construction since 2006;
- a VIP lounge that also serves as an airport terminal;
- a technical building housing the control tower, the technical block, the secretariat and the meteorological station;
- a meteorological park;
- a 1.9 km long track, with two (02) Stop Extensions (PA) of 100 m each and 30 m wide;
- a Jet A1 fuel storage area with two (02) 50,000-litre tanks and a service station;
- a fire station equipped with an extinguishing vehicle with an 8,000-litre water tank and a 20,000-litre underground storage tank;

- a power plant.

Photo 1: VIP Lounge

Photo 2: Terminal under construction

Photo 3: Administrative and technical building

Photo 4: Fire station

Photo 5: Fuel storage area

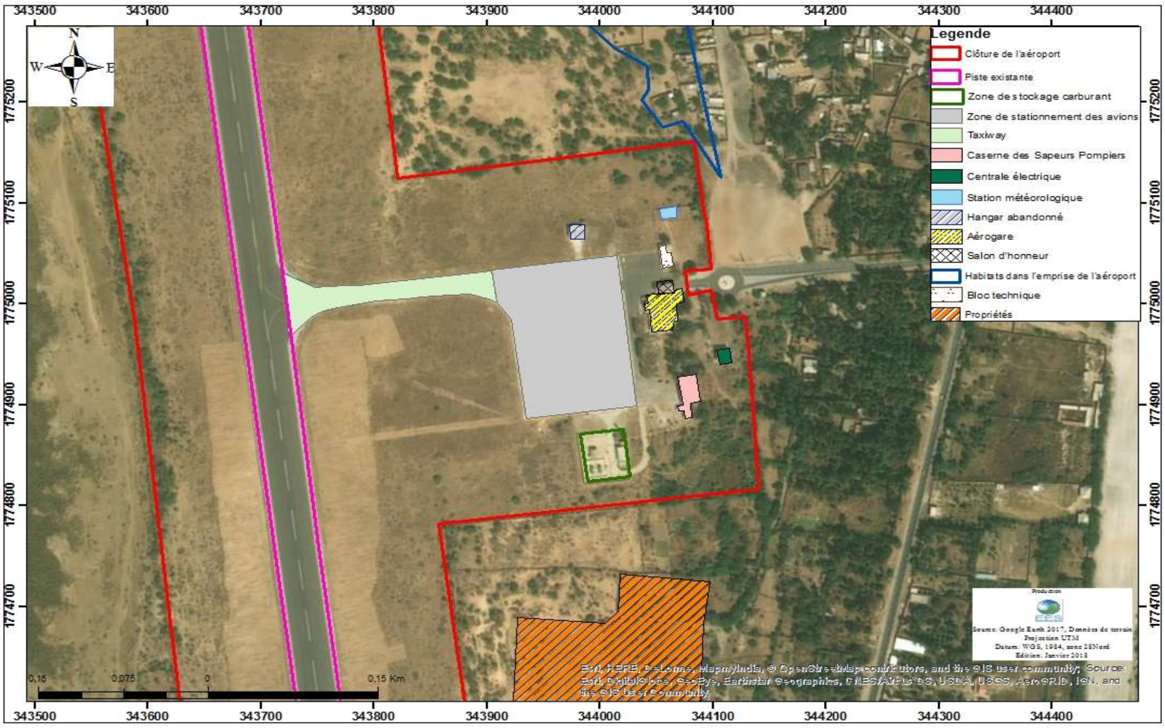
Photo 6: Gas station

Source: SEA snapshot, January 2018

Photo 7: Airport wall collapsed in places Photo 8: Wild garbage dump

Source: SEA snapshot, January 2018

The current components of the airport are shown on the following map.



Map 2: Location of the components of the current airport

V.4.2.2. Extended area of influence

Nearby study area

This area corresponds to the immediate environment of the Saint-Louis airport site.

- **Land use north of the airport**

The airport is bounded to the north by an arm of the Senegal River and the Senegal-Mauritanian border. This northern boundary is marked by the presence of sensitive natural elements, particularly mangroves.

- **Land use east of the airport**

The airport is bounded to the north-east by the Dakar-Bango military camp and natural vegetation, to the center-east by houses and a football field, to the south-east by houses, market gardening fields, a 7 km long concrete canal and natural vegetation dominated by the *Borassus* species. The Bango-Khor road is also located east of the airport.

- **Land use south of the airport**

The airport is bounded to the south by the first dwellings in the Khar Yalla district and the N2 national road.

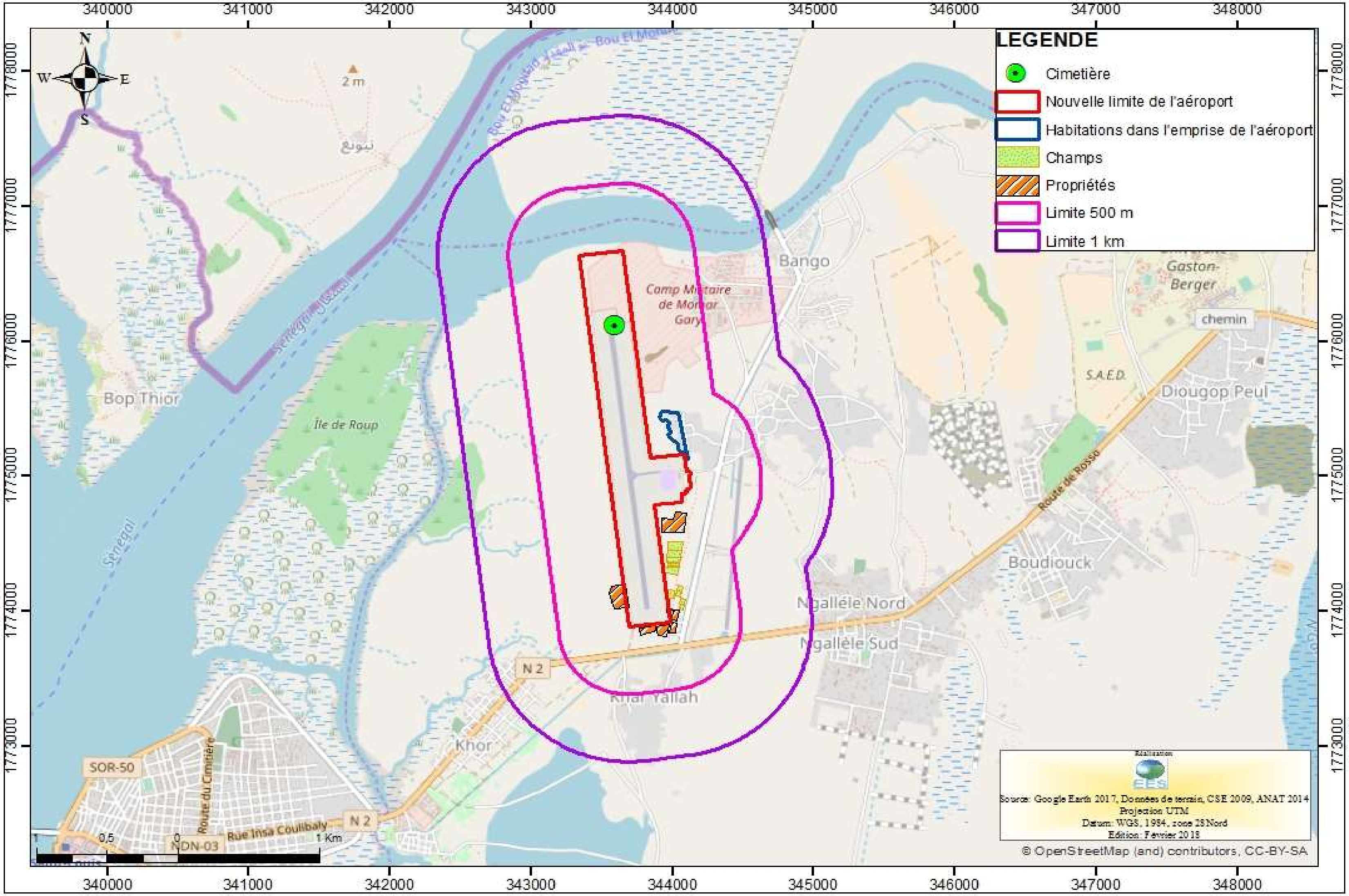
- **Land use west of the airport**

The airport is limited to the west by natural vegetation dominated particularly by mangroves and acacias. Private property has also been identified southwest of the airport. In this western area of the airport is also the Roup Island.

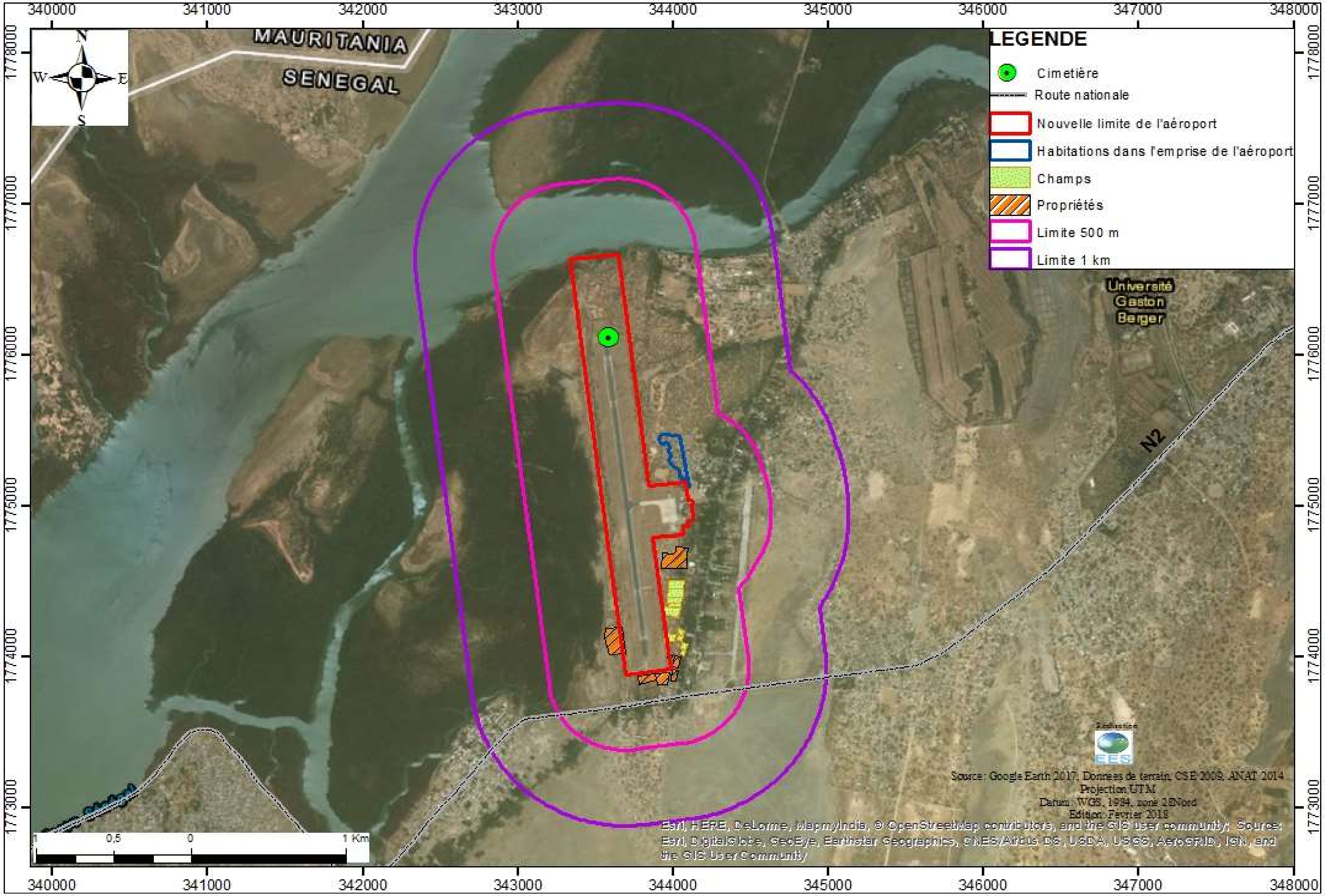
The table below summarises the different entities identified in the immediate environment of the airport.

Table 18: Immediate Site Environment

Entities	**Distance**	**Orientation in relation to at the airport site**
Mangrove	80 m	West
Housing	11 m	West
Dakar Bango	300 m	North
River	10 m	North
Bango-Khor Road	145 m	East
Dwellings in the right-of-way	00 m	East
Dwellings on the fence wall	00 m	East
Football field	10 m	East
First dwellings Khar Yalla district	11 m	South
National Road N2	186 m	South



Map 3: Land use in the project's areas of influence



Map 4: Land use in the project's areas of influence (Satellite image**)**

V.5. DESCRIPTION OF THE PHYSICAL ENVIRONMENT

V.5.1. GEOLOGY

The Commune of Saint-Louis is located in the Senegal-Mauritanian sedimentary basin. The geological formations of this basin consist of ancient lands largely covered by recent Quaternary deposits.

In the project area, two (02) types of formations are identified. These are Tertiary and Quaternary formations.

The Tertiary formations known at the outcrop are the Taïba formations, of Eocene age, are composed of limestones and marls with nummulites, phosphated in the west. They represent the Upper Bartonian Lutetian.

The Quaternary formations outcrop in almost the entire project area and are represented by:

- the Pleistocene characterized by red sands of the continental dunes; these deposits are composed of fluvial sands that are based on the formation of Taïba (Upper Lutetian - Bartonian);
- the Holocene made up of recent river alluvium from alluvial formations. In addition, formations of deltaic to marine origin linked to the last transgression of the Nouakchottan are found there. The latter are made up of vases and shellfish sands. These formations occupy paleo-valleys perpendicular to the coast. Along the beach, the Holocene is represented by the sands of beaches and dune beds, which are the most recent manifestations of the post-transgressive marine footprint regulating the coastline.

The Saint-Louis airport is built on mud and shellfish sands.

V.5.2. RELIEF

Like the Commune of Saint-Louis, the relief of the project area is relatively flat. Altitudes vary between 0 and 15 m throughout the municipality. Indeed, the Commune of Saint-Louis is located near the mouth of the Senegal River, between the continent and the Langue de Barbarie, on particularly low and flat Quaternary formations.

The morphology of the Commune of Saint-Louis results from a low dune alignment, oriented from northwest to southwest on the mainland. Also, the position to the west of the barrier beach constituting the Langue de Barbarie has strongly influenced the general shape of the relief but also the hydrography.

V.5.3. WATER RESOURCES

The hydrological and hydrogeological structure of the delta is closely linked to the tectonic and geodynamic history of the area.

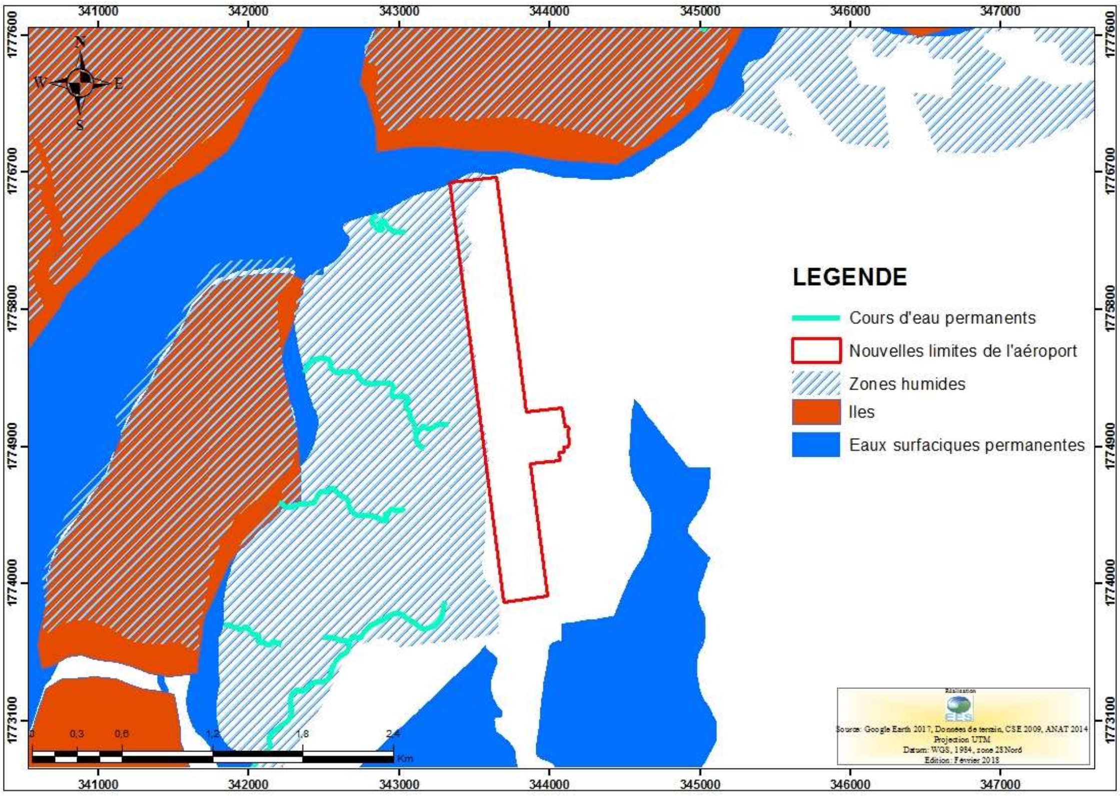
V.5.3.1. SURFACE WATER RESOURCES

The hydrographic network is quite dense in the project area. It is mainly made up of the 1700 km long Senegal River, with a large number of basins. The river originates in Guinea and flows through Mali and Mauritania before flowing into the Atlantic Ocean at Saint-Louis. It also represents the border between Senegal and the last two (02) countries.

The river supplies on both sides:

- Two (02) natural depressions: Lake Rkiz (in Mauritania) and Lake Guiers (in Senegal),
- A series of clay settling tanks (Ndiael, Khant, Nguisset, Ndiasséou, Djoudj in Senegal; Aftout and Saheli in Mauritania);
- A network of marigots (Djoudj, Thieguel, Gorom, Lampsar, Diovol, Leybar, Sofal on the left bank and Thialack, Djeuss on the right bank) most often flowing on salt soils.

The Senegal River is also composed of several tributaries including the Gorom, Djeuss, Lampsar and Ngalam rivers. It is the most important watercourse in the country and its regime varies according to the seasons. Indeed, it records a period of high and low water, respectively from June/July to October/November and from November/December to May/June. The maximum flood arrives in early November in Saint-Louis. This flood supplies groundwater and other aquifers. However, the river regime is characterized by an interannual irregularity characterized by wet and dry years.



Map 5: Hydrography of the project area

V.5.3.2. GROUNDWATER RESOURCES

Groundwater is contained in the more or less clayey and sandy clayey formations of the Tertiary and Quaternary which are characterized by Quaternary sand tables (with surface outcrops in the areas near the river or basins) and the terminal Continental.

- **Aquifer of the Quartenary sands**

This aquifer is located in the dune belt of the northern coast between Dakar and Saint-Louis. It consists of sandy and sandy-clayey deposits that lie directly on the Eocene's marly and marly-limestone bedrock. It contains significant water reserves with exploitable resources estimated at more than 115000 m^3/d (Travy 1988)[8].

It is contained in coastal and infra-basalt sands with surface outcrops. Its depth varies between 03 and 10 m in the "Niayes" and between 10 and 20 m in the high areas. This aquifer system extends to the east into the lutetian limestones and clayey sands of the Continental Terminal.

The aquifer represents most of the hydrogeological potential of the Gandiolais area. Its potentiality is closely linked to the river and marine dynamics.

- **Continental Terminal Aquifer**

The Continental Terminal is made up of sandy clay formations from the late Tertiary and early Quaternary periods.

The aquifer covers most of Senegal. However, its reserves in the study area are often salty, which explains the scarcity of drilling in the area.

The deeper Continental Terminal aquifers reach a depth of thirty (30) to one hundred (100) metres in some areas.

The recharge of the aquifers of the Quaternary sands and the Continental Terminal is largely carried out during the flood periods of the Senegal River. However, the deterioration of climatic conditions, repeated episodes of drought, the estuarine position of the municipality, among other aspects, have had a major impact on the potential of these aquifers both on their capacity and on water quality.

V.5.3.3. WATER SUPPLY FOR THE COMMUNE OFSAINT-LOUIS

Drinking water supply in the Commune of Saint-Louis is provided by the Senegalese Water Authority (SDE).

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[8]Mouhamadou Doudou FALL: Conceptual hydrogeological modelling of the quaternary sand sheet of the northern coast of Senegal between Dakar and Saint-Louis, June 2012

As part of the implementation of the **programme to increase the distribution capacity of running water in the Commune of Saint-Louis**, the National Water Exploitation Company of Senegal (SONES) has initiated major innovations in hydraulic works from Bango to the Leybar water tower and the Khor treatment plant. This programme has received funding of CFAF 4 billion from the Ministry of Hydraulics and Sanitation in collaboration with the Commune of Saint-Louis[9].

V.5.3.4. Water Quality

The hydrology and hydrogeology of the project area are strongly affected by salinization resulting from the influence of marine dynamics on river waters.

The Senegal River is the main source of fresh water supply. Before the Diama dam was put into operation, the salt invasion could go up to Podor, 250 km upstream and undergo an intense phase of evaporation.

In the project area, the Bango "dam bridge" structure, located about 1.2 km from Saint-Louis airport, was built in 1939 and its main objective is to limit the contact of salt water from the mouth of the river with that of the Bango reserve.

However, this structure is marked by strong variations in salinity in its eastern part and there is also the age and obsolescence of the structure, and the degradation of the gates.

In addition, the construction of major hydraulic and hydro-agricultural works also has more or less harmful effects on water quality. In the area, the operation of the dam and the opening of the breach on the Langue de Barbarie have a strong influence on the hydrological functioning of the waters by promoting the influence of marine dynamics and consequently an increased presence of salinity. This situation has consequences on the water supply of local populations, market gardening but also on the environment, leading to, among other impacts, a deterioration in water quality and a proliferation of certain invasive aquatic plant species.

In addition, in the project area, there is potential water pollution due to wastewater discharges from agricultural activities and local populations.

V.5.4. MORPHOPEDOLOGICAL CHARACTERISTICS OF THE PROJECT AREA

At the Saint-Louis airport site, three (03) soil types are identified:

- **Crude mineral soils or poorly developed soils with inputs on the western part**

Characteristic of living coastal dunes, these soils generally have a coarse sandy surface horizon, low organic matter content in humus horizons and an often acidic pH on the surface. These soils are poorly or not organized in horizons (undifferentiated profile), either because there is a regular reception of fresh materials at regular intervals or permanent rejuvenation due to intense

[9] www.ndarinfo.com ; Wednesday, March 2, 2016

erosion action. They are generally located on sandy coastal ridges, along river valleys and on subcurrent mudflat complexes.

- **Subarid reddish-brown soils on the eastern part**

These *falo-type* soils, on the banks of the river or marigots, are made up of current deposits. They develop more particularly on sandy to sandy-clayey materials and have a uniform red color throughout the profile with a low but homogeneous organic matter content over a large part of the profile. Their content of fine elements is also low. They are generally located between tropical ferruginous soils in the south and sub-desert grey soils in the north. They are very sensitive to wind erosion when exposed.

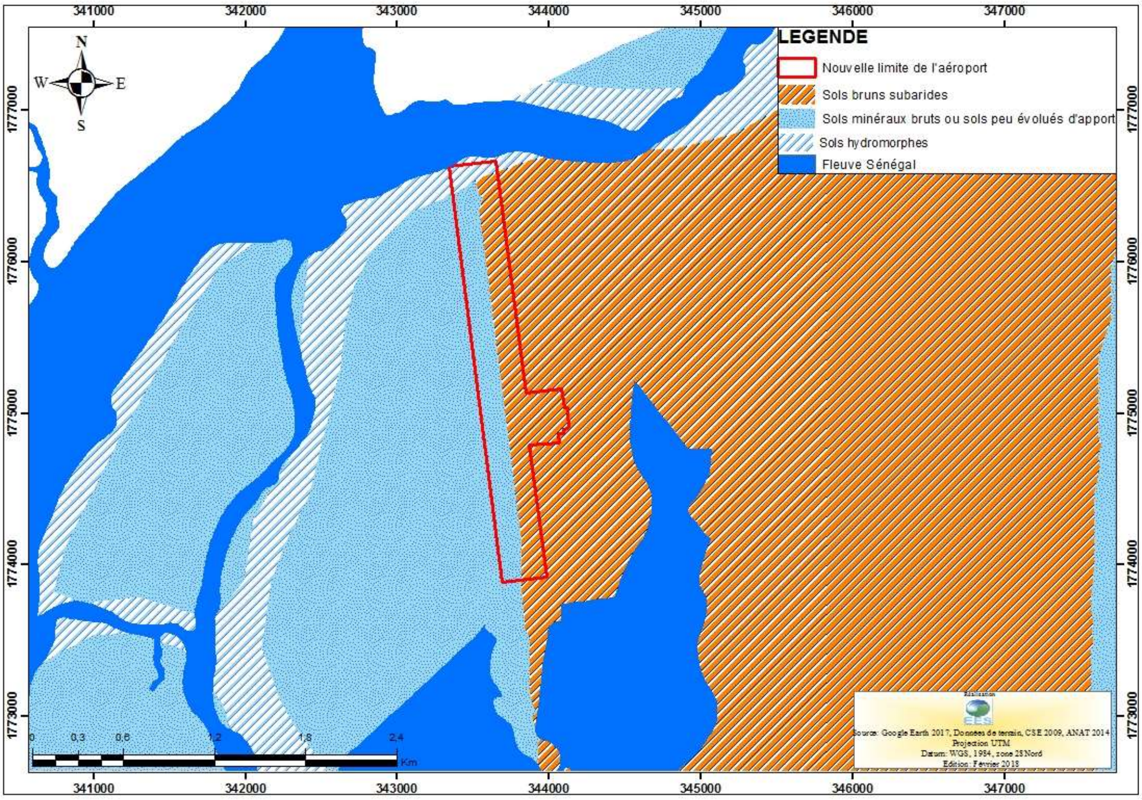
- **Hydromorphic soils with halomorphic soils in the north**

Hydromorphic soils with low gley humus, of the very fine to medium alluvial family, have the characteristics of mangrove soil that has evolved as a result of their flooding.

They are marked by marine influence and the different episodes of salt tongue upwelling in the delta and lower valley and are characterized by organo-mineral deposits (mudflats and fossil mangroves) and saline deposits whose frequency increases significantly as we move towards the mouth of the river.

Hydromorphic soils, located mainly in settling or flood basins, result from a more or less sustainable submersion by the river's flood waters.

Salt or halomorphic soils are present in the delta in some basins and fluvio-deltaic levees (ancient mudflats northeast of the city of Saint-Louis). These soils are generally characterized by a vegetative cover mainly composed of seasonal herbaceous species and in places by saline blooms.



Map 6: Morphopedology of the project area

V.6. CLIMATE

V.6.1. GENERAL CHARACTERISTICS OF THE CLIMATE

Located on the edge of the Senegalese coast, the Saint-Louis airport is located in the Sahel coastal climate domain subject to maritime and continental influences. Located between the 400 and 100 mm isohyets, the climate of the project area is characterized by the alternation of a long dry season from October to June, marked by the predominance of trade winds (maritime and continental) and a short rainy season from June to September/October, dominated by the monsoon flow from the St Helena high.

The study of climatic data concerns the monthly averages of the various climatic parameters recorded at the Saint-Louis meteorological station from 1987 to 2016.

V.6.2. CLIMATIC PARAMETERS

V.6.2.1. WINDS

Types of flows

Due to its position on the coast, the project area is swept by three (03) types of flows: the maritime trade wind, the continental trade wind, also called harmattan, and the monsoon.

- **Maritime trade winds**

Particularly coastal, cool and humid, the maritime trade wind comes from the Azores high and is from north to north-west. It is unable to generate precipitation because its vertical structure prevents the development of cloud formations. However, it can cause dew and sometimes fog. During its trajectory in the interior of the country, it warms up and acquires characteristics similar to those of the harmattan.

- **Continental trade winds or harmattan**

The continental trade wind comes from the Saharo-Libyan high (Maghreb) and is responsible for the hot and dry continental winds. It is a flow that remains very hot during the day and cool at night. This dry air flow is unable to cause precipitation. On the other hand, it is at the origin of the dust clouds observed during the dry season. Three (03) directions are assigned to it, namely the North, Northeast and East sectors.

- **Monsoon**

It is nothing more than an extension of a trade wind when it crosses the geographical equator. The monsoon comes from the St. Helena high with the western and northwestern dominant areas. It enters the country during the northern summer coinciding with the rainy season. This flow dominates during the rainy season and is at the origin of precipitation. Nevertheless, during this period, the maritime trade wind continues to oscillate with low frequencies.

Wind direction

The analysis of the wind rose in the project area, from 1987 to 2016, shows a directional variation of the wind according to the season. It highlights two (02) distinct wind seasons:

- The first period runs from November to June: coinciding with the dry season, this period is marked by the predominance of winds, from the north to the east quadrant, which dominate the circulation for six (06) months with an average intensity reaching 4.7 m/s. During this period, the North/North-East sector clearly shows its dominance with more than 70% of the frequencies. However, May and June mark the transition to the rainy season, with the presence of westerly winds.
- the second period, from July to October, is marked by the predominance of winds from the west to north quadrant, with more than 61% of the frequencies. This period coincides with the advent of the rainy season characterized by the circulation of monsoon flows. During the same period, a slight overlap was noted between the monsoon flow from the trade wind from the St Helena High in the South Atlantic and the maritime trade wind, which slowed the intensity of the winds unlike the first period. October is a transitional period that marks the end of the rainy season and the advent of the dry season. This transition is characterized by the presence of winds from the northern sector.

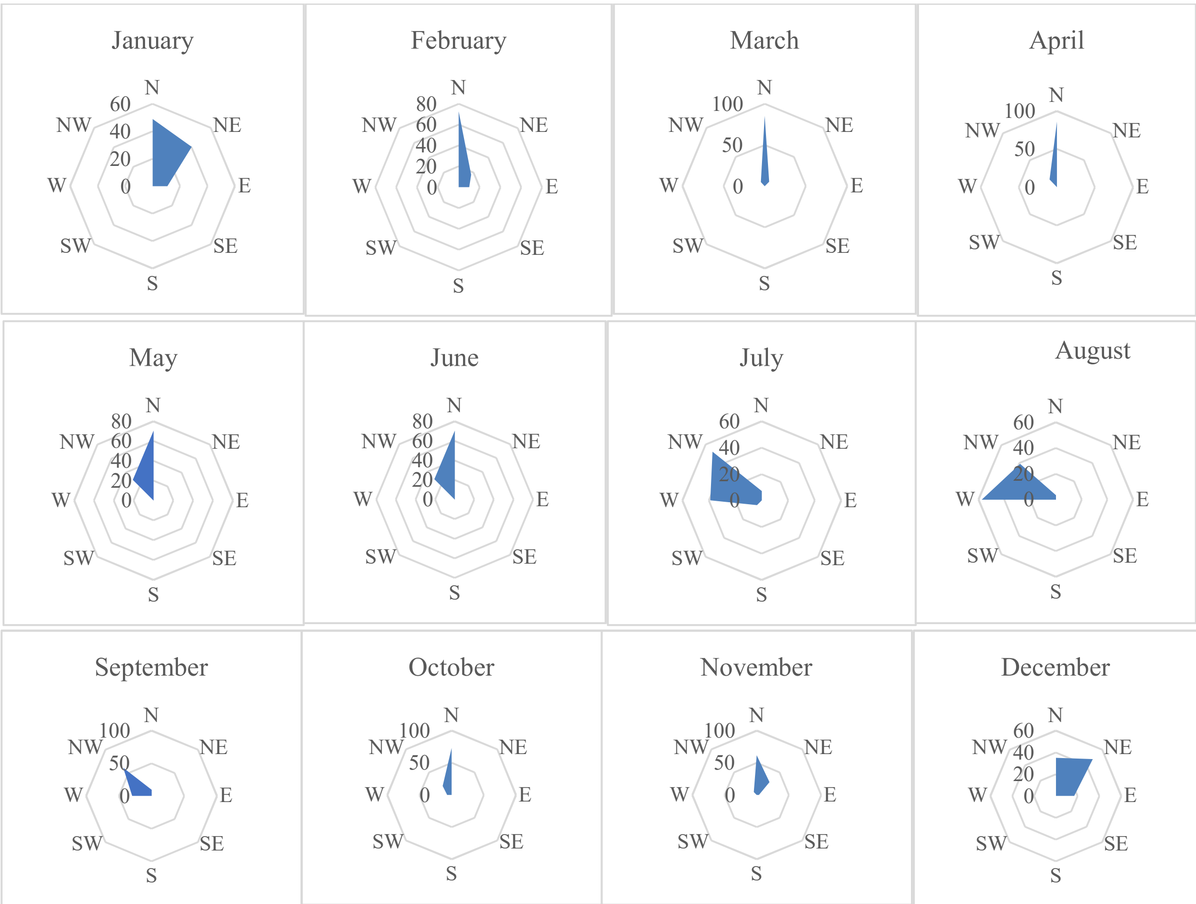


Figure 2: Percentage of dominant wind directions at Saint-Louis station, 1987-2016

Source: ANACIM 2018

Wind speed

The evolution of the curve of the monthly average wind speed is unimodal with a maximum in April (5 m/s) and a minimum in September (3.1 m/s). The average annual speed from 1987 to 2016 is 3.8 m/s. The highest speeds are recorded between January and July (dry season) and the lowest between August and November (rainy season).

The figure below shows the inter-monthly variability of wind speed.

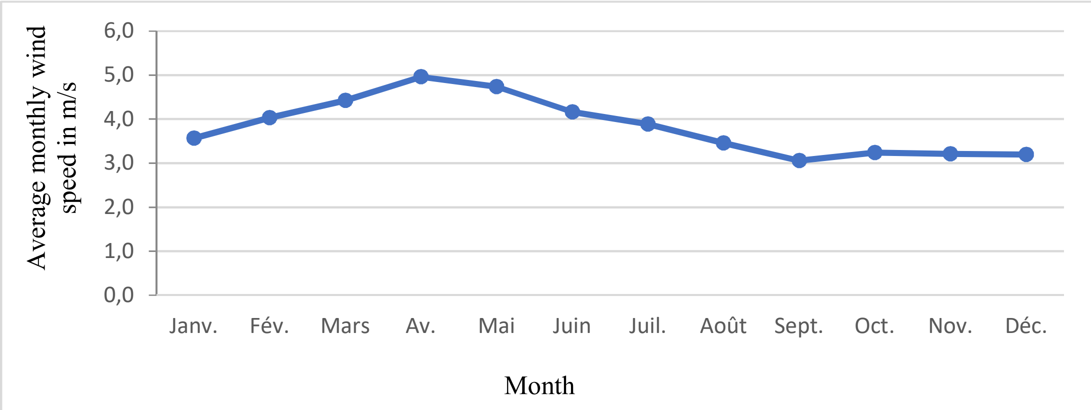


Figure 3: Average wind speeds, Saint-Louis station, 1987-2016
Source: ANACIM 2018

Generally, wind remains an essential parameter and its influence is important on the other parameters.

In addition, strong gusts of wind can sometimes ground aircraft. Wind direction and strength must be measured with electronic sensors located near the runways.

V.6.2.2. Insulation

It is a parameter that is highly dependent on cloud cover and precipitation. The average daily duration of sunstroke in Saint-Louis is fairly constant. It varies between 6 and 8 am from June to January and between 8 and 9 am from February to May. Low exposure values are generally recorded during the rainy season from June to September (6.1 to 7.2 h). From October, coinciding with the end of the rainy season, sunstroke values begin to increase and reach their maximum in February at 9.3 h. The normal rate from 1987 to 2016 is 7.6 h/day.

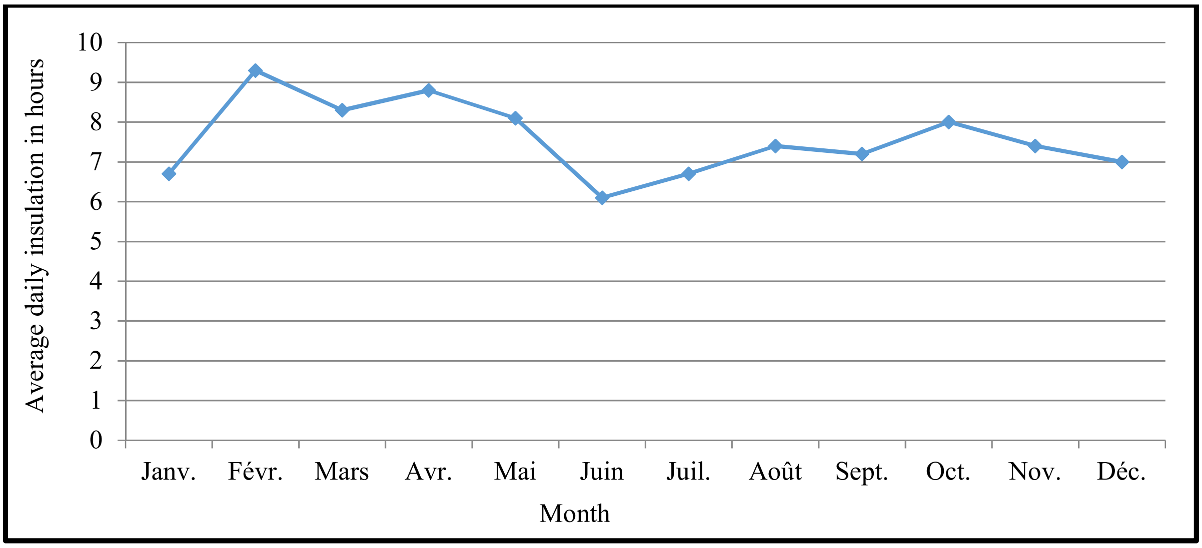


Figure 4: Average monthly change in insolation at the Saint-Louis station, from 1987 to 2016

Source: ANACIM 2018

V.6.2.3. Temperatures

Temperatures are relatively low overall with an annual average of 26.2°C from 1987 to 2016. The lowest average temperatures are recorded between December and June, when the highest temperature ranges from 10.2 to 15.2°C. However, the highest temperatures are observed between July and November, coinciding with the rainy season from June to September.

The Commune of Saint-Louis, because of its position on the coast, benefits from a microclimate characterised by moderate temperatures influenced by the circulation of maritime trade winds from the cold currents of the Azores. The presence of the harmattan is weakly felt in the area.

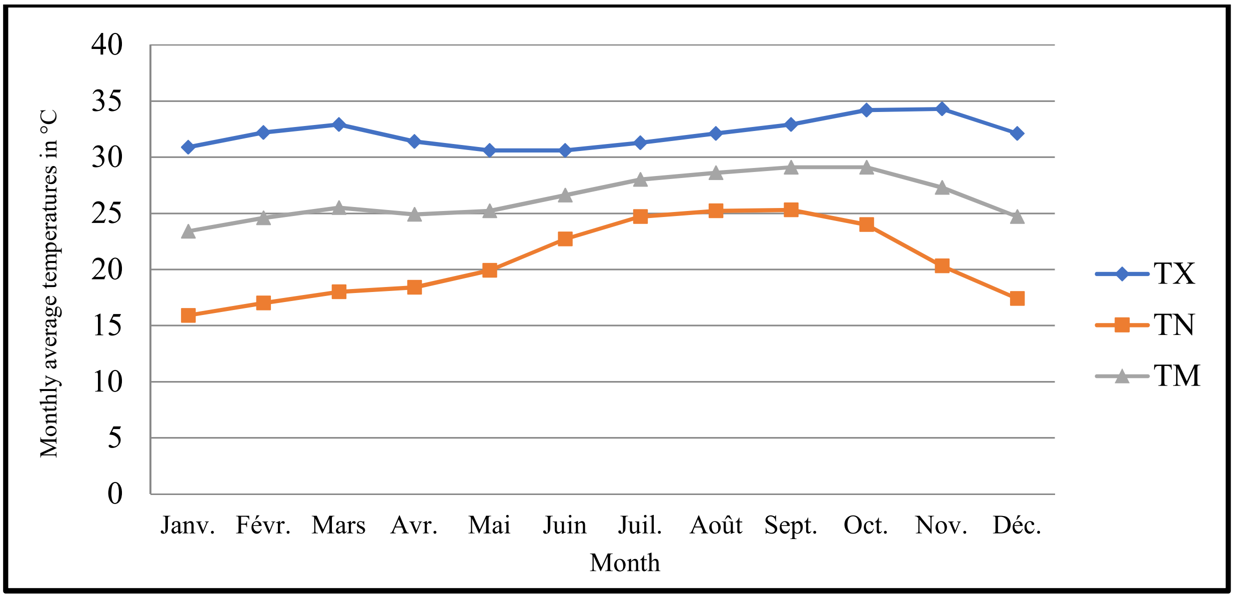


Figure 5: Evolution of monthly average temperatures, Saint-Louis station from 1987 to 2016

Source: ANACIM 2018

V.6.2.4. Evaporation

The monthly average evaporation curve shows a unimodal evolution with a maximum in January (185.6 mm) and a minimum in September (77.5 mm) in the middle of the rainy season. The normal from 1987 to 2016 is 132 mm.

In addition, the highest evaporation values are recorded during the non-rainy season, from October to June. This situation leads to high temperature and sunstroke values. It is during this period that most of the water bodies in the project area dry up.

The lowest values are observed during the rainy season, from July to September. These low evaporation values are due to the high cloud cover and relative humidity during this period.

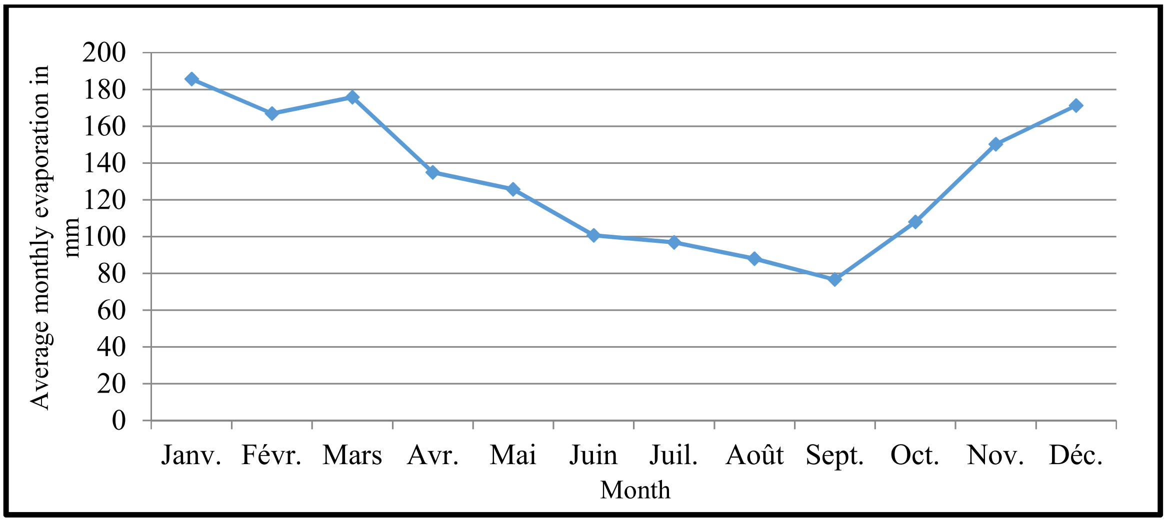


Figure 6: Average monthly evaporation rate, Saint-Louis station, 1987-2016

Source: ANACIM 2018

V.6.2.5. Relative humidity

The analysis of the monthly average relative humidity curve shows that it has a unimodal evolution with a maximum in September (80%) and a minimum in January (51%). The normal for 1987 to 2016 is 66.5%. The maximum and minimum averages follow the same trend.

The most important values are recorded during the rainy season, between June and September. This is due to the presence of the monsoon characterized by high humidity. From October onwards, the humidity starts to fall and reaches its lowest level in January. This period is marked by the presence of winds from the north to east quadrant.

The relatively high average relative humidity in the project area is favored by the position of the Commune of Saint-Louis in the River Delta but also by its proximity to the ocean.

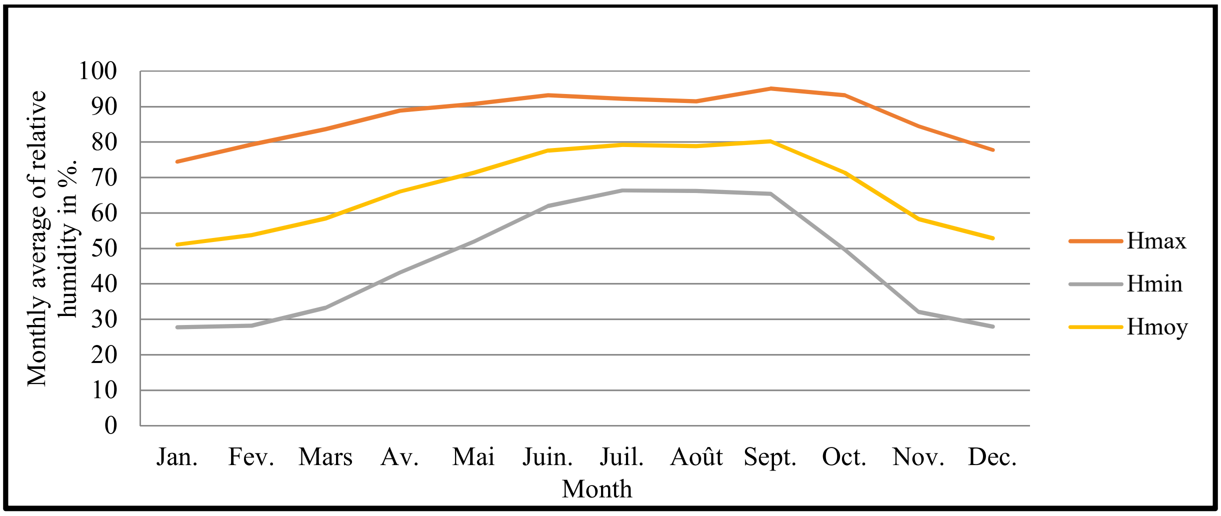


Figure 7: Monthly average change in relative humidity, Saint-Louis station from 1987 to 2016

Source: ANACIM 2018

Hmax : Maximum relative humidity ; Hmin : Minimum relative humidity ; Hm : Average relative humidity.

V.6.2.6. Rainfall measurement

The Saint-Louis airport is located in the coastal Sahelian climatic area, between the 100 and 300 mm isohyets. Indeed, the annual cumulative rainfall in the area rarely exceeds 300 mm.

The analysis of monthly rainfall is of paramount importance as it allows the monthly and interannual evolution of rainfall to be captured.

- **Inter-monthly variation in precipitation**

The analysis of the evolution of the monthly averages shows a variability in rainfall from one month to another. Indeed, the rainy season starts in the project area in June and ends in October. Most of the rains are recorded between July and September. In other words, these three (03) months regroup most of the seasonal cumulation. Rainfall increases until the middle of the rainy season (September) and then gradually decreases towards the end of the season. The rainfall profile thus shows a single peak corresponding to the month of September, which remains the rainiest month with 106 mm.

In addition to this rainy season’s rainfall, there is also off-season rainfall also known as "Heug" rainfall between January (2 mm) and February (1 mm). These rains are associated with invasions of polar air. They are generally low or insignificant, but can exceptionally reach high values.

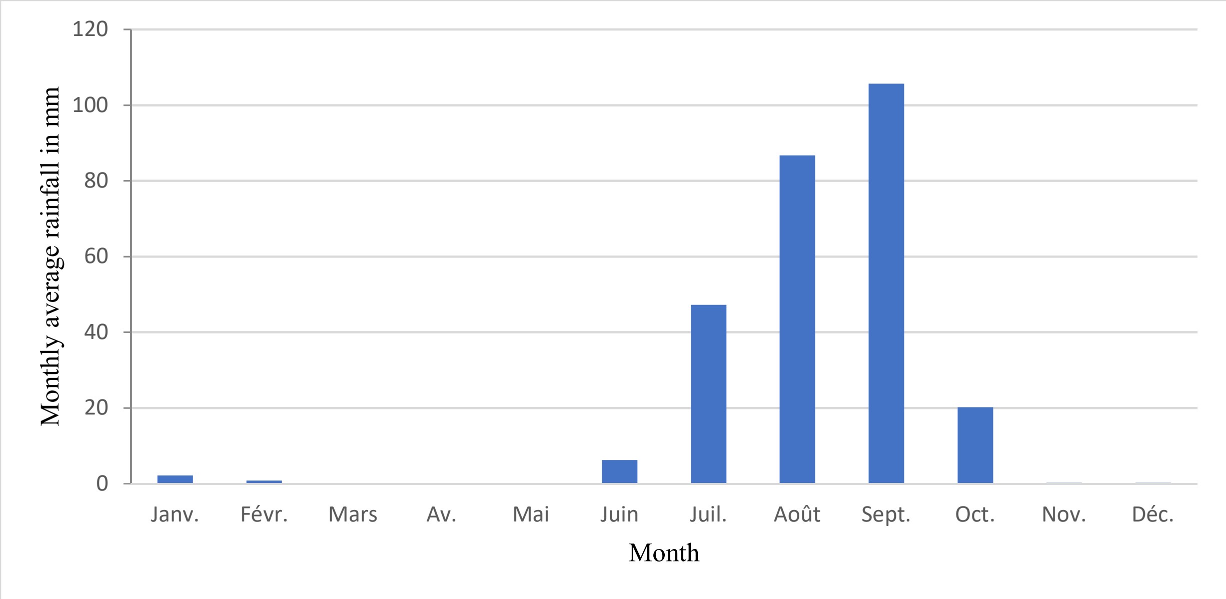


Figure 8: Average monthly precipitation trends, Saint-Louis station, 1987-2016

Source: ANACIM 2018

Interannual variation in precipitation

During the rainy season, precipitation is linked to the presence of the monsoon from the St. Helena high. They are not very abundant and rarely exceed 300 mm/year. Indeed, the normal from 1987 to 2016 is 270 mm.

The analysis of annual rainfall variations shows an interannual irregularity in rainfall in Saint-Louis. Over the 1987 to 2016 series (30 years), there are 17 deficit years, i.e. less than normal compared to 13 surplus years. The year 1992 is the most loss-making year in the series with a deficit of 211 mm, while 2010 is the most loss-making year with a surplus of 324 mm.

In addition, a return to normal rainfall has been noted since the 2000s. From 1986 to 2015, 2010 remains the wettest year of the series.

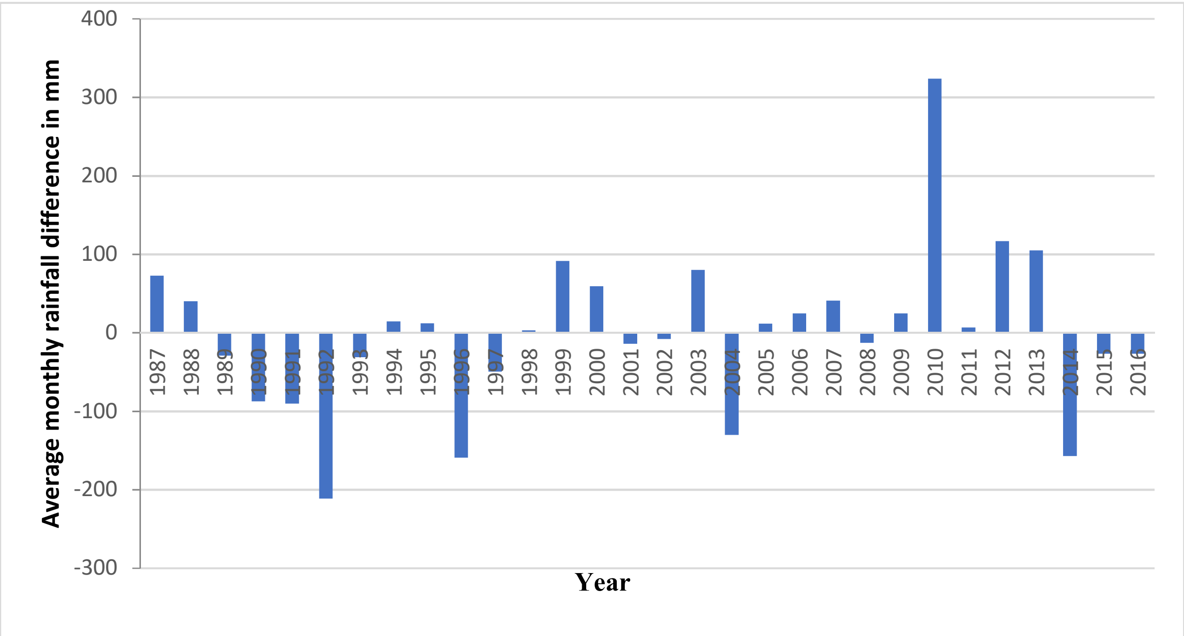


Figure 9: Interannual rainfall trends, Saint-Louis station, 1987-2016

Source: ANACIM 2018

In summary, accurate knowledge of the weather situation is essential for air traffic. Indeed, for an aircraft to take off or land, it is necessary to monitor weather conditions at the airport in addition to visual observations and the use of specific equipment such as: the ceilometer that determines the altitude and cloud layer coverage, the transmissiometer that evaluates visibility, as well as various sensors that measure weather conditions.

The most frequent incidents related to meteorology are:

- an unfavorable wind;
- fog and/or low cloud in all seasons and at all times;
- cumulonimbus, especially during the hot season;
- low clouds clinging to the terrain and resulting in poor visibility;
- etc.

V.7. DESCRIPTION OF THE BIOLOGICAL ENVIRONMENT

V.7.1. FLORA

The Saint-Louis Region is marked by the presence of three different eco-geographical areas, namely:

- the ferlo marked by a vegetation typical of the steppe dominated by thorny species with as dominant species: *Pterocarpus lucens, Acacia senegal, Acacia tortilis, Acacia seyal, Balanites aegyptiaca, Boscia senegalensis, Borassus flabellifer*, *Combretum sp, Ziziphus mauritiana, Calotropis procera, Leptadenia sp*, etc.;
- The Senegal River valley, characterized by halophyte vegetation growing on temporarily flooded land, is essentially composed of species such as *Acacia nilotica, Balanites aegyptiaca, Acacia seyal, Zizyphus mauritiana, Tamarix senegalensis*. Flood-prone areas are most often colonized by the species Vetivera nigritina. As for the banks of the river, they are colonized by the *Typha australis* “forming in places real aquatic jungles more than four (04) meters high”;
- The Niayes characterized by vegetation growing on hydromorphic depressions with *Adansonia digitata, Acacia nilotica, Acacia raddiana, Acacia senegal, Balanites aegyptiaca, Faidherbia albida, Prosopis juliflora, Tamarindus indica, Ziziphus mauritania,* etc. as dominant species.

The Commune of Saint-Louis is located in the eco-geographical area of Gandiolais. It contains important plant resources. The forest formations in the area cover an area of 21,100 ha with an estimated potential of 3,228,300 stems[10].

[10] Regional Land Use Planning Scheme (SRAT) 2014 - 2039

The area has a specific ecosystem consisting of the delta, *Niayes* and dunes. Forest formations consist of pseudo-shrub steppes, shrubby savannah, swampy meadows, mangroves and tannins.

The mangrove or coastal ecosystem is represented in the delta over a small area in the Saint-Louis mudflats, which constitute a very special environment. Two (02) species have been identified in the project area: *Rhizophora racemosa* and *Avicenia africana*. They are generally small in size and only remain in a relict state in the project area. This is due to the deterioration of climatic conditions associated with anthropogenic actions.

The Saint-Louis airport site is characterized by sparse shrub steppe vegetation overall and a little bushy to the southwest. The predominant forest species identified in the site are *Acacia seyal* (Sourour)*, Acacia senegal* (Werek)*, Azadirachta indica* (niim) and *Calotropis procera* (paftan).

North of the airport, on the temporarily flooded areas, the presence of mangroves (*Avicennia africana*) is noted. *A* few *Balanites aegyptiaca* (soump) have also been identified southwest of the airport.

The herbaceous stratum is present and is marked by the presence of species such as *Cenchrus biflorus*, *Aristidas tipoides*. Also, northwest of the airport, the presence of *Vetiveria nigritana* (vetiver) is noted on the temporarily flooded areas.

The presence of one (01) foot of *Mangifera indica* (mango tree) and one (01) *Adansonia digitata* (baobab) between the eastern border and the administrative block is also worth noting.

Only the species *Adansonia digitata* (baobab) and *Acacia senegal* (werek) are of major conservation concern because they are classified as partially protected species under the Forest Code in force in Senegal.

Photo 9 and 10: Plant cover of the site

Source: SEA snapshot, January 2018

The closest classified forest to the airport site is Maka Diama (12 km from the airport) and the nearest park is the Langue de Barbarie (19 km).

V.7.2. WILDLIFE AND AVIFAUNA

The Saint-Louis Region has significant potential in terms of wildlife resources. Indeed, several important areas have been identified, including

- the National Park of Djoudj (16000 ha) and the Langue de Barbarie (2000 ha);
- Wildlife Reserves including Gueumbeul (720 ha), Djovol (03 ha), Ndiaël (46500 ha), etc.

Avian fauna remains the most represented class. It is characterized by a large colony of native and migratory species. Small wildlife is also well represented with the presence of small rodents, reptiles, etc.

On the other hand, large terrestrial fauna is poorly represented due to the nature of vegetation, climate and anthropogenic factors. All these parameters have favored the migration of several species.

However, the airport site is not of particular interest in terms of wildlife resources. Nevertheless, its proximity to surface waters makes it an area of average environmental sensitivity because surface waters contribute to the physiological life of fauna and flora but also to the maintenance of biodiversity.

V.8. SOCIO-ECONOMIC SITUATION OF THE PROJECT AREA

V.8.1. DEMOGRAPHIC SITUATION

The population of the Saint-Louis Region is estimated at 957,602 inhabitants in 2015[11] and in 2018 it is estimated at 1,036,000 inhabitants[12], with a density of 49 inhabitants per km^2. The male population is smaller than the female population, with a sex ratio of 99 males to 100 females. The region is characterized by a very young population. Indeed, the under-15 age groups constitute 43%, with the under-5s representing 15% of the population compared to 51% of adults (15-59 years).[13]

The Department of Saint-Louis has 304,304 inhabitants with a high density of 346 inhabitants/km^2. The departmental population represents 33% of the regional population.[14]

The Commune of Saint-Louis has 33 districts, including the Bango district where the airport is located. In 2018, the population of the municipality is estimated at 239,075 inhabitants including 120,102 men and 118,972 women[15]. This district of Bango has 7,972 inhabitants, 3,304 of whom are women and 4,668 men (SRSD, 2018).

The ethnic composition is mainly dominated by the Wolofs, followed by the Peulhs and Moors. The presence of foreigners of African and European origin is also noted. The population is predominantly Muslim.

V.8.2. SPATIAL PLANNING / LAND ISSUES

The analysis of spatial planning aims, among other things, to determine the evolution of land use, space consumption, soil artificialisation linked to infrastructure and urbanisation, etc. This analysis must also take into account urban planning documents, the classification into urban areas, to be urbanized, natural or agricultural.

Located at the mouth of the Senegal River, Saint-Louis asserts a unique identity characterized by the natural site where the city develops but also by the union of the Senegal River (fresh and silty waters) and the Atlantic Ocean (brackish waters).

It is in this natural environment that the city of Saint-Louis, the Langue de Barbarie (ultimate coastal barrier), the large island of Sor was born, thus constituting an archipelago city.

The urban area is made up of three islands parallel to the coast: Sor Island, Saint-Louis Island and Langue de Barbarie.

The land use of Bango is characterized by three (03) dominant entities which are the Prytanée Militaire school of Saint-Louis (600 m from the airport), the Bango military barracks (located

[11] ANSD: Census and Demographic Statistics Division Bureau of Civil Status and Demographic Projections: Demographic Projections of the Population of Senegal 2013-2025

[12] ANSD: Census and Demographic Statistics Division Bureau of Civil Status and Demographic Projections: Demographic Projections of the Population of Senegal 2013-2025

[13] ANSD/SRSD of Saint-Louis : Regional Economic and Social Situation 2013, published in April 2015

[14] ANSD/SRSD of Saint-Louis : Regional Economic and Social Situation 2013, published in April 2015

[15] ANSD: Census and Demographic Statistics Division Bureau of Civil Status and Demographic Projections: Demographic Projections of the Population of Senegal 2013-2025

190 m from the airport) and the Saint-Louis airport, the subject of this study. The latter is based on two (02) land titles (TF132 and TF107).

The problem related to land is real in the project area. Indeed, some dwellings have been identified in the airport right-of-way.

V.8.3. CULTURAL AND TOURIST HERITAGE

The city of Saint-Louis is a European creation, organized from a ship anchored off the coast. The Cape Verde Company, in 1633, established a first trading post for the slave trade. In 1643, this trading post was transferred to the island of *Ndar*, which takes the name of Saint-Louis in homage to the King of France.

It became the seat of the General Council of the colony in 1879 and in 1895, it became the capital of French West Africa (F.W.A.) including Senegal, Sudan, Guinea and Côte d'Ivoire. In 1902, the transfer of the capital of the A.O.F. from Saint-Louis to Dakar marked the end of this beautiful period, which continued until the First World War. The approach of independence completed the city's decline with the definitive transfer of the Senegalese government to Dakar in 1957-1958.[16]

After a first classification in 1976 as a protected area by President L.S. Senghor, the island of Saint-Louis in Senegal was classified as a World Heritage Site by UNESCO in 2000[17].

The river region and the city of Saint-Louis have significant tourist potential. The Senegal River and the areas it crosses offer a wide diversity of landscapes and sites. The natural reserves and national parks (the Langue de Barbarie Park, the Djoudj Park) have a great diversity of wildlife, including birds, and a historical, cultural and natural heritage. All these elements together make Saint-Louis du Sénégal a unique tourist destination.

This more than three centuries old city gradually fell asleep in the 20th century, with the loss of its economic and administrative power leading to the degradation or disappearance of remarkable buildings. Since its classification, the conservation and renovation process has taken on a new dimension.

The local authorities, in this case the Commune of Saint-Louis in collaboration with its partners, have implemented a dynamic policy of heritage protection and plan for the implementation of a Safeguarding and Enhancement Plan.[18]

The rehabilitation of the Saint-Louis airport, which is a built heritage, is in line with the above-mentioned municipal policy.

V.8.4. BASIC INFRASTRUCTURE

V.8.4.1. EDUCATION

[16] http://www.villedesaintlouis.com/patrimoine.php Page consulted on 09/02/2018

[17] http://www.villedesaintlouis.com/patrimoine.php Page consulted on 12/12/2017

[18] ; Page consulted on 12/12/2017

The Saint-Louis Region has 122 pre-schools, 736 elementary schools, 03 technical and vocational training institutions, 149 middle and secondary schools and [19]03 higher education institutions.

The region has a gross pre-school enrolment rate of 7.8% and a gross elementary enrolment rate of 93%, compared to 60% for the average and 21% for general secondary education. Technical and vocational education is still poorly attended with 1,694 students, 45% of whom are girls, and non-formal education has a population of 7,327 learners.[20]

The schools available to the Commune of Saint-Louis are listed in the following table.

Table 19: Schools in the Commune of Saint-Louis

School establishment	Private	Public	Total Total
Nursery/pre-school	44	09	53
Elementary	19	46	65
Average teaching	12	15	27
Secondary education	01	05	06
Professional training	06	03	09

Source: Commune of Saint-Louis

In addition to formal education, Koranic education is very developed in the municipality, in the form of "*Daara*" Koranic schools. However, this model remains very informal so far.

The Bango district, the airport's location area, has 04 schools classified in the following table. It should be noted that there is no school in the vicinity of Saint-Louis airport.

Table 20: Schools in the Bango district

School establishment	Number	Location
Kindergarten	01	Bango
Elementary	02	Bango and sinthian
Average teaching	01	Bango

Source: Commune of Saint-Louis

V.8.4.2. HEALTH

The Saint-Louis Region has 03 hospitals, 07 health centers, 107 health posts and 187 health huts. The Department of Saint-Louis is second only to Podor in terms of health infrastructure. Indeed, 21.38% of the infrastructure is located in the Department of Saint-Louis[21].

By WHO standards, the coverage rates in the region are among the most favorable in the country after Dakar. Indeed, Saint-Louis has one hospital for 308,000 inhabitants (WHO standard = 300 - 150,000 inhabitants), one health center for 185,000 inhabitants (WHO standard = 50,000 inhabitants), one health post for 8,600 inhabitants (WHO standard = 10,000 inhabitants)[22].

The Commune of Saint-Louis has a number of health structures presented in the table below.

[19] ANSD/SRSD de Saint-Louis: Situation Economique et Sociale Régionale 2013, published in April 2015
[20] PRDI Saint-Louis 2013-2017: Perspectives Final version, January 2013
[21] ANSD/SRSD de Saint-Louis: Situation Economique et Sociale Régionale 2013, published in April 2015
[22]PRDI Saint-Louis 2013-2017 : Perspectives Final version January 2013

Table 21: Health structures in the Commune of Saint-Louis

Health structure	Number
Regional Hospital (Level 03)	01
Health Center	01
Health station	10

Source: Commune of Saint-Louis

The Saint-louis airport does not have a health structure (infirmary or dispensary) within its premises. It is located approximately 5.5 km from the Saint-Louis regional hospital.

V.8.4.3. DRINKING WATER SUPPLY AND SANITATION

The Saint-Louis Region has a water access rate of 98.7% in urban areas and 80.1% in rural areas[23].

Drinking water supply in the region is provided by a drinking water supply network, managed by the Regional Hydraulics Division. The Saint-Louis Department is supplied by the *Sénégalaise Des Eaux* (SDE). It registers two (02) drinking water supply networks and three (03) drinking water treatment units. In 2014, the length of the network was 367,391 m with a production of 5,885,741 ^{m3} and a consumption of 5,387,191 m3.

The rate of access to water in urban areas varies according to the different administrative districts and is highest in the Saint-Louis Department, regardless of the type of connection (Private Connection or Borne Fontaine).

The Saint-louis airport is supplied with water by the Senegalese Water Network (SDE).

In terms of sanitation, the delay is still perceptible in both urban areas (63.3%) and rural areas (34.3%). However, major sanitation works have been carried out through PEPAM IDA, including the construction of :

- 9,347 family latrines with hand-washing facilities in more than 400 villages in the region;
- 26 sanitary blocks already received out of the 31 planned at school level;
- 15 schools benefiting from sanitary blocks with drinking water.[24]

Stormwater drainage from Saint-Louis airport is carried out via a functional ONAS drainage network.

V.8.4.4. ENERGY

Electricity consumption in the region increased from 102,592 MWh in 2013 to 112,244 MWh in 2014, an increase of 9%[25]. SENELEC is the main operator and supplier of electricity in the region, via the national grid. Indeed, the Saint-Louis Region has been connected to the national grid since the commissioning of the **Lower Valley Project** with a 30,000 Volt capacity network that runs from Sakal to Aéré Lao.

[23] ANSD/SRSD de Saint-Louis: Situation Economique et Sociale Régionale 2013, published in April 2015

[24] ANSD/SRSD de Saint-Louis: Situation Economique et Sociale Régionale 2013, published in April 2015

[25] ANSD/SRSD de Saint-Louis: Situation Economique et Sociale Régionale 2013, published in April 2015

However, it is worth noting the presence of other operators such as the Senegalese Rural Electrification Agency (ASER) and the Moroccan-Senegalese Electrification Company of Saint-Louis (COMASEL).

The airport's electricity supply is provided by SENELEC. In the event of a failure on the latter's network, emergency power supply is provided at the current airport by a small power plant equipped with two (02) diesel generators.

V.8.4.5. TRANSPORTATION

As part of the urban transportation modernisation programme initiated by the State of Senegal and implemented by the Dakar Executive Council of Urban Transportation (CETUD), the Saint-louis Region now has 105 minibuses operating with seven (07) lines, a total length of 47 km, which primarily serve the university, schools, markets, mosques, health centers and links with Bango and Ngallèle[26].

In addition to these minibuses, the presence of tourist carriages, taxis, fast buses, clandestine vans and horse-drawn vehicles can be noted. However, some boats such as the **Bou El Mougdad** sail on the Senegal River between Saint-Louis and Podor.

The presence of the Saint-Louis airport favors air transportation, even though aircraft and passenger movements have decreased considerably (from 824 to 577 for aircraft and from 14,835 to 2,3290 for passengers).

V.8.5. SOCIO-ECONOMIC ACTIVITIES

V.8.5.1. AGRICULTURE

The Saint-Louis Region has a strong agricultural vocation due to the water and land potential it has, in particular the availability of its irrigable land estimated at 172,800 ha[27].

With the presence of the Senegal River and its tributaries, three types of agriculture are practiced: irrigated agriculture, recession agriculture and rainfed agriculture.

Irrigated agriculture offers a rather varied production with rice as its main speculation, followed by market garden crops such as onions, cabbage, tomatoes, okra, carrots, turnips, peppers, eggplants, corn, etc. Rice cultivation occupies most of the developed areas. It is developed in the riparian areas of the Senegal River and its tributaries, in the Lampsar basins and in the Ndialakhar Valley, while market gardening is practised in all areas.

Recession agriculture is practiced for market gardening along the river and its tributaries during the period of low water generally between October and June.

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[26] http://www.mittd.gouv.sn/fr/content/modernisation-des-transportations-urbains-%C3%A0-saint-louis-le-cetud-introduced-18-new-minibus page consulted on January 19, 2018 at 5:00 pm

[27] PRDI Saint-Louis 2013-2017: Perspectives Final version, January 2013

Rainfed agriculture is more highly rated in the Diéri. The most widely grown crops are mainly groundnuts, millet and cowpeas. These crops are highly dependent on rainfall, which leads to a reduction in cultivated areas, yields and production in the [28]event of a rainfall deficit.

Market gardening is practiced around the Saint-Louis airport with speculations such as onions, cabbage, tomatoes, okra, carrots, turnips, peppers, aubergines, corn, etc.

[28] Final report diagnostic study in the five regions where the Millennium Challenge Account (M.C.A.) projects are implemented Saint-Louis Region February 2009

V.8.5.2. BREEDING

In the Saint-Louis Region, the breeding practiced is of the traditional extensive type, which remains by far the most widespread breeding method, especially in the Diéri and more particularly in the Ferlo. However, semi-extensive experiments have been initiated in Walo following the narrowness of pastures on the one hand and the abundance of agricultural and agro-industrial by-products on the other.[29]

Livestock farming remains the second most important activity after agriculture and occupies an important place in the economic fabric of the area.

In the Department of Saint-louis, the livestock is composed of Cattle, Sheep, Goats, Equines, Asins, Camelins and poultry.

Table 22: Composition of livestock during the 2014 / 2015 season

Cattle	Sheep	Goats	Camels
5483	5809	11222	67

Source: *SES Régionale Saint-Louis 2014, August 2015*

The main constraints of the sector are the lack of productivity in the sector, the persistence of extensive traditional livestock farming, the poor integration between agriculture and livestock, the lack of support infrastructure, difficulties in accessing financing, the lack of capacity of livestock organisations and the lack of investors in poultry farming[30].

V.8.5.3. FISHING

The fishing sector occupies a very important place in the Saint-Louis Region. Indeed, with its 70 km of maritime fringe and its many rivers, this sector is a source of wealth and employment. It contributes to the food supply of coastal populations and generates income for households and public administration.

Two types of fishing are practiced: artisanal maritime fishing in the Atlantic Ocean and inland fishing in the Senegal River and its many tributaries, including Lake Guiers, Taouey, Doué, Ngalenka, etc.

The majority of fishermen are located in the districts of ***Guet Ndar*** located in the center of the Langue de Barbarie and ***Goxu Mbacc***. There is currently no fishing port in Saint-Louis. Landings are made along the banks.

Table 23: Total landings of artisanal fisheries and breakdown of production in 2014

Quantity of fish (kg)	Local consumption (kg)	Mareyage (kg)	Processing (kg)
57 775 000	2 176 050	46 750 100	10 848 650

Source: SES Régionale Saint-Louis 2014, August 2015

[29] Final report diagnostic study in the five regions where the Millennium Challenge Account (M.C.A.) projects are implemented Saint-Louis Region February 2009

[30] PRDI Saint-Louis 2013-2017 : Perspectives Final version January 2013

The local valorization of fish products is carried out by the women processors located in ***Guet Ndar*** and ***Goxu Mbacc***. They face inadequate working and hygiene conditions, lack of space, equipment and modern materials.

The main constraints related to fishing activity are essentially: the reduction of traditional fishing areas exacerbated by the increasing restriction of access to the Mauritanian Exclusive Economic Area (**EEZ)**, difficulties related to the conservation, processing and marketing of fishery products, the lack of infrastructure and equipment for sanitation, the state of insalubrity, insecurity and promiscuity prevail over the current landing sites[31].

No landing sites for fish products have been identified near Saint-Louis airport.

V.8.5.4. CRAFTSMANSHIP

The Saint-Louis Region[32] has about 500 craftsmen and the sector directly and indirectly supports 10,000 people. The production craft industry is the most important trade in terms of quantity (2/3 of the total number of craftsmen).

However, the craft industry represented by 30 out of 111 entrepreneurs appears to be the sector with the highest contribution in terms of turnover, mainly due to the sale of works of art to tourists during the high season and utilitarian objects for the local population.

Crafts are most often practiced in the craft village of Saint-Louis located in the ***Sor*** district and in the ***Khelcom*** art market located in downtown Saint-Louis. The various trades encountered are: wood carving, jewellery, painting, dyeing, sewing/making, hairdressing, carpentry, shoemaking, weaving, etc.

It should be noted that there are artisanal fruit and vegetable processing units and artisanal soap manufacturing units.

The various constraints of the sector are linked to the degradation of the artisanal village and the blatant lack of tourists who no longer come to visit the places.

V.8.5.5. TRADE

Trade in the Saint-louis Region concerns the primary, secondary and tertiary sectors. The primary sector contributes more than 20% to the regional gross local product and employs nearly a quarter of the working population. The secondary sector is dynamic and mainly driven by companies located in the region (CSS, SOCAS, GDS, etc.). Next to it, small units thrive that are active in the agri-food sector. The tertiary sector refers to all that is trade in services (banking, insurance, trade in goods and services...). It is based on informal trade and formal trade.

[31] Commune of Saint-Louis Sectoral feasibility - Fishing Feasibility study and environmental and social impact study of the tourism development project in the Saint-Louis Region November 2010
32 Commune of Saint-Louis Sectoral feasibility study and environmental and social impact study of the tourism development project in the Saint-Louis Region November 2010

The number of shops registered in the region is 1,500, or 95% of the commercial companies surveyed. There are 15 permanent markets and 21 weekly markets, the Department of Saint-Louis has 04 permanent markets and 02 weekly markets. The products found on the market are the basic necessities, namely local unscented rice, oil (in barrels, bottles and sachets), sugar, milk, potatoes, tomatoes, gas, etc.[33]

There is no permanent or weekly market near the Saint-Louis airport.

[33] ANSD/SRSD of Saint-Louis: Regional Economic and Social Situation 2013, published in April 2015

VI. ANALYSIS OF VARIANTS

VI.1. METHODOLOGY

The variant analysis is a chapter of the ESIA that allows comparisons to be made between different technological options and the potential for development of facilities within the land right-of-way, in order to provide the best possible option. This chapter also examines the "no project" option, which provides the rationale for the project's rationale.

This analysis, based on the advantages and disadvantages of each option studied, will optimize the promoter's choices in terms of safety, economic, social and environmental aspects.

To do this, the analysis of the variants was carried out for the following topics:

- the “no project” option;
- the demolition variants of existing structures;
- the refuelling variants;
- the variants of the runway extension.

The site variants for this project have not been studied insofar as the project concerns the rehabilitation of the Saint-Louis airport, the right-of-way of which is already clearly defined.

VI.2. THE « NO PROJECT » OPTION

One of the first options that frame the project is the “no project” option. This option will not make it possible to achieve the objectives of the Emerging Senegal Plan, which aims to make the country a regional air transportation hub by focusing on three (03) pillars: the commissioning of Blaise Diagne International Airport (effective since 07 December 2017), the start of the national fleet's activities under the supervision of Air Sénégal SA and the rehabilitation of airports. If this last pillar is not achieved, this flagship PES project will not be effective.

Moreover, not to carry out such a project is equivalent to maintaining the isolation of inland regions and the low level of domestic air transportation traffic, which will result in a reduction of the country's connectivity and interregional trade.

From an environmental point of view, the option not to carry out the project would avoid all the negative impacts associated with airport rehabilitation work and operations. No pollution or nuisance would therefore be generated and the mangrove swamp that protects the coastline from waves and wind and water erosion will be preserved.

The situation of the receiving environment will be under the sole influence of its usual management method. However, the purpose of this study is to demonstrate that with the rehabilitation work, no significant changes will be noted in the environmental characteristics of the study area.

From a socio-economic point of view, not carrying out such a project would mean compromising the economic development of the areas concerned by the loss of business opportunities (commercial activities) around the site induced by the demolition work, reconstruction and airport operations.

In addition, employment opportunities for workers in the area will be lost as well as this additional opportunity to develop expertise and train the local workforce through technology transfer.

On the basis of this analysis, the airport rehabilitation project is essential to enable air transportation to be optimised by bringing them up to standard.

VI.3. FUELLING TECHNIQUES

Fuelling of aircraft includes all delivery operations aimed at filling the tanks of an aircraft with the quantities and qualities of fuel requested by the aircraft operator[34].
For this project, the analysis focused on the two (02) most common refuelling techniques.
A first technique is carried out at airports equipped with a pressurized fuel distribution network with pressure taps located near aircraft parking areas (tarmac). According to this refuelling technique, trucks, known as oleoservers, are used to transfer fuel under pressure into aircraft tanks.

Photo 11: Image of an oleoserver

Source: Titan Aviation official website

The second and most common refuelling technique concerns all airports that do not have a pressurised fuel distribution network. This second technique consists of using tank trucks, called "bunkers".

The latter must travel between the airport depot used to store hydrocarbons, near the terminal, and the aircraft parking areas.

Photo 12: Image of a bar feeder

[34] Definition of the **Order of 23 January 1980 on precautions to be taken for the refuelling of aircraft at aerodromes:** Consolidated version as at 17 January 2008

Source: Titan Aviation official website

The table below is a summary of the advantages and disadvantages of the two refuelling techniques mentioned above.

Table 24: Advantages and disadvantages of refuelling techniques

Fuelling technology	**Advantages**	**Disadvantages**
Fuelling with distribution network	Use of oleoservers Equipped with control systems, valves, hoses, lifting platform, etc. High flow rate up to 250 m3/h; Quick filling of the aircraft tank; Good conservation of fuel properties Easy transfer.	Requires the installation of an underground network under fuel pressure; The oleoserver motor remains in operation for the duration of the refuelling; Many energy losses; Complex and sophisticated machines; Risk of accidents; Possibility of hydrocarbon leaks in the underground pipelines of the network.
Fuelling without a distribution network	Use of bar feeders with a large capacity tank; Does not require the installation of an underground distribution network; No risk of subsoil pollution; Engine shutdown during refuelling time; Easy maintenance; High flow rate up to 250 m3/h;	Large-sized machines; Transportation of large quantities of hydrocarbons; Risk of accidents.

Fuelling technology	Advantages	Disadvantages
	Quick filling of the aircraft tank.	

- **Conclusion on the selected alternative**

The comparative analysis of the two refuelling techniques shows that the one without a distribution network is the optimal option because the risks of underground pollution are lower. In addition, the vehicle used is simpler to use, easier to maintain and saves energy when transferring fuel from the vehicle to the aircraft.

VI.4. DESTRUCTURING OPTIONS FOR EXISTING BUILDINGS

Rehabilitation work will begin with the demolition of existing structures. For the Saint-Louis airport, this demolition will involve the passenger terminal, the power station, the fire hangar and the complex consisting of the control tower and the technical unit.

Thus, demolition is partial and in this case, it is important to take measures to preserve and protect the part of the construction to be saved.

Before starting work, it is essential to carry out a complete and thorough examination of the building to be demolished, as well as the structures and sites adjacent to it. This preliminary study stage is not an insignificant one and requires time; it requires sufficient time and resources to be provided for its implementation.

In addition to diagnosing the structures to be demolished, this study makes it possible to define the types of waste produced, quantify them and propose a recovery and disposal process for each type of waste.

Following this phase, the contracting authority can define the most appropriate demolition method that integrates both the economic aspect and good control of nuisances and risks.

Thus, several techniques can be used to carry out this destructuring phase. As part of this project, we analyzed three techniques: mechanical deconstruction, cutting demolition and explosive demolition.

The table below highlights the advantages and disadvantages of each of these techniques.

Table 25: Advantages and disadvantages of demolition alternatives

Destructuring variant	Advantages	Disadvantages
Demolition by explosives	Reduced intervention times; Limitation of the impact area of the materials; Possibilities to orient the fall of the building; Efficient and economical technique.	Requires in-depth technical know-how and a great knowledge of structures; Requires specific organizational and security rigour; Increased risk of material spills, landslides, collapses and fires; Waste is mixed and sorting is difficult; Produces a lot of dust and noise and vibration pollution.

Destructuring variant	Advantages	Disadvantages
Demolition by cutting	Precision of the cuts ; Absence of shocks; No vibration; Safety of implementation; Allows access to difficult areas; Preferable technique in case of partial demolition.	Expensive equipment (diamond tools and concretion tools, thermal, electric or hydraulic saws, torches); High noise level ; Need to use experienced staff; Smoke emissions (cutting by torches).
Mechanical deconstruction	Possibility of selective sorting of material waste; Possibility of using a new generation mechanical excavator with misting system; Allows water to be injected just before the concrete cracking for dust collection; Noise pollution reduced by the use of crunchers instead of rock breakers.	Requires a careful analysis of the building; Meticulous, complex and technical work, Its implementation requires more time.

- **Conclusion on the selected alternative**

The analysis of the table shows that deconstruction is the best method of demolition because it makes it possible to combine increased safety with the control of noise and vibration pollution. This option thus makes it possible to preserve the safety of buildings that are not concerned and people working around the airport demolition site.

Photo 13: Deconstruction by mechanical shovel

Source: www.sned.fr

This deconstruction makes it possible to separate the different categories of materials, remove hazardous waste and recover certain elements. Moreover, in this approach, the buildings to be demolished are not considered as future waste but as resources of materials to be recovered. The ultimate objective is to reduce the quantities of waste produced at source and to promote its recovery and recycling in order to limit landfilling.

VI.5. TRACK EXTENSION VARIANTS

The Saint Louis Airport rehabilitation project essentially consists of an extension of the movement areas and in particular the runway, which corresponds to a rectangular area designed to be used for aircraft take-off and landing. The runway of an airport is generally oriented in the direction of the prevailing wind direction, so the current orientation (NNW-SSE) of the runway will not be analyzed. In the following, we will examine the impacts related to the extension of the 600 m long runway to the north or south.

VI.5.1. EXTENSION OF THE RUNWAY TO THE SOUTH

The analysis of the indirect area of influence of the project reveals the dwellings in the Khar Yalla district located 11 m from the site boundary and the N2 national road at 186 m, as shown in the land use map of the project areas of influence (see maps 3 and 04, pages 110 and 111).
The extension of the runway in this direction by 600 m will not only impact the N2 national road but also and above all a large part of Khar Yalla's houses located on the extension of the runway.
Thus, the disruption of road infrastructure will inevitably lead to a deviation of the latter with all the environmental and social impacts that will result (loss of land and housing, traffic disruption, etc.).
In addition, the populations of the Khar Yalla district will have to be cared for through the implementation of a RAP.
This variant will thus generate potential negative environmental and social impacts. From an economic point of view, it is very expensive because it includes the costs of rebuilding the road and those related to the development and implementation of the RAP.

VI.5.2. EXTENSION OF THE RUNWAY TO THE NORTH

The analysis of the indirect area of influence of the project shows that the airport is limited to the north by the Senegal River branch and the Senegal-Mauritanian border. This northern boundary is marked by the presence of sensitive natural elements, particularly mangroves.

The extension of the runway in this direction will bring the airport's boundaries closer to the river arm and the runway installation work will impact these sensitive ecosystems. From an environmental point of view, this swampy area is made up of a mangrove ecosystem that serves as a refuge for wildlife and avifauna, and the work of installing the track and building the fence wall will result in the disturbance of wildlife species.

However, from a social point of view, this option is the least restrictive because it does not require the displacement of populations.

- **Conclusion on the selected alternative**

Following this analysis, it appears that the extension of the runway to the north, despite its significant environmental impacts, is the most advantageous option for local populations, who will not be displaced but will also be the least expensive. All necessary measures should then be taken to minimise the impacts on the above ecosystems.

VII. PUBLIC CONSULTATION AND INFORMATION DISSEMINATION

VII.1. INTRODUCTION

Public consultation is a constituent element of the environmental impact assessment. It promotes the free expression of the perception of a project by representatives of all categories of stakeholders (administrative authorities, state technical services, local populations).

Indeed, it is a regulatory process, set out in the Environmental Code by Ministerial Decree No.° 9468 MJEHP-DEEC of 28 November 2001 regulating public participation in environmental impact assessment. This communication exercise allows fro the assessment of the level of acceptance of the project by the stakeholders, which corresponds to its socio-institutional validation.

The objectives of the public consultation are essentially:

- to inform stakeholders about the project to rehabilitate Senegal's airports;
- to gather their opinions and concerns in relation to the components, objectives, issues and priorities of the project;
- to collect the recommendations of the stakeholders met, the application of which will improve the viability of the project in its host environment;
- to collect updated data on the locality, department and region from the technical services of the State and local authorities, which will make it possible to understand the initial situation in the project area.

VII.2. METHODOLOGY ADOPTED

In order to achieve the objectives set, the methodology used proposes the following phases:

- identification and contact with the various stakeholders, through written correspondence. These provide general information on the start of the project's ESIA and include a summary project description and a site location map. At the same time, a request for a meeting is specified in the letter;
- the organization of meetings with the targeted actors, the objectives of which are to better address the project and place it in its context. These meetings also make it possible to identify the economic, social and environmental impacts of the project and to initiate the necessary reflections in order to propose appropriate solutions;
- the development of the public consultation report that will provide the promoter and decision-makers with a better understanding of stakeholders' views on the project in order to take them into account as the project progresses.

VII.3. SCHEDULE FOR CARRYING OUT PUBLIC CONSULTATIONS

The public consultations were conducted in three (03) phases, which are:

- the preparation and filing of preliminary newsletters and appointments;
- meetings with the various targeted stakeholders;
- the drafting of the reports of the exchanges made during the public consultations.

These steps lead to the drafting of the chapter on public consultation.

VII.4. IDENTIFICATION OF STAKEHOLDERS

At the national level

At the national level, the following structures were encountered:

- Senegalese Airports Authority (ADS);
- Blaise Diagne International Airport (AIBD);
- National Agency for Spatial Planning (ANAT);
- Airport Infrastructure Branch ;
- High Authority of Senegalese Airports (HAAS)
- Civil Protection Directorate (DPC);
- Agency for the Safety of Air Navigation in Africa and Madagascar (ASECNA);
- National Agency for Civil Aviation and Meteorology (ANACIM);
- General Directorate of National Security (DGSN);
- General Customs Directorate (DGD);
- National Police;
- SMCADY.

In the private sector, we have identified the following stakeholders.

- SONATEL ;
- TIGO ;
- EXPRESSO ;
- AGEROUTE ;
- EDS ;
- SONES ;
- SENELEC ;
- ONAS.

At the regional and departmental level

Administrative authorities

- Governor of the Saint-Louis Region;
- Prefect of Saint-Louis;
- Saint-Louis Departmental Council.

Deconcentrated technical services of the State

- DREEC of Saint-Louis;
- Regional Water and Forest Inspection of Saint-Louis;
- Regional Labor and Social Security Inspectorate of Saint-Louis;
- Regional Sanitation Service of Saint-Louis;
- Regional Hygiene Service of Saint-Louis;
- Regional Directorate of Rural Development of Saint-Louis;
- Regional Hydraulics Division of Saint-Louis;
- Regional Urban Planning Department of Saint-Louis;
- Regional Livestock Service of Saint-Louis;

- Saint-Louis Land Registry Office;
- Regional Service for Spatial Planning of Saint-Louis;
- Regional Planning Service of Saint-Louis;
- Regional Service of Statistics and Demography of Saint-Louis;
- Fire and Rescue Company (fire brigade) of Saint-Louis.

At the local level

The authorities concerned by this consultation are:

- Municipality of Saint-Louis;
- Commander of Saint-Louis Airport;
- Regional Development Agency of Saint-Louis;
- Support Center for Local Development in Saint-Louis.

The populations of the districts listed below were also met:

- Khor Usine district;
- Khar Yalla district;
- Ngallèle district;
- Bango district.

VII.5. RESULTS OF THE PUBLIC CONSULTATIONS

Following public consultations with stakeholders, the results obtained are expressed in terms of criteria, acceptability, formulation of fears, concerns and strong recommendations.

VII.5.1. PERCEPTION OF THE PROJECT BY ADMINISTRATIVE AUTHORITIES, LOCAL ELECTED OFFICIALS AND DECENTRALIZED TECHNICAL SERVICES OF THE STATE

The administrative authorities and local elected officials and technical services in the Saint-Louis region have all welcomed the project, which they consider beneficial in that it revitalizes air services to the region and encourages the development of tourism initiatives in the context of hydrocarbon discoveries.

However, since the airport areas concerned are ASECNA land titles, the stakeholders raised expressed their concerns about the safety of local populations living irregularly in part of the airport right-of-way.

It was also pointed out that there is a risk of encroachment on Mauritanian territory during aircraft movements as the runway will be partially extended to the north.

In addition, the existence of potential nuisances in connection with the works was mentioned. The nuisances feared during airport demolition and reconstruction work consist of dust emissions, noise generated by various machines and vehicles and risks associated with the work.

The results of these public consultations are presented in the following table.

Table 26: Results of consultations with administrative authorities, local elected officials and technical services in Saint-Louis

Stakeholders Consulted	Opinions, fears	Recommendations for action
GOVERNANCE	- This serendipitous project will allow the destination of Saint-Louis to be reopened by air. - The airport is in a bad state with a drastic drop in traffic - The airport's right-of-way is squarely occupied by populations exposed to the risks of accidents and noise pollution - With the erection of the fence wall, this project will eliminate this security concern - An airport must be in an environment isolated from dwellings with a safety margin for the population - There is an Airport Security Committee chaired by the Governor, which conducts regular inspections of the airport, identifies hazards and makes recommendations.	- Relocate the populations that occupy the airport's right-of-way - Take into account the security of the military camp - Define a security perimeter around the airport to protect people and avoid accidents - Build a social project to identify all the impacts and find a relocation site
PREFECTURE	- This project to bring the airport up to standard will increase air traffic for the benefit of the region's various economic and tourist activities. - There are a lot of rambling animals in the airport - The airport has several land titles - ADS was seized several times in relation to the irregular occupation of the airport right-of-way and reports on the status of uncontrolled occupations of the airport rights-of-way provided	- Safeguard the space that is being attacked by populations - Collaborate with the Domains Department to take stock of the situation regarding the occupation of the airport's right-of-way by the population - Consult the gendarmerie regarding territorial security
COUNCIL DEPARTMENTAL	- The current runway is too small and winds are strong in places - The extension is the solution to accommodate large aircraft - Saint-Louis has opportunities to offer in terms of tourism - Large vegetable companies in the region will be able to take advantage of this project to export their goods more easily - This project generates tax revenue for the Department - This project could be profitable for gas exploitation	- In the event of displacement, relocate the affected populations - The Commune of Saint-Louis no longer has any land resources, negotiate with the authorities of Gandon or Diama for the granting of land in the event of the relocation of populations - Maintain a good relationship with the Mauritanian State because, in the event of a conflict, the airport's activities could suffer

	- It is planned to replace the Rosso ferryboat with a bridge; this will facilitate access and attract passengers to Saint-Louis airport. - This airport rehabilitation project could encroach on the mangrove swamp - The area is entirely inhabited, the airport's activities will cause inconvenience to the populations - There is a risk of encroachment on Mauritanian territory at the time of take-off or landing of aircraft	
DREEC	- This project will boost the region's tourism sector and develop the city's attraction. - Possibility of developing income-generating activities, direct and indirect job creation - There are irregular occupations in Bango within the airport right-of-way - There was a complaint filed by the Airport Director to clear the occupied right-of-way - Sanitation problems in Bango	- Identify and delimit the airport's right-of-way - Make a RAP or accompanying measures in case of population displacement - Collect the opinions of the populations living around the airport - Identify habitat types adapted to the environment - Supervise breeders to avoid the divagation of animals - Establish a good waste management system to avoid the proliferation of birds that could affect airport operations - Preserve the ecosystem in the area - Establish an early warning system to respond effectively and quickly in the event of an accident - Report all classified facilities - Perform fuel tank testing tests - Identify all facilities classified in the study; - Establish the baseline health situation to see the epidemiological profile of the area and anticipate the probable diseases likely to be caused by the airport's activities - Assess air quality - Assess the impact of noise on wildlife
IREF	- Risk of generating impacts on fauna and flora - Risk of wildlife migration due to noise generated by the activity - Impact on mangroves and slaughter of many prosopis resulting in habitat disruption - No fully protected species in the area except mangroves - Site adjacent to a water body	- Preserve and maintain the mangrove swamp to protect the structures against salt - Replace the species found on site and better replant the area - Conserve habitat to avoid bird loss - Avoid changing the vegetation cover - Consider compensatory reforestation in the mangrove swamp to prevent erosion and the spread of the barbaric tongue

		- Notify the Water and Forestry Department before the start of the work site to take an inventory in order to set logging taxes - Plan the budget allocated to slaughter taxes in the project - Propose compensation measures for orchards to be destroyed
SRA AND HYDRAULICS	- Bango's water supply is about 1 km from the airport - The groundwater is superficial and at a depth of about 2 m - Only the cities of Saint-Louis and Richard-Toll have wastewater systems and the connection rate is low - Most concessions have drainable pits or direct infiltration pits - The airport cannot connect to the ONAS network for the moment because the latter is undersized with a bad slope	- Avoid polluting the groundwater that is superficial and supplies the Bango reserve - Install a piezometer to periodically check the condition of the slick - Meet with the SDE for the existence of an underground network that would cross the vicinity of the airport - Set up a drinking water treatment unit, draw raw water from the Bango reserve and treat it or have a large water reserve supplied by the SDE to guarantee the airport's water autonomy - Prefer latrines with watertight pits because the groundwater is superficial - Collect rainwater and discharge it into the river because it is not normally loaded - Set up a recovery basin for contaminated wastewater - Contract with an approved service provider for the periodic disposal of contaminated wastewater - Ideally, install a wastewater pretreatment plant
SRAT	- The project will transform the face of the city of Saint-Louis - There is enormous land pressure in Bango - The land assigned to the airport is a land title - There are orchards located within the airport right-of-way - Farmers encroach on the airport's right-of-way to feed their livestock - The Khar Yalla district, 90% of which is inhabited, is part of the airport's right-of-way - In perspective, this project will promote human settlement in the vicinity of the airport	- Take into account the cemeteries that are within the airport's control; in the event of relocation, consult the population and propose compensatory measures - Plan actions to take better account of mangroves in the project activities - Enforce architectural standards in the vicinity of the airport - Develop a small area in the vicinity of the airport for the benefit of livestock producers encroaching on the airport
URBANISM	- This project is important for the State - Given the different development perspectives underway, this project will be beneficial for Saint-Louis - The land is privately owned by ASECNA	- Ensure that construction methods are respected - Avoid high-rise buildings in the vicinity of the airport

	- Bango is being densely occupied - The occupation of the flight cone by the populations of Khar Yalla is a problem - Dislodging these populations will be a burden for the project and will pose a social problem	
DRDR	- Facilitation of fruit and vegetable exports - Existence of many orchards and hen houses in the project area	- Discuss with the owners of the plots to be decommissioned and compensate them - Take into account the risks associated with the work
FIRE BRIGADE	- This project is to the great benefit of the population - The fence wall of the current airport is destroyed in places - The fire hydrant is not functional - Water autonomy in case of fire is lacking	- Take into account the risks of fire and panic - Install at least 4 fire hydrants around the Tarmac - Install fire extinguishers appropriate to each type of risk - Provide emergency lighting to safely evacuate people in the event of fire and panic - Install a fire safety system to ensure compartmentalization in the event of a fire - Collaborate with the BNSP firefighters within the framework of the ISS - Set up general and selective alarms - Define a gathering point for people in case of panic; Make a POI for the fuel storage area - Isolate the part used by the public from premises at particular risk
OHR	- There are strict health controls to be carried out at all borders - There is no regulatory garbage dump in the city - Due to a lack of staff, the BRH does not intervene for health control at the airport level, but this is necessary	- Support the airport in the management of household waste - Install a hygiene antenna in the airport for the sanitary control of travellers as well as products in case of freight
ARD	- This project is a development opportunity for the region - This project will have a fairly broad economic impact - All works related to the airport's activities will have an impact on road infrastructure	- Raise awareness of the project and its impacts - Supporting populations to adapt to new labor market offers
IHHROS	- This project will create jobs	- Declare the parent company and temporary workers at the IHRTS level - Recruitment in accordance with the provisions of the Labor Code - Do not make daily workers work more than five days a week - Give a daily pay slip to each daily worker

		- Have employees undergo the medical fitness check-up and the annual medical check-up - Affiliate workers with the CSS, IPRES and IPM - Give priority to hiring the local population - Establish a safety register on the site - Provide employees with PPE adapted to each workstation - Establish a safety plan and a traffic plan during the construction phase - Submit the safety plan and the traffic plan within the IWHSSR - Elect an employee delegate with more than 10 employees - Set up a HSC with more than 50 employees - Implement an HIV policy and facilitate talks aimed at preventing certain diseases - Putting a medicine box in

VII.5.2. PERCEPTION OF THE PROJECT BY THE STRUCTURES ENCOUNTERED AT THE NATIONAL LEVEL

The categories of actors working in several sectors, in particular the aeronautics sector and the representatives of the concessionaires, were met and gave their opinions and concerns on the project.

In essence, they highlighted the existence of constraints related to the different phases of airport upgrading: demolition, construction, equipment and operation and made recommendations to the promoter and also to the airport operator.

In addition, they believe that the advent of renovated airports will generate new economic activities around these infrastructures: various shops, passenger transportation services from the airport to their final destinations, service opportunities for the maintenance of premises, the removal of solid and liquid waste.

The table is a summary of the exchanges made with national entities based in Dakar.

Table 27: Results of consultations at the national level

Entities	Opinions, fears	Recommendations for action
ADS	• ADS does not question the project in its principle of upgrading airports, which is a strong recommendation of IATA; • Some airports receive direct flights from Europe and elsewhere, which forces them to be built to the highest standards of safety and security in air navigation: Cap Skiring, Saint-Louis, Ziguinchor ; • It would be wise for Cap-Skiring, which is more frequented than Saint-Louis, Matam and Kédougou, to benefit from this project and to be modernized and better equipped; • Similarly, Kolda receives more traffic than Tamba and Kédougou; • The Ziguinchor airport brings in the most economic benefits, given that it is the main airport (AIBD) that supports the airports; • For Saint-Louis, it would be interesting to develop the freight aspect; • The upgrade will provide each airport with a control tower and modern navigation aids; • At airports, there is an animal hazard control service and a Fire and Rescue Service (SSLI); • The management of an airport to standards is expensive because of incompressible expenses (water, energy, security, equipment maintenance, etc.); • It is important to highlight the versatile nature of Ziguinchor airport, which is both civilian and military, and to specify where military aircraft will land when the work is carried out.	• Establish a consultation between the Promoter TRANSCON and the ADS for the follow-up of airport rehabilitation works; • Take into account the training of personnel who must manage these airports; • Provide for duplicate equipment so that in case of malfunction the second one takes over; • See the possibilities of maintaining part of the runway during the work and define specific landing procedures under work conditions.

ANACIM	• The project responds to an old ASECNA recommendation that airports be renovated and brought up to ICAO and IATA standards; • Faced with the obligation to make weather data available in real time, airports will have to be equipped with the most modern means of communication.	• Build new infrastructure at each airport; • Provide premises for measuring devices and ANACIM agents; • Relocate old weather stations if necessary; • Distribute the new GIS coordinates of the weather stations • Centralize the data collected continuously/stations; • Provide modern SAOMA-type equipment in airports; • Rehabilitated airports should be equipped with the most modern means of communication. ADIE and ANACIM have a common project in this direction.
CPD	• The widening of the runways will ensure the safety of aircraft during take-off and landing; • Airport security is managed by ASECNA; • ASECNA fire brigades are in charge of fire safety inside airports, the state fire brigades come in as reinforcements if necessary; • There is a memorandum of understanding between ASECNA and the DPC for mutual assistance in the event of a fire or accident; • Aircraft fires are difficult to control, but fortunately Senegal has only recorded a few very rare cases of aircraft accidents; • ASECNA firefighters specialize in aircraft fires; • ASECNA has all the necessary provisions to ensure fire safety; • The ERP regulations are a reference document for the calculation of decommitments (Decree 5945 of 14 May 1969 establishing safety rules against the risks of fire and panic in ERP systems).	• Fence airports and put deterrent mechanisms above fences (barbed wire, glass shards, etc.); • Limit breaches to avoid animal divagation and brush at airports; • Put surveillance cameras on the facades in front of the aircraft parking air; • Strengthen security and vigilance around airports; • Place the fuel tanks on a reinforced concrete watertight retention that can contain the entire stored product; • Install fire hydrants at the expense of fire hydrants that are likely to be buried by sand; • Install RIAs, cooling rings, multi-purpose powder extinguishing media, as other means of firefighting; • Set up general and selective alarms; • Do not align more than 25 consecutive chairs without overlap in waiting rooms; • Arrange exits according to the number of people likely to frequent the area; • Make sure that the doors open from the outside (article 50 of decree 5945 of 14 May 1969) for a room that must contain more than 50 people.

AIBD	• The most commonly monitored environmental parameters are noise, air quality, water, energy and waste management; • Air quality influenced by air traffic flows, the high frequency of traffic of vehicles and machines of all kinds serving the airport area, • Water quality and energy are the subject of an option to empower the airport; • AIBD has a functional WWTP for wastewater management; • AIBD is linked to the National Parks Directorate for optimal management of biodiversity, which is achieved through the preservation of indigenous plant and animal (bird) species; • The airport right-of-way cannot be fenced (4500 ha) for the moment but the limits are monitored by the gendarmerie and the DESCOS with whom AIBD collaborates; • To assess its level of compliance with the ESMP, it is essential to conduct regular internal audits; • On the social side, very important communication is required.	• Compensate for vegetation losses through reforestation campaigns; • Take into account the monitoring of birds in the context of the control of avian risk; • Create a framework for functional consultation between airport managers, local populations, administrative and local authorities, certain technical services; • Work with the Airport Operations Branch to reframe the replicability of environmental compliance practices in airport terminals; • Establish community relays within the population for permanent two-way communication.
HAAS	• This project is a good initiative; • Blaise Diagne International Airport (Blaise Diagne International Airport (BIA) is the only airport that meets international standards; • The main objective of HAAS is to ensure airport security by ensuring the protection of aircraft and passengers; • According to HAAS, Cap Skirring airport should be the priority because it receives international flights while Ziguinchor airport receives domestic flights; • There are manuals explaining the specific materials to be used in the construction of the various compartments of an airport; • The National Agency of Civil Aviation and Metrology (ANACIM) deals with all questions concerning safety distances with the populations, construction and safety standards;	• Involve HAAS in the implementation of the project; • Discuss safety terms before construction begins; • Comply with Senegalese standards for the construction and equipment of airports; • Require HAAS approval of construction plans; • Install a fence wall with a standard height and topped with barbed wire; • Separate "departure" and "arrival" flows in airports; • Contact ANACIM for a list of approved equipment; • Have all equipment validated by ANACIM and the Senegalese Radiation Protection and Nuclear Safety Authority (ARSN); • Prefer the installation of the VOR guidance system indoors rather than outdoors for safety reasons and discuss it with ANACIM;

	• HAAS' involvement in airport management is related to everything related to security, especially at departure and also to the devices to be installed in the passenger circuit (up to access to the aircraft in compliance with all the rules).	• Ensure that each structure (police, gendarmerie, customs, health service) has premises within the airports; • Implement preventive measures against terrorism (speed bumps, check points, inspections, internal and external rounds, etc.); • Allow HAAS to carry out verification visits to rehabilitated sites before opening.
DPAF	• This project will make the areas concerned viable and will have a positive impact on tourism and economic activities; • At these airports, the DPAF mainly provides border police and immigration control and ensures compliance with security standards; • Control will be increased and modernised at airports and border surveillance strengthened; • The air police are not permanently present at these airports, but work in collaboration with the police station attached to the local community concerned; • Notified by the Airport Commander, the Head of Post sends elements in case of flight (landing or take-off) to ensure security and control operations.	• Take into account the airport's proximity to the market at Kédougou airport (gold area); • Establish modern infrastructures that meet international standards; • Ensure that the fence wall is brought up to standard to avoid frequent divagation of animals; • Take into account the proximity of Saint-Louis airport to the homes and the regional hospital in the event of an extension; • Take into account the extension possibilities that are often made at the terminal level; • Provide on-call accommodation for the police.
CUSTOMS	• An airport without customs service cannot be considered international; • Customs controls the people and goods that must be safe and well supervised; • The rehabilitation of Ourossogui airport will allow the development of traffic, especially with immigrants from the area; • Cap Skirring also receives a lot of traffic and should benefit from the rehabilitation; • All appropriate measures must be taken to ensure that the upgrading of these airports integrates customs formalities into a	• Take into account Customs' concerns before carrying out the work • Provide customs facilities both on arrival and departure of flights at all airports; • Provide on-call accommodation for night flights • Take into account the freight circuit to be secured and set up warehouses for its storage; • Emphasize the principle of standardization of infrastructures, distribution of premises and equipment to be set up.

	strategic position that makes it possible to mark out the entire airport; • It is desirable to provide the floor plans of the spaces to be built in order to determine the positions (orientations) of the premises allocated to Customs.	• Take into account the possibility of establishing them as international airports as soon as the volume of traffic and services justify this status.
SMCADY	• The airport designation cannot be validated without a kerosene trade; • The availability of this fuel in sufficient quantity is an obligation for an airport; • This requires storage in tanks, generally with large capacities near the runways, of the quantities of fuel to be transhipped to the requesting aircraft manufacturers; • These quantities and fuel types (AVGAS and kerosene) are dependent on: o the frequency of air traffic to be served, o the nature of the aircraft serving the route, o the nature of the fuel required. • The other airports will have well-dimensioned storage facilities or be supplied on demand according to the flights scheduled; • International inspections are the responsibility of civil aviation institutions to comply with JIG Standards, IATA and major fuel airlines; • SMCADY has maintained its performance by obtaining a GOOD rating on all these inspections.	• Carry out the adequate sizing of the fuel stocks necessary for the airports to be rehabilitated according to needs and avoid large capacity storage if it is not necessary; • Comply strictly with the checklist of procedures for controlling the quality of fuel deposited in storage tanks; • Carry out regular quality inspections of installations (subject to frequent safety-inspections) on an unannounced and scheduled basis.
	• During earthworks, there may be competition between the company in charge of the rehabilitation works and AGEROUTE, in particular for the supply of backfill materials (sand, laterite, etc.) in the quarries; • Misunderstandings could arise as to who is responsible for restoring quarries at the end of the work;	• Create a consultation framework between the project owner of the rehabilitation works and AGEROUTE; • Comply with weight, gauge and axle load standards; • Communicate on the period of equipment transfer and the planned route for vehicles and take into account traffic disruptions;

AGEROUTE	• The classified road network has a load capacity (weight, gauge) that must be respected to maintain roads in good condition. • Regulation No. 14/2005/CM/UEMOA for heavy vehicles for the transportation of construction equipment and materials is the reference document in this field.	• Ensure the maintenance of damaged roads and approach AGEROUTE in case of intervention on the classified network; • Consider cumulative impacts and propose mitigation measures to minimize the impacts related to its work; • Tie up trucks when supplying construction sites with construction materials to mitigate impacts on air quality; • Set up continuous air quality measurement systems for effective monitoring of physico-chemical air parameters in real time at each airport.
EDS	• The airports of Saint-Louis, Ziguinchor, Tambacounda and Kédougou are served by the EDS networks of the localities concerned; • It should be noted that the airport has a private network and the SDE meter is located at the entrance; • Matam airport is served by the local ASUFOR; • Airport reconstruction projects will be supplied with water from the EDS network except in the case of Ourossogui; • In Saint-Louis, the site could be supplied with water from a direct withdrawal from the Bango reserve after an agreement contract with OLAG. • This approach will reduce the pressure on the drinking water resource; • It is important to install a water storage device for autonomy in the event of a power failure; • This device is sized according to daily needs; • Some equipment is remotely managed and there are possibilities of interference.	• Set up a water storage device equipped with a booster for an autonomy of 3 to 4 days; • Choose water-saving equipment and regularly monitor their consumption to detect any discrepancies; • Avoid the proximity of the SDE connection to the ONAS network if it exists because the latter could contaminate the SDE pipes in the event of a defect and install a non-return valve at the entrance to the airport's private network; • Disinfect the network set up in airports before it is put into service with concentrated bleach; • Avoid draining used oil from construction machinery and vehicles on site (liquid waste); • Prevent noise pollution by prohibiting night work; • Regularly water all around the perimeters of buildings during their demolition; • Take into account air pollution and cover trucks transportationing construction materials; • Prohibit the use of rubble for wetland backfilling (solid waste).

		• Avoid a frequency conflict between airport equipment and the remote management system of SDE facilities by approaching ARMP.
ONAS	• It is essential to decide on the provisions adopted for the evacuation of rainwater in the perimeters of airports; • Poor water management can cause damage to the ecosystem; • The existing sewerage network is very far from the airport for Ziguinchor, Tambacounda and Kédougou; • For Saint-Louis and Ziguinchor the network is more or less distant but connection possibilities exist; • For Matam, there is a draft Master Sanitation Plan • The modalities of collaboration may be defined within the framework of a protocol signed with ONAS.	• Establish a stormwater drainage network and define a discharge point; • Estimate liquid discharge rates and see opportunities to connect to the local network for Saint-Louis and Ziguinchor airports; • Ensure that there are no oils or hydrocarbons in the liquid waste to be discharged into the system; • Implement a wastewater treatment system for other airports; • Characterize and estimate the daily flows for the proper sizing of the treatment system.
SONES	• Physical and biophysical environmental aspects must be taken into account in the study; • In Ziguinchor the airport is very close to the people; • It is necessary to specify whether the airport will close during the work or continue to receive flights; • For water supply, the river can be the solution.	• Involve the populations in the process and establish permanent communication during the work; • Take dust emissions into account during construction and propose effective mitigation measures; • See the possibilities to connect to the SONES network for water supply; • Approach the Office du Lac de Guiers (OLAG) in case of a stitching on the river.

SENELEC	• SENELEC's intervention will be at the level of the regions concerned; • SENELEC has solved most of its problems related to the production of sufficient quantities of energy; • It is the quality of the transmission and distribution network that is currently a problem; • However, only Saint-Louis and Matam are in the interconnected network; • SENELEC has a network of underground and overhead cables in all these areas, which constitutes a real potential danger; • Possibilities for cable redirection exist at the expense of the promoter.	• Submit to SENELEC the assessment of the needs of airport equipment brought up to standard to enable the study and technical opinions of their electrical energy autonomy; • Re-evaluate the files on the electrical energy needs of airports that will be shared with the Distribution Department; • Define and communicate in time the electrical energy needs in terms of power for their effective management; • Submit a request for a power increase, if the airport is already connected; • Take into account the presence of warning grids during the work and stop at the appropriate time to avoid impacting underground cables; • Ask for a power cut when working near overhead cables.
SONATEL POTOU	• SONATEL's network is present in all these areas and airports are generally well served; • It is always possible to move equipment or cables if they are impacted by the work; • The impact on a cable can affect nearly 1000 users; • The network is essentially aerial, only the optical fibre is underground; • This optical fibre does not yet exist in Kédougou.	• Inform SONATEL before starting work; • Take into account the presence of the fibre located at a depth of 0.5 m and the warning screen at 0.8 m during the work.
TIGO	• Their antenna is present in the five regions concerned by the project; • The frequencies they use do not interfere with aeronautical frequencies; • The optical fiber may not be impacted because it is underground;	• Get closer to their services before the work begins; • Take into account the presence of their antennas in strategic positions.

	• Sometimes their antenna is impacted by work and moved; • The antennas are in a strategic position to obtain a good network; • Their movement can be costly and lead to the installation of a second antenna to reinforce the network.	

VII.5.3. PERCEPTION OF THE PROJECT BY LOCAL POPULATIONS

The populations of the districts of Khor Usine, Khar yalla, Ngallèle and Dakar Bango met, welcomed the project, and the promoter's approach to inform them and exchange with them.

At the end of these exchanges, it is clear that most of the populations met showed a reluctance to participate in this project. This reluctance is justified by the fear of being expropriated from their homes and losing their agricultural activities, which are their main source of income. They ask that the project be relocated, otherwise the airport should be limited to its current limit. People do not want to hear about expropriation, knowing that a large part of it is established on the airport's land title.

However, another segment of the population is ready to accept the project if the commitments made in 2002 to the population are respected and accompanying measures are proposed.

In summary, the population asks to be informed about the limits of the future extension in order to be able to estimate the impacts on their homes and agricultural activities. However, it welcomed our participatory approach to involve them from the beginning of the process. Below are the recommendations of the populations we met with:

- relocate the airport;
- limit the airport to the current right-of-way;
- avoid leaving the populations behind;
- favor local populations in terms of benefits and jobs;
- define the limits of the extension;
- delimit the airport's land base;
- delimit a safe distance between the airport and the first dwellings;
- respect the commitments made in terms of delimiting the airport's right-of-way;
- save the canal during the work.

VII.5.4. CONCLUSION ON THE PUBLIC CONSULTATIONS

Public consultation, which is a tool for exchanges between the promoter and project stakeholders, allowed the latter to freely share their opinions, fears and concerns regarding the Saint-Louis airport rehabilitation project.

The various meetings held have shown that this project is very acceptable and will allow the revitalisation of air movements through a modern airport.

However, issues related to safety and nuisance caused by construction work and during operation by aircraft movements were raised by the majority of stakeholders, who made the recommendations mentioned above to address them.

VII.5.5. STAKEHOLDER ENGAGEMENT PLAN

VII.5.5.1. COMMUNITY RELATIONS POLICY

A good relationship with the communities is one of the major conditions for the success of this demolition and reconstruction project, which complies with ICAO and IATA standards.

During the construction phase, it is recommended that TRANSCON give priority to recruiting local workers as soon as it is established that the required skills are available and to ensure social cohesion.

In the operational phase, the administration of the airport domain is the responsibility of the Ministry of Air Transportation staff. However, it is possible to sell services whose actors will be determined and authorised by the airport commander.

The application of a good community relations policy would be beneficial to the promoter.

VII.5.5.2. HUMAN RESOURCES MANAGEMENT POLICY

The promoter must have in his procedures, an internal human resources management policy, in accordance with the Labor Code in force, which must cover the following aspects:

- Prerequisites before starting any activity:
    - Provide the IWHSS with the declaration of establishment of the company and the declaration of the worker's movements;
    - This declaration of establishment will allow the use of a Health Insurance Institution (IPM) for non-occupational diseases.
    - The Declaration of Workers' Movements (DMT), which allows you to join the Social Security Fund and IPRES and the types of contracts must also be reported to the IRSST.
- Human resources policy and procedures:
    - set up internal regulations that must be validated by the labor inspector and must review the general working conditions (working hours, discipline, safety measures);
    - set up a clear and accessible communication system for all workers in the company;
- Working conditions :
    - respect collective agreements;
    - improve working conditions through compliance with occupational health and safety rules;
- Employment conditions and equal opportunities:
    - protect contractual and temporary workers;
    - avoid any discriminatory policy when hiring;
    - avoid any harassment by management or senior employees;
    - avoid forced labor;
    - prohibit the work of minors;
    - extend labor policies to suppliers, recruitment agencies and other third parties;
    - develop grievance mechanisms for workers.

This human resources management policy can be improved by the promoter but should be communicated to staff.

VII.5.5.3. INFORMATION AND COMMUNICATION TOOLS FOR STAKEHOLDERS

The stakeholder engagement plan is an ongoing process that must be undertaken before rehabilitation work begins.

Different methods will be used to inform stakeholders of the ongoing engagement process undertaken by the promoter. These will include traditional methods such as newsletters, posters and monthly information meetings.

When it comes to stakeholders such as administrative and local authorities, technical agencies and public agencies, etc., communication will be by official mail.

Similarly, the letters will also be used to inform them of the engagement and disclosure mechanisms related to compliance work.

For stakeholders at the local level, illustrative signs and posters in the form of monthly newsletters will be placed on bulletin boards in each relevant location (neighbourhood/village public square, schools, mosques, prefecture, sub-prefecture and town hall) to inform relevant stakeholders about engagement and information disclosure mechanisms.

During the rehabilitation work, the installation of traffic signs will also inform people about key activities that could affect them (e.g., starting work, transportationing equipment to the site, number of jobs created, etc.).

VII.5.5.4. GRIEVANCE MECHANISM WITH WORKERS AND COMMUNITIES

A mechanism will be put in place to receive and give appropriate responses to complaints and concerns about the activities of the Saint-Louis Airport Rehabilitation Project, considering their handling within a time frame acceptable to stakeholders.

Complaints can come from a variety of sources (use of local labor, environmental problems, failure to meet expectations). Thus, they can be classified according to the following criteria:

- type of procedure ;
- complaints involving contract workers;
- environmental and social performance;
- cultural issues ;
- behaviour of the personnel working on the site;
- lack of information and communication about the project.

VII.5.5.4.1. RECEIPT AND REGISTRATION OF COMPLAINTS AND CLAIMS

The promoter may make available to the communities surrounding the airport complaint books or forms for the filing of any claims, complaints or grievances. These forms and complaint forms will be submitted to the neighbourhood committees and the commune concerned.

They may also be deposited at the prefecture and sub-prefecture.

When a complaint or claim is filed, the complainant (who has identified himself/herself) receives an acknowledgement of receipt. Those who cannot complete the complaint booklet will be able to submit their complaint verbally to the team responsible for receiving complaints at the site level. The latter will complete the grievance booklet and a witness copy with acknowledgement of receipt and the team leader's stamp will be given to them.

VII.5.5.4.2. COMPLAINT HANDLING

As defined in the paragraphs above, the sponsor will need to establish a team to be responsible for the implementation of the grievance mechanism. It will be the first to receive complaints and is responsible for handling them.

Any complaints received are recorded in the complaint register and a complaint tracking form is opened. The actions taken to process the complaint (processing chronology and proposed solutions) must be mentioned.

The register must at least include the following elements:

- date of receipt of the complaint;
- name of the person who received the complaint;
- address and contact of the complainant;
- the subject of the complaint;
- the resolution schedule (beginning and end of the execution of the corrective action);
- date on which the complaint was resolved;
- date of sending the notification to the complainant.

VII.5.5.5. CSR POLICY

The promoter will have a well-defined CSR policy, based on the expectations of the local community and/or population.
TRANSCON will opt for a policy that goes beyond the legal framework imposed on it by implementing best practices.
This policy can be built according to TRANSCON's sensitivity and its CSR budget according to the development priorities of the municipality, either towards:

- the hygiene and health component:
  - comply with measures to protect populations against all potential nuisances identified, particularly in terms of noise and dust (see PGES);
- the social aspect:
  - to promote the employment of indigenous working populations in the neighbourhoods surrounding airports in their rehabilitation projects.

All these actions will promote a better coexistence of the airport with the populations of the host area.

VIII. ENVIRONMENTAL AND SOCIAL IMPACT ANALYSIS

VIII.1. METHODOLOGY AND LIMITATIONS OF THE EVALUATION

This chapter presents the assessment of the positive and negative impacts that the Saint-Louis airport rehabilitation project will have on the human, biophysical and socio-economic environment.

The various points covered in this section are the identification of the direct, indirect, temporary and permanent effects of the project on the receiving environment as well as the identification of socio-economic impacts, and proposes mitigation or enhancement measures depending on the nature of the impact.

The environmental management and monitoring plan to minimize residual impacts and ensure effective monitoring of the components likely to be affected by the project is presented in Chapter X of this report.

VIII.1.1. PRESENTATION OF THE ENVIRONMENTAL COMPONENTS

The environmental components likely to be affected by the project are divided into three (03) categories according to their nature and are called important elements of the environment and concern:

- **physical components**
  - air quality;
  - soil quality;
  - the quality of surface and groundwater;
- **biological components**
  - wildlife and birdlife;
  - wildlife habitats;
  - special status species
  - terrestrial vegetation;
- **human components**
  - socio-demographic characteristics;
  - economic activities;
  - land allocation and use;
  - public infrastructure and facilities;
  - archaeological and cultural heritage;
  - public health;
  - the living environment, including public safety, landscape, sound environment.

These environmental components will be impacted during the project, through activities that are presented in the following paragraph.

VIII.1.2. PRESENTATION OF THE SOURCES OF IMPACTS

Activities related to the construction and operation of the Saint-Louis airport that are likely to generate both positive and negative impacts on the various environmental components are:

- **In the construction phase:**
  - Demolition work;
  - The transportation and storage of construction materials and materials;
  - Mechanical and manual handling of equipment;
  - Traffic in and around the site;
  - Earthworks and excavation work;
  - Construction work;
  - The use of water;
  - Waste generation and management;
  - Job creation;
  - The purchase of goods and services.
- **During the operation phase:**
  - Fuel supply;
  - Aircraft refuelling;

- Aircraft cleaning;
- Aircraft movements (take-off and landing);
- Waste generation and management;
- Job creation;
- Purchase of goods and services.

In order to know the environmental components that will be impacted by each type of activity, the sources of impacts will be reported in a double entry table called the Leopold matrix whose primary function is to identify the potential impacts on the different environmental components. This matrix is presented below.

Table 28: Interaction matrix sources of impacts-important elements of the environment

Phase	Impact-causing activities	Air quality	Soil quality	Surface and groundwater quality	Terrestrial wildlife	Special status species	Avifauna	Terrestrial vegetation	Socio-demographic characteristics	Economic activities	Land allocation and use	Public infrastructure and facilities	Archaeological and cultural heritage	Public Health	Living environment
Rehabilitation Phase	Weeding and deforestation of the site														
	Development of access roads														
	Routing and storage of construction materials and materials														
	Mechanical and manual handling of equipment														
	Traffic in and around the site														
	Excavation and excavation work														
	Construction work														
	Water use														
	Waste generation and management														
	Job creation														
	Purchase of goods and services														
Operation Phase	Fuel supply														
	Aircraft refuelling														
	Aircraft cleaning														
	Aircraft maintenance and servicing														
	Waste generation														
	Job creation														
	Purchase of goods and services														

VIII.1.3. EVALUATION PROCESS

Once all the potential impacts of the project on the socio-economic environmental component have been identified, the significance of the foreseeable changes in this component is assessed. The approach and grid for assessing the significance of the effect are briefly described in the following paragraphs.

The methodological approach used to assess the environmental impacts of the project is essentially based on an assessment of the intensity, scope and duration of the anticipated impact. These three (03) qualifiers are aggregated into a summary indicator, the importance of the impact, which makes it possible to make an overall qualitative judgment on the anticipated effects for a component, following an intervention on the environment.

The significance of the impacts will be assessed on the basis of the following criteria:

- the intensity;
- the duration;
- the extent.

VIII.1.3.1. INTENSITY

The intensity of the impact defines the extent of changes that affect the integrity, function and use of each component of the environment affected by the project. It is obtained by crossing the **size of the disturbance** with the **value given to the environmental component** impacted.

The intensity of the environmental impact varies from very high to low and results from the combination of the factor affecting the degree of disturbance and the factor affecting the value of the component. The following table shows the different possible combinations.

Table 29: Impact intensity determination grid

Degree of disruption	**Value of the component**		
	Great	Average	Low
High	Very strong	Strong	Average
Medium	Strong	Average	Low
Low	Average	Low	Low

VIII.1.3.1.1. DEGREE OF DISRUPTION

The **degree of disruption of a component** defines the extent of the structural and functional changes it is likely to undergo. It depends on the sensitivity of the component to the proposed interventions.

Changes can be positive or negative, direct or indirect. The degree of disruption is judged:

- **high**, when the expected effect jeopardizes the integrity of the component or significantly and irreversibly modifies the component or its use;
- **medium**, when the effect results in a reduction or increase in quality or affects the use of the component, without compromising its integrity;
- **low**, when the effect only slightly affects the quality, use or integrity of the component;

- **indeterminate,** when it is impossible to predict how or to what degree the component will be affected. Where the degree of disturbance is undetermined, the environmental effect assessment cannot be conducted for this component.

VIII.1.3.1.2. Value of the environmental component

The **value of the component** includes both its **ecosystem value** and its **socio-economic value**.

The **ecosystem value of** a given component is considered to be:

- **large**, where the component is of major interest because of its ecosystem role, diversity and outstanding qualities, the conservation and protection of which are the subject of a consensus in the scientific community**;**
- **medium**, where the component is of high interest and recognized quality, the conservation and protection of which is a matter of concern but not a matter of consensus;
- **low,** when the component has an interest and qualities for which there is little concern for conservation and protection.

The **socio-economic value of** a given component is considered as:

- **large**, when the component is subject to legal or regulatory protection measures (threatened or vulnerable species, conservation park, etc.) or is essential to human activities (land);
- **average**, when the component is valued (economically or otherwise) or used by a significant portion of the population concerned without however being subject to legal protection;
- **low**, when the component is little or not valued or used by the population.

The **value of the component** integrates both the ecosystem value and the socio-economic value, whichever is higher, as shown in the following table.

Table 30: Grid for determining the value of the environmental component

Socio-economic value	**Ecosystem value**		
	Great	**Average**	**Low**
Great	Great	Great	Great
Average	Great	Average	Average
Low	Great	Average	Low

For the physical and biological environments, environmental value is based on the establishment and integration of 2 elements (ecosystem and social).

In the case of the human environment, only social value is taken into account in determining environmental value.

This social value expresses the relative importance attributed by the public, the various technical services of the State, local government or any other legislative or regulatory authority to a given environmental component.

It indicates the popular or political desire or willingness to maintain the integrity or originality of a component. This willingness is expressed through the legal protection afforded to it or through public interest at the local or regional level.

Social value is established according to the concerns of the population concerned by the environmental component. The perceptions and concerns collected from populations such as public consultations are used as elements to establish this value.

The intensity of the environmental impact varies from very high to low and results from the combination of the factor affecting the degree of disturbance and the factor affecting the value of the component. The following table shows the different possible combinations.

Table 31: Impact intensity determination grid

Degree of disruption	**Value of the component**		
	Great	**Average**	**Low**
High	Very strong	Strong	Average
Medium	Strong	Average	Low
Low	Average	Low	Low

VIII.1.3.2. DURATION

The duration of the impact determines the period during which the effects will be felt in the environment. It is not necessarily equal to the time period during which the immediate effects of the impact are felt, since residual effects secondary to the initial cause may occur long after the initial cause has dissipated.

When an effect is intermittent, its frequency is determined in addition to the duration of each episode.

The duration of the impact can be:

- **long,** when the effects are permanently felt in a continuous or discontinuous manner over the lifetime of the equipment or activities and even beyond in the case of irreversible impacts;
- **average,** when the effects are temporarily felt in a continuous or discontinuous manner over a relatively long period of time but less than the lifetime of the equipment or activities;
- **short,** when the effects are felt temporarily in a limited period of time, usually during the construction period or when activities begin.

VIII.1.3.3. SCOPE OF THE PROJECT

The extent of the impact refers to the area affected by the effects and the proportion of the population affected. It can be:

- **regional** when the impact affects a large area; or several components located at a distance from the project; or is felt by the entire population of the study area; or by a significant proportion of the population of the receiving region;
- **local** when the impact affects a relatively small area or a number of components located within, near or at a distance from the project site, or is felt by a limited proportion of the population in the study area;
- **punctual** when the impact affects only a very limited area or a component located within or near the project site, or is felt by only a small number of individuals in the study area.

VIII.1.3.4. IMPORTANCE

The combination of the intensity, extent and duration of the impact through the evaluation grid below, makes it possible to determine its importance on a component of a given environment. The importance of the impact is determined according to 05 levels according to the value of the variables that define it.

The significance of each environmental impact is assessed by taking into account the mitigation or enhancement measures integrated into the project.

During this first assessment, if it is found that these analyzed impacts are not negligible and that the proposed measures are not effective, specific mitigation measures may be proposed to allow optimal integration of the project into its environment.

Mitigation measures aim to avoid, mitigate or compensate for the negative social and environmental impacts of a project by prioritizing solutions with zero negative impacts.

As for positive impacts, improvement or optimization measures are proposed in order to perpetuate these assets, make them better and benefit a larger layer of the components concerned.

The proposed mitigation and optimization measures integrate operationality, adaptability to the context, ease of implementation and above all the quality/price ratio in order to benefit all parties.

Table 32: Environmental Impact Significance Determination Grid

Intensity	Extended	Duration	Importance
Very strong	Regional	Long	Very strong
		Average	Very strong
		Short	Very strong
	Local	Long	Very strong
		Average	Very strong
		Short	Strong
	Punctual	Long	Very strong
		Average	Strong
		Short	Strong
Strong	Regional	Long	Very strong
		Average	Strong
		Short	Strong

Intensity	Extended	Duration	Importance
	Local	Long	Strong
		Average	Strong
		Short	Average
	Punctual	Long	Strong
		Average	Average
		Short	Average
Average	Regional	Long	Strong
		Average	Average
		Short	Average
	Local	Long	Average
		Average	Average
		Short	Low
	Punctual	Long	Average
		Average	Low
		Short	Low
Low	Regional	Long	Average
		Average	Low
		Short	Low
	Local	Long	Low
		Average	Low
		Short	Very Low
	Punctual	Long	Low
		Average	Very Low
		Short	Very Low

Following the implementation of the specific mitigation measures, the residual impact will be determined and monitoring and evaluation measures will be recommended to guide them and better manage them through a monitoring plan.

The following figure is a summary of the steps to be followed in determining impact significance.*

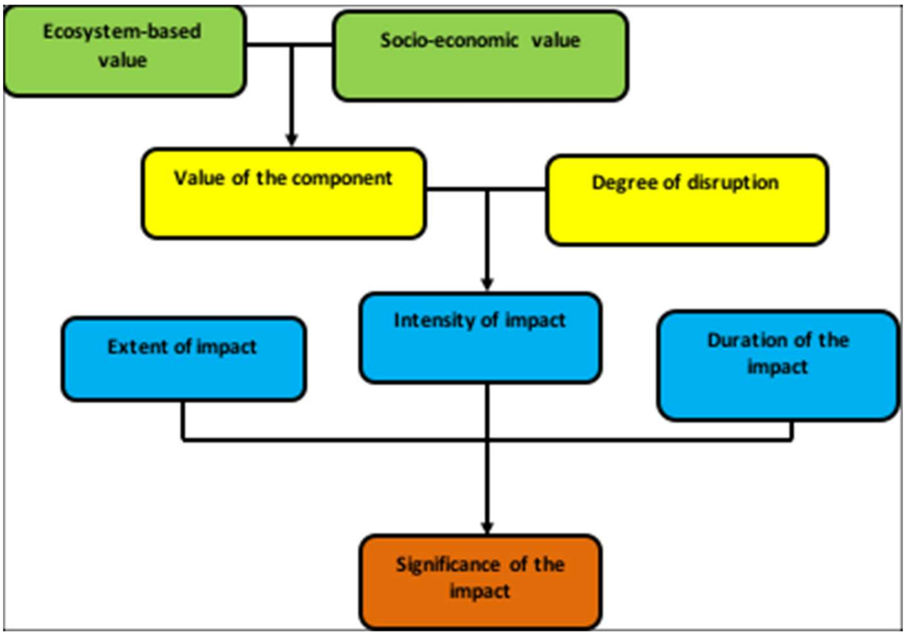

Figure 10: Process for identifying impact significance

VIII.2. ENVIRONMENTAL AND SOCIAL ISSUES (VALUE OF THE ENVIRONMENTAL COMPONENT - VCE)

This section describes the environmental components likely to be impacted by the project during its construction and operation phases.

VIII.2.1. AIR QUALITY

The rehabilitation and operation of Saint-Louis Airport will generate air pollutants and greenhouse gases. These emissions are likely to affect air quality.

The value of the environmental component remains ***high*** because no changes in air quality are noted in the project area.

VIII.2.2. SOIL, SURFACE AND GROUNDWATER QUALITY

Rehabilitation works are likely to affect soil quality and consequently groundwater. It should also be noted that the project site is located in the Senegal River delta, which is considered a wetland with permanent water bodies. Thus the value of the component is considered to be ***large.***

VIII.2.3. QUALITY AND AVAILABILITY OF DRINKING WATER

Water supply during the rehabilitation and operation phases will be provided by SDE. However, given the scarcity and importance of the resource to populations, the component value remains ***high.***

VIII.2.4. VEGETATION IN THE AREA OF DIRECT INFLUENCE

The airport's rehabilitation work will inevitably lead to deforestation and clearing activities.

Indeed, the airport site is marked by sparse shrub steppe vegetation overall and a little bushy in the southwest. *Avicennia africana* mangroves have also been identified in the northern part of the airport. Thus, given the sensitivity of the ecosystems around the airport but also the importance of preserving the flora, the environmental value is considered to be **high**.

VIII.2.5. WILDLIFE AND AVIFAUNA

The wildlife and avifauna potential is low in the project area mainly due to human pressure on wildlife habitats. However, the need to preserve wildlife means that the value of the environmental component is considered to be **average.**

VIII.2.6. SOUND CLIMATE

Studies carried out on the initial sound environment of the site have revealed that the sound environment of the semi-urban environment to be used for the project is very quiet.

The environment in its initial state is of the unpolluted (sound) type. Rehabilitation work as well as activities related to airport operations (take-off, landing, etc.) will generate noise. This noise generated could cause noise pollution for local populations, workers but also for wildlife and birds. Thus, the value of the component is considered **high**.

VIII.2.7. POPULATION HEALTH AND SAFETY

During the rehabilitation and operation phases of the airport, the health and safety of workers and surrounding populations must be taken into account to mitigate any inconvenience. Thus, the value of the component is considered **high** because the preservation of the health and safety of the population is paramount.

VIII.2.8. SOCIO-ECONOMIC ACTIVITIES

During the airport's rehabilitation and operation phases, positive externalities will be produced through the recruitment of manpower, the development of small businesses and crafts, the purchase of goods and services and possibly cultural mixing. Thus, the value of the component is **high**.

VIII.2.9. SUMMARY OF ENVIRONMENTAL AND SOCIAL ISSUES

The table below summarizes the environmental and social issues in the project area.

Table 33: Summary of environmental and social issues in the project area

Issues at stake	Environmental Component Values (EVC)
Air quality	Great
Soil and water resources quality	Great
Drinking water quality and availability	Great
Vegetation	Great
Wildlife and avifauna	Great
Economic activities	Great
Hygiene, health, safety and security	Great
Sound climate	Great
Living environment	Great

VIII.3. IDENTIFICATION OF THE MAJOR IMPACTS OF THE PROJECT

In this section, all impacts related to the project during the rehabilitation phase as well as during airport operations are studied in detail. Impact management measures are proposed for each environmental component (physical, biological, human) impacted by the project.

VIII.3.1. IMPACTS ON THE BIOPHYSICAL ENVIRONMENT

VIII.3.1.1. IMPACTS IN THE REHABILITATION PHASE

The activities likely to have an impact on the physical environment of the project area are the traditional activities of a construction site, such as the installation of equipment, civil engineering works (earthworks, levelling, backfilling, etc.), construction works, waste generation, etc. These activities are likely to lead to:

- dust emissions from the transportation and storage of building materials;
- exhaust emissions from the operation of construction machinery and vehicles;

- the risk of contamination of the soil, subsoil and water resources through discharges, accidental oil spills or the use of hazardous chemicals, but also through poor waste management;
- soil degradation following civil engineering work and site installation;
- the modification of the surface and groundwater flow regime due to civil engineering works (levelling, earthworks, backfilling, etc.).

VIII.3.1.1.1. IMPACTS ON THE ATMOSPHERIC ENVIRONMENT

- **On air quality**

Air quality will be affected by emissions of pollutants and especially dust from demolition and reconstruction activities, particularly through the use of construction materials, vehicles and construction machinery.

During rehabilitation work, dust could spread during the movement of machinery and vehicles, the transportation of materials and, to a lesser extent, during the loading, unloading and/or storage of construction materials.

Indeed, if the loads of materials (sand, gravel, etc.) are not covered, trucks risk losing part of the materials throughout their journey, thus constituting inconveniences for the populations of the localities crossed but also for the workers present on the site. In addition, the airport is located close to the homes in the Bango, Ngallele and Khar Yalla districts, where the first homes are located within the airport wall.

In Saint-Louis, the main dust emissions occur during the dry season between November and June. These would be greatly increased if the work were to take place during this period.

Exhaust emissions will come from the operation and use of machinery, vehicles, site generators, concrete plants, etc. This equipment burns diesel oil and emits CO, CO_2, SOx, NO_x, etc.

However, these quantities of pollutants released are expected to be relatively small and over a short period of time. Thus, the significance of the impact is considered low.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Punctual	Short	Low

Mitigation measures

In order to make the impacts on air quality during the rehabilitation phase of the airport insignificant, the study recommends the following mitigation measures:

- water the site soil and traffic lanes to minimize dust generation;
- limit the speed of trucks to 30 km/h at the houses and on the construction site;
- cover with tarpaulins the trucks transportationing materials (rubble, sand, etc.) on site;
- implement demolition methods that minimize dust emissions
- reduce open sand storage to a strict minimum or cover it if necessary;
- ensure rigorous planning of work periods according to the seasons (if possible);

- stop unused vehicles and equipment by avoiding the standby position such as idling engine;
- ensure preventive and curative maintenance of exhaust emission equipment;
- define the desired technical specifications for construction machinery, with regard to national and international exhaust gas standards;
- inform and raise awareness among local populations.

On the climate

During the airport's rehabilitation work, the operation of construction site machinery, equipment and vehicles as well as the use of trucks to transport construction materials will lead to greenhouse gas (GHG) emissions such as CO_2. In addition, the preparation of the land, which will require localized deforestation within the airport site. Vegetation has been identified as a "carbon sink" that absorbs very large amounts of atmospheric carbon, which helps to reduce the amount of atmospheric CO_2.

However, these emissions from construction machinery and vehicles will not have significant impacts on climate change due to their low magnitude (intermittent and limited emissions). Thus, the importance of the impact of rehabilitation works on the climate is considered low.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Punctual	Short	Low

Mitigation measures

Even if the rehabilitation work cannot have a significant impact on the climate, the study recommends that the following measures be taken into account:

- define the desired technical specifications for construction machinery, in line with international exhaust gas standards;
- stop unused vehicles and equipment by avoiding the standby position such as idling engine;
- carry out regular and complete maintenance and roadworthiness tests on vehicles and construction machinery to minimise pollution due to poor combustion;
- comply with national and international standards in terms of GHG emissions.

With the implementation of the above recommendations, during the rehabilitation phase, the residual effects on the climate will be very small.

VIII.3.1.1.2. IMPACTS ON SOILS AND WATER RESOURCES

The airport's rehabilitation works are likely to alter the quality of the soil, surface water and, consequently, groundwater. These potential impacts are presented below.

Modification of local topography and soil destructuring

Grading and excavation work on the site will change the soil profile and local topography. This modification will slightly disrupt the natural runoff of stormwater because the difference in elevation is small. Indeed, the altitudes of the airport site vary between 00 and 15 m.

This work could also reverse the natural horizons of the soil by creating embankments and excavated material that can disrupt the pedogenetic process and impoverish the soil.

However, this work will be limited to the site's right-of-way and will be carried out over a short period of time. Thus, the significance of the impact of preparation activities is considered low on the modification of local topography and soil destructuring.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Local	Short	Low

Waterproofing, compaction and soil compaction

During rehabilitation works, some civil engineering operations such as compaction and/or paving can lead to waterproofing and compaction of soils that will no longer be able to properly perform their environmental functions.

The construction of access roads, the use and parking of heavy machinery, backfilling activities and the construction of foundations could cause the soil to settle if it does not have sufficient bearing capacity to support the weight of these machines.

As a result, the work may change the speed and infiltration rate of runoff and the recharge rate of groundwater. Thus, stagnation and/or runoff of water is accentuated, leading to flooding and/or water erosion of the soil.

It should be noted that part of the airport (north and west) is located on hydromorphic soils and poorly developed input soils. These types of soils are characterized by their hydromorphic nature and are located on the banks of the Senegal River.

However, rehabilitation works that only concern a limited area will be carried out over a short period of time (10 months). Thus, the significance of the impact is considered low.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Local	Short	Low

Pollution of soil, surface and groundwater

- **By accidental spillage or leakage of chemicals**

The site preparation work as well as the airport rehabilitation work represent a risk of contamination of the soil, surface and groundwater.

Indeed, the storage and handling of certain substances (fuels, lubricating oils, used oils, chemicals, etc.) used in the operation and maintenance of equipment, machinery and construction vehicles can lead to accidental spills or leaks that can contaminate the soil, runoff and groundwater by infiltration.

However, these accidental spills and leaks are punctual even if the immediate environment of the site may be inadvertently affected.

It should be noted that the Senegal River is located on the northern limit of the airport. The latter is marked by the relatively large presence of floodplains that are identified to the north and west. In addition, the water table is shallow (wells and ***seanes*** less than 03 m in the market fields located east of the airport) in the project area.

In addition, the risk of soil and water pollution is present off-site through the transportation of raw materials during rehabilitation work, refuelling and other substances. Thus, the significance of the impact is considered to be average over a short period of time.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Local	Short	Average

- **By generating waste**

These previously mentioned works are sources for generating solid and/or liquid waste (liquid effluents, packaging, cable reels, empty containers, used spare parts for machinery, etc.).

Poor management of this waste at the site level can lead to the dissolution of liquid waste and leaching of solid waste that could contaminate soils, surface water and groundwater through infiltration.

However, construction site waste is generally inert waste (excavated material, rubble, plaster, cables, coils, etc.) that is generated over a short period of time. Thus, the significance of the impact is considered to be average.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Local	Short	Average

Mitigation measures

During the preparation and rehabilitation of the airport, the study recommends the following actions:

- conduct a soil survey;
- define heavy vehicle routes (work lanes) and work areas in order to limit rolling surfaces and soil compaction;
- limit the site's footprint to the strictly necessary area;
- rehabilitate the site after the work;
- provide a water drainage system before the rainy season to ensure that runoff water flows to the natural circuits;
- ensure that no vehicle maintenance is carried out on site;
- ensure that vehicles and construction machinery have a proper technical inspection;
- take into account the NS 05-061 standard on waste water before any discharge of effluents into the natural environment;
- limit spills and accidental leaks by:
  - the provision of anti-pollution kits;
  - the storage of oils and other hazardous products in sealed retention basins;
- collect solid and liquid waste according to a waste management plan in accordance with national and international regulatory provisions;

- raise awareness and train staff on solid and liquid waste management;
- limit the site's footprint to the strictly necessary area;
- implement an HSE policy;

With the implementation of these recommendations, the significance of these impacts on land and resources will be very low.

VIII.3.1.1.3. IMPACTS ON WATER RESOURCES USED BY POPULATIONS

The airport preparation and rehabilitation works will lead to increased water requirements (for civil engineering, soil watering, cleaning operations, workers' needs, etc.) over a short period of time.

The water supply will probably be provided by the Senegalese Water Company (SDE), which is the current supplier of the airport, which has its own internal network.

Water requirements during the rehabilitation phase are not yet estimated. However, during these rehabilitation works, water will be used rationally in order not to compete with the water supply of the populations.

Mitigation measures

The study recommends the following measures:

- collect and use rainwater for watering the slopes if the work is carried out during the rainy season;
- see the possibilities of sourcing water from the Bango water reserve and the Senegal River branch and contact the Office of Lakes and Rivers (OLAC) in this regard
- implement a rational water management policy;
- put up signs in toilets and sinks to make employees and visitors aware of the importance of water conservation;
- repair any degradation that may cause water leakage in a timely manner,
- use water tarpaulins in good condition if necessary to prevent water leaks;
- raise employee awareness of the importance of the resource and the need to preserve it.

VIII.3.1.1.4. IMPACTS ON FLORA AND FAUNA

The airport's preparation and rehabilitation work will inevitably lead to deforestation, which will take the form of felling, weeding and brushing of the plant species currently present on the site.

It should be noted that this vegetation identified on the site serves as a shelter, a nesting box, a resting place but also as a feeding station through its seeds, fruits and insects living there.

However, it should be noted that the current site is not very rich in vegetation and only two (02) of them (one (01) *Adansonia digitata* and one (01) *Acacia senegal*) present a major conservation challenge because they are classified as partially protected species under the Forest Code in force in Senegal.

In addition, the extension of the airport to the north will lead to the disappearance of the mangrove swamp. This mangrove protects the coastline from waves and wind and water erosion, but also conserves biological diversity and provides spawning grounds and nutrients for many fish and shellfish species.

Rehabilitation work (demolition, construction, use of vehicles and construction machinery, presence of labor, etc.) will generate noise that will impact wildlife and birds. Indeed, a risk of temporary disturbance of terrestrial wildlife and nearby birds will be noted.

In addition, during this phase, several types of waste (excavated material, waste oils, plant debris, construction site waste, etc.) will be generated on site. The risks of pollution following an accidental spill or leak of dangerous products can be noted. Plant species, small mammals and reptiles (rodents, lizards, salamanders, varans, snakes, crustaceans, etc.) can be very sensitive to certain pollutants. The risk of small fauna (small reptiles or rodents) falling into open excavations during foundations can also be noted during the work.

In summary, all of the above factors could lead to the degradation of vegetation and the displacement of wildlife to other areas, thus impoverishing the area in terms of biodiversity. Thus, the significance of the impact is considered to be average.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Punctual	Short	Average

Measures to mitigate negative impacts

The study recommends the following measures to reduce the impacts on fauna and flora during the construction phase:

- limit the site's footprint to the strictly necessary area;
- establish an effective system for the management of excavations and waste resulting from the work;
- use machinery, vehicles and equipment that comply with noise emission standards and raise staff awareness;
- avoid the accidental or deliberate introduction of alien species during the work and establish a monitoring plan for these species;
- prevent the animals from wandering around inside the site;
- establish a request for clearing;
- contact the IREF to report on the reference situation found on site and obtain technical advice on how to felling trees.
- make an inventory of the wildlife and plant species present in the direct area of influence of the project;
- implement an off-site reforestation plan and ensure follow-up, in collaboration with the Saint-Louis forest sector;
- have a memorandum of understanding within the framework of compensatory reforestation with the Waters and Forests of Saint-Louis;
- choose the mangrove as a site for the reforestation plan to be established and thus support the service in its mangrove restoration activities;

- support the forestry service for possible intervention.

VIII.3.1.2. IMPACTS DURING THE OPERATING PHASE

VIII.3.1.2.1. IMPACTS ON THE ATMOSPHERIC ENVIRONMENT

On air quality and climate

In the operational phase, air quality deterioration and air pollution will be mainly due to airside emissions and exhaust pipe emissions from the different types of vehicles circulating on the site. These emissions will mainly come from aircraft and their daily activities (take-off, landing, etc.), fuel combustion (Jet A1 or AVGAS), support vehicles, fuel storage, aircraft refuelling, fuel distribution station, painting of buildings and vehicles, power plant powered by diesel generators and increased road traffic in and around the airport.

The main pollutants emitted will be NOx, CO, CO_2, SOx, SO2 and to a lesser extent VOCs (Volatile Organic Components) and HC (Unburned Hydrocarbons).

CO_2 is the main reaction product of the combustion of all fossil fuels and is directly related to its carbon content.

In the troposphere, nitrogen peroxide decomposes in the presence of O_3 (ozone) and forms NO_2 and NO whose mixture forms nitrogen oxides (NOx). NOx contributes directly to climate change caused by greenhouse gases, by the absorption of infrared rays reflected from the earth and coming from the sun.

Studies have shown that air traffic contributes to the formation of ozone (O_3), which is not produced directly by aircraft operation but is a secondary pollutant.

Thus, the operation of the airport will lead to greenhouse gas (GHG) emissions. These GHGs are gaseous components that absorb infrared radiation emitted by the earth's surface. They thus contribute to the greenhouse effect and the increase in their concentration in the Earth's atmosphere is one of the complex factors of global warming.

Considering all these factors, the significance of the impact can be considered as average on air quality and climate change.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Local	Long	Average

Mitigation measures

The study recommends the following mitigation measures:

- Identify emission sources and implement an air quality management system;
- Work on measures to reduce polluting emissions;
- Assess air quality in the area of influence of the project in the operational phase,
- Ensure long-term monitoring of ambient air quality at the various sites identified as potential receptors,
- Ensure the use of good quality fuel during the operating phase,
- Create green spaces far from the track;
- Carry out reforestation campaigns outside the site;
- Ensure compliance with the requirements of the standards in force.

VIII.3.1.2.2. IMPACTS ON SOIL QUALITY AND SURFACE AND GROUNDWATER RESOURCES

In the operational phase, the main impacts on land and water relate to pollution likely to be caused by the airport's various activities, including the storage of fuels such as Jet A1, AVGAS (aircraft) and diesel (power plant), refuelling of aircraft, fuel distribution, painting of vehicles and buildings.

The handling of fuel (transportation, disposal, storage, refuelling, etc.), waste and new oils and chemicals can lead to contamination of the soil, subsoil, surface and underground water by accidental spills or leaks.

Maintenance and cleaning activities on aircraft, airport pavements (runways, taxiways and aircraft parking areas), buildings (airports and administrative buildings) and roads (access and service roads) are also likely to produce soil, surface and groundwater pollution by infiltration. Indeed, poor management of wastewater, washing water and waste generated by these activities can lead to a deterioration in soil quality and contaminate groundwater through infiltration.

However, fuels and oils will be stored in sealed tanks and under retention. As for the unloading area, it will be designed in such a way as to be able to recover and evacuate liquids in the event of leaks. Also, tank trucks that will be used for the transportation of fuel will be subject to prior roadworthiness tests.

Thus, the significance of the impact on soils, surface and groundwater can be considered as average.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Local	Long	Average

Mitigation measures

In order to prevent pollution of soil and water resources, the following mitigation measures are recommended:

- put in place procedures and safety measures that must be followed for any refuelling operation;
- collect runoff water according to its origin and control its quality before any discharge;
- implement a stormwater management plan;
- treat water likely to be polluted by hydrocarbons;
- comply with NS 05-061 wastewater standard before any effluent discharge;
- recycle treated wastewater if possible;
- use retention basins or sealed containment basins for chemical storage;
- dispose of and handle fuel on prepared and sealed surfaces;
- implement an inspection and maintenance program for the various installations;
- implement response procedures in the event of an accidental spill or leak;
- set up an Internal Operation Plan (IOP) to deal with emergency situations;
- apply preventive and protective measures;

- sort and then store the waste in a sealed storage area;
- regularly monitor solid and liquid waste likely to be polluting;
- find approved channels for the transportation, storage and disposal of waste;
- carry out periodic tests (hydraulic and watertightness) at regular intervals to check the condition of the tanks and the operation of the trucks.

With the application of these mitigation measures, the significance of the impact on soils, surface and groundwater could be considered low.

VIII.3.1.2.3. IMPACTS ON WATER RESOURCES USED BY POPULATIONS

During this phase, the water will be used mainly for domestic use (drinking and sanitation), cleaning and maintenance activities, and for the fire-fighting system.

The water supply system of the future airport will probably always be provided by the Senegalese Water Network (SDE).

Water requirements in the operational phase are not yet estimated. However, during the exploitation phase, water will be used rationally in order not to compete with the water supply of the populations.

Mitigation measures

The study recommends the following measures for the preservation of the resource:

- collect and use rainwater for watering green spaces;
- implement a rational water management policy;
- put up signs in toilets and sinks to raise awareness among employees and travellers about the importance of water conservation;
- repair any failure that could cause a water leak in a timely manner;
- promote preventive maintenance of pipes and water points (taps, flushes, washbasins, etc.).

VIII.3.1.2.4. IMPACTS ON FLORA AND FAUNA

During the operational phase, the main potential impacts will be related to the generation of noise due to the operation of aircraft (aerodynamic noise, engine noise generated by turbojets, noise generated by rotating parts, in particular propellers), groundhandling and transportation vehicles, but also to human presence (employees, passengers, etc.). There are also potential nuisances for wildlife and birds from the light and lighting of the airport and its surroundings.

These nuisances related to noise and lighting at the airport are considered to be a source of annoyance and disturbance for local fauna and especially for avian fauna. The latter is the most exposed with risk of collisions. Collisions can cause injury or even death to the animal, either at the time of the accident or after it has fallen.

However, in the project area, there are fewer and fewer places where these birds can take refuge. Thus, the significance of the impact is considered low.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Average	Low	Low	Local	Long	Low

Mitigation measures

In order to make these impacts insignificant, the study recommends the following measures:

- avoid the divagation of animals in the airport;
- set up a buffer area between the airport and the natural areas;
- avoid the proliferation of rapidly growing alien species;
- ensure the reduction of engine noise through regular maintenance and technical visits;
- take into account noise control in airport management;
- develop an action plan to reduce aircraft noise pollution;
- influence flight schedules and/or limit night flights, since noise levels are higher at night than during the day.

VIII.3.2. IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT

The rehabilitation work and operating activities of the Saint-Louis airport are likely to generate positive and negative effects on the environment of the human environment.

VIII.3.2.1. POSITIVE IMPACTS

VIII.3.2.1.1. REHABILITATION PHASE

During the rehabilitation phase of the Saint-Louis airport, positive externalities will be generated through the recruitment of manpower, the development of small businesses, the purchase of goods and services, cultural mixing and possibly the discovery of archaeological objects.

- **Direct job creation**

The activities of the demolition, reconstruction and redevelopment sites of the airport area to be rehabilitated will require the recruitment of unskilled personnel for clearing the brush, guarding, manoeuvring work, etc. A qualified workforce will also be recruited for tasks requiring specialization.

The paid participation of local labor in the work will improve the standard of living of these individuals and their dependants.

The recruitment of staff, particularly local staff, contributes on a large scale to reducing unemployment. Thus, the significance of the impact is considered **moderate**.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Local	Short	Average

Bonus measures

In order to make the most of this opportunity, the study recommends the following measures:

- recruit local workers as a priority;
- set up a local recruitment committee;
- pay decent wages to workers;
- involve IWHSS in the declaration and identification of workers.

Indirect job creation

The rehabilitation phase of the airport also generates indirect jobs through the development of new activities near the site, such as catering, trade in manufactured products, everyday food, etc.

In addition, urban and peri-urban transportation will be more developed with the movement of construction site personnel. Thus, the significance of the impact is considered to be **average**.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Local	Short	Average

Bonus measure

The study recommends the following measures to improve the impact:

- develop and secure spaces around the airport to allow the installation of these activities;
- define with the local populations the rules of good conduct for peaceful coexistence with the security and access requirements of the airport area;
- manage entrepreneurship ambitions around the airport perimeter through the definition and dissemination of a code of conduct that will have the value of an internal regulation to be respected;
- raise awareness among workers, service providers and merchants of the importance of hygiene and safety instructions.

Business opportunities for SMEs

The workers will come from a variety of backgrounds: local, regional and international. It should be recalled that the contracting company for the airport rehabilitation contract is of Czech origin. However, it will use local companies to carry out the structural works and other services. This constitutes a business opportunity, an opening to national entrepreneurship with other local structures specialized in the supply of building materials on renovation sites. Thus, the significance of the impact is considered to be **average**.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Average	Regional	Short	Average

Bonus measure

The application of the following measures could improve the positive impact:

- promote access by local companies to goods and services: local rental of construction machinery and vehicles for demolition, rubble removal, transportation of workers, construction materials, equipment, etc.;
- prioritize local craftsmen in providing office furniture and other amenities;

- develop subcontracting so that local small and medium-sized enterprises can access markets related to the implementation of the project.

VIII.3.2.1.2. OPERATION PHASE

The activities of the Saint-Louis airport will generate positive impacts, as detailed below.

- **Job creation**

The airport rehabilitation works will generate jobs that will require proven qualifications but also unskilled jobs. These job opportunities are the responsibility of **TRANSCON**, which defines their profiles, quantifies their needs and is the main authorising officer of the recruitment market. All jobs to be filled must be competitively tendered and concluded in a transparent manner. The cleaning of the site sites will be the subject of a contract between **TRANSCON** and the local service providers authorized to remove from these sites the various wastes generated during the construction phase.

From security to administration, jobs will be created. In addition, the Saint-Louis Airport will outsource the reception, maintenance and disposal of various types of waste (solid and liquid). This approach could be beneficial for local companies specialising in these services. Thus, the importance of the impact is considered high.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Regional	Long	Strong

Bonus measures

- involve the local community in staff recruitment procedures;
- promote local employment if the profile presents itself and ensure the continuous training of recruits to upgrade them;
- develop a modern social policy for staff.
- promote the female workforce;
- propose employment contracts in accordance with Senegalese regulations;
- develop maintenance and security training specific to safety, hygiene and health standards for local companies wishing to operate at the airport if the outsourcing of these services is confirmed;
- set up a service of surface technicians in charge of the hygiene and sanitation of the airport premises;
- introduce a distinction rewarding compliance with hygiene and health regulations for services and service providers around and in the airport;
- create an ideal living environment for staff development.

- **Strengthening regional air services**

In order to strengthen Senegal's position as a reference point in air transportation and to increase regional connectivity, the regional air hub project was initiated. The State of Senegal intends to focus on three (03) essential pillars to make the country a regional air transportation hub, a project that is one of the twenty-seven (27) flagship projects of the Emerging Senegal Plan (ESP).

The rehabilitation of Saint-Louis airport will contribute, on the one hand, to strengthening the region's services but also to relaunching tourist activities in this part of Senegal. Based on these impacts, significance is considered **very high**.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Regional	Long	Very strong

Bonus measures

- Rehabilitate and equip Saint-Louis airport with the most modern technologies;
- provide ramps to facilitate access for people with reduced mobility;
- revitalize and make the services provided to passengers on departure and arrival more pleasant: waiting and accompanying platform for passengers, cafeteria;
- equip the airport with the latest generation of hygiene equipment;
- assign a sufficient number of qualified personnel and specialists to the various workstations;
- provide on-call accommodation for staff;
- authorize and make available shuttle vehicles between the airport and passengers' final destinations;
- create a healthy atmosphere of cohabitation with service providers in the airport area.

Revitalization of tourism, cultural and economic activities

The rehabilitation of the Saint-Louis airport will be a new springboard for tourists from all walks of life to discover the region (visits to the wetlands of the North, Djiouth Park, etc.). It will also be an opportunity for these tourists to discover the region's annual cultural activities (International Jazz Festival).

It should be noted that the revitalization of this sector will be accompanied by the development of its various branches, including transportation, accommodation and catering.

Thus, the relaunch of the activities of Saint-Louis airport will allow the development of the air transportation network and at the same time economic activities, which will result in the satisfaction of the transportation needs of foreign trade (sub-regional). It will also contribute to the diversification of destinations in the interior of the country and the efficiency of travel time for individuals, politicians, the army and businessmen. As a result, the significance of the impact is considered **very high**.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Regional	Long	Very strong

Bonus measures

- provide ramps to facilitate access for people with reduced mobility;
- create relaxation areas, dining areas for airport staff and airport users;
- create tours and tourist itineraries;
- initiate development and equipment projects for tourist sites in the Saint-Louis region
- create information desks to better inform users;
- develop the ground transportation network to facilitate access to the airport;
- strengthen the security, safety and protection of the airport space.

VIII.3.2.2. NEGATIVE IMPACTS

VIII.3.2.2.1. REHABILITATION PHASE

Although producing positive impacts, the rehabilitation of the airport will also produce negative externalities. They are discussed in the following paragraphs.

Living environment

❖ **Noise pollution**

The rehabilitation work will generate noise and dust, especially during demolition activities but also during reconstruction.

This work will require the use of various mobile and stationary equipment. Through the noise they generate, these machines can become a nuisance for the environment, which can affect the living environment of the local populations and the natural environment that are exposed. Among this noisy equipment, we can mention:

- mobile equipment (transportation trucks, loaders, excavators, bulldozers, etc.);
- fixed equipment (concrete mixers, drills, compressors, small machinery, generators, etc.).

However, it should be noted that the buildings to be demolished will be located within the site of the current airport and are far from the first dwellings. The impact is considered to be of moderate importance.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Average	Local	Short	Average

Mitigation measures

- implement demolition methods that minimize dust emissions;
- use a new generation mechanical excavator with misting system that injects water just before the cracking of the concrete for a dust collection;
- water the site regularly to limit dust emissions;
- use equipment and tools with low noise levels and respect the limit of 85 dB at 1 m;
- carry out daily acoustic measurements in the noisiest areas and on the property line and implement corrective measures;
- provide workers with adequate PPE to fight against noise pollution;
- timely maintenance of pneumatic tools, machinery and equipment to keep the noise level generated at an acceptable level;
- ensure that certain very noisy equipment such as site diesels and compressors are properly covered against noise;
- install a screen wall towards residential areas, particularly in the nearest neighbourhoods.

❖ **Waste generation**

The rehabilitation phase will start with a demolition and removal of the current wearing course (runway, taxiway, tarmac, Resa and Stopway). This first phase will be an important source of waste and debris production that must be managed effectively.

In addition, site preparation work and operations associated with the installation of the new pavement and access and service roads, the reconstruction of buildings and the installation of airport equipment and facilities will produce a very large volume of excavated material, rubble and various types of waste (packaging, green waste, metals, etc.).

Thus, most of the waste comes from the demolition of existing infrastructure and construction waste (structural and finishing waste).

For the effective management of these various types of waste, a waste management system will be set up that will reflect good waste management practices, namely the principle of collection, sorting, recycling and disposal by appropriate and appropriate means. The management of hazardous waste (solvents, waste oil, paint waste, etc.), especially their recovery and treatment, will be carried out with the local specialised companies in accordance with the regulations in force.

The impact will then be of medium significance and short duration.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Average	Local	Short	Average

Mitigation measures

- set up a waste disposal center as soon as the worksites open;
- ensure that waste is not abandoned, released into the natural environment or burned in the open air;
- draw up a waste tracking form for so-called hazardous waste;
- collect separately and recover waste as much as possible;
- ensure that the mixed waste is stored in "all coming" bin(s) or container(s) and disposed of in authorised landfills;
- create a buffer area between the airport and the houses.

❖ **Traffic densification**

The rehabilitation of the airport will require a considerable contribution of building materials and equipment. The latter will be transported to the site by dump trucks from various horizons. In addition, there are vehicles used for the movement of personnel and those used by TRANSCON to transport the equipment and material to be set up for the renovation of the infrastructure. All these aspects will inevitably increase traffic in this area and therefore the risk of accidents, but also noise and pollution levels.

TRANSCON will have to put in place a communication plan that includes all stakeholders and take all necessary measures.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance

Great	Average	Average	Local	Short	Average

Mitigation measures

- Inform stakeholders (municipalities, populations, AGEROUTE...) on the date of the convoy (by radio, newspapers, telephone, letters) on the routes, risks and measures to be taken to avoid accidents;
- Inform the DPC and use a professional escort between Dakar and the site;
- Establish permanent communication with these stakeholders throughout the rehabilitation project;
- Use trucks in good working order for technical inspection for transportation to the site and suitable container platforms / doors;
- Limit speed to 30 km/h to the right of the population and make drivers aware of the importance of respecting the rules of good conduct;

Loss of housing for residents of the surrounding neighbourhoods (Khar Yalla and Bango) and market gardening land

The airport right-of-way is currently fenced, but in part, so that beyond the fence the site is irregularly occupied by local populations who have built their homes there. Similarly, vegetable fields have been identified east of the current fence.

The release of the airport right-of-way by relocating these human facilities is inevitable for bringing the infrastructure up to standard, which must establish a plan for aeronautical easements. Indeed, Annex 14 of the Convention on the International Civil Aviation Organisation (ICAO) stipulates that "airports must have an obstacle-free airspace so that aircraft can approach and take off safely and that this volume of space must also be defined so that it can be protected, in order to ensure the growth or even the very existence of the airport".

In addition, there are the nuisances related to air pollution and especially noise that will impact these human installations located in the airport enclosure.

Thus, the release of the right of way will lead to the loss of housing but also to the loss of marketable land and therefore income for the populations who used this land.

At this stage of the project, the modalities for releasing the airport right-of-way are not yet clearly established. However, it is strongly recommended that the authority take all necessary measures to comply with ICAO texts for the safety of persons and aircraft.

Although the area concerned is not very large, the impact on land is still major.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Punctual	Long	Strong

Mitigation measures

- Relocate the populations living on the airport right-of-way and ensure that they are relocated to a suitable site;
- Set up measures to support the populations affected by relocation;
- Compensate affected populations before work begins;

- Comply with IFC Performance Standard 5 for involuntary movement of people and economic activities;
- Compensate the people affected;
- Support populations in their relocation when releasing illegally occupied land bases;
- Secure and enhance these spaces for the airports concerned;
- Establish with the land registry the actual airport boundaries and install a barbed wire fence (different from the fence wall provided by the project).

Cultural and historical heritage

In the project area, there are no archaeological sites or historic monuments that could be affected or threatened with extinction as a result of the work.

However, two cemeteries were identified respectively at the end of the runway (north side) and on the northern boundary of the airport.

Construction work (excavation, extension of the runway) could have an impact on these cemeteries, which have great cultural value for the local population. However, during the development of the contours of Saint-Louis airport, care will be taken not to impact these cemeteries.

During construction work at the airport site, in the event of the discovery of archaeological remains and/or physical cultural properties, it will be the responsibility of **TRANSCON** to immediately notify the services of the Ministry of Cultural Heritage.

The value of the environmental component is average, given the importance of these places for the populations. The degree of disturbance will be considered low if the company in charge of the works takes all necessary measures to avoid any modification in the cemeteries located in the airport area.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Average	Low	Low	Punctual	Short	Low

Mitigation measures

To avoid impacts on cemeteries, the following measures should be adopted:

- avoid impacting cemeteries as part of rehabilitation work;
- communicate and consult with local populations (keep them informed) before starting work around cemeteries.

VIII.3.2.2.2. NEGATIVE IMPACTS DURING THE OPERATING PHASE

The main environmental components impacted during airport operations are air quality, living environment and water and energy consumption; the first aspect is addressed in the chapter on impacts on the physical environment.

Living environment

- **Noise pollution**

During the operation phase, noise generated by the operation of aircraft is the main source of discomfort felt by workers and residents of the airport. It is produced by three sources:

- Aerodynamic noise that is caused by the friction of air on the aircraft. This type of noise is observed during the approach and landing phases, which cause turbulent air flows in addition to the noise caused by the landing gear and speed brakes, producing a loud humming sound.
- Engine noise generated by turbojet engines that produce a roar during take-off when operating at full power.
- The rotating parts that also generate noise. The higher the speed of rotation of the propellers, the higher the sound emitted becomes and therefore the more annoying it becomes.

As the first source of impact at an airport, aircraft noise has long been a concern for ICAO, which, through Annex 16 of the Civil Aviation Convention and the adoption of new standards, has provided rigorous regulation in this field and takes into account environmental issues and new aviation technologies.

In this respect, it should be pointed out that noise control is therefore a major issue to be taken into account in airport management by drawing up an action plan to reduce aircraft noise pollution. The runway at Saint-Louis Airport is less than 200 metres from the nearest residential areas.

This cohabitation will inevitably expose the populations concerned to the noise pollution generated by the operation of the airport but also and above all the airport's workers.

The implementation of the action plan will significantly reduce this impact, which will then be of medium importance.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Average	Local	Long	Average

Mitigation measures

- Perform daily acoustic measurements in the noisiest areas and on the property line and implement corrective measures;
- Provide workers with adequate PPE to fight against noise pollution;
- Act on flight scheduling and choose time slots that limit night flights;
- Favor airlines that regularly renew their fleets;
- Encourage airlines to raise awareness and train their pilots in flight techniques to reduce noise emissions;
- Implement appropriate air navigation procedures to better channel noise pollution and reduce its impact;
- Create a framework for functional consultation between airport managers, local populations, administrative and local authorities and certain technical services.

❖ **Generation of solid and liquid waste**

During the operational phase, the airport activity includes several entities on the same site. Each company produces a different type of waste. This waste can be classified into two main categories, namely non-hazardous waste such as inert waste, non-hazardous industrial waste, industrial and commercial packaging waste, etc. and hazardous waste represented by hazardous industrial waste such as waste oils, batteries, neon lights, soiled packaging, etc.

At the same time, the activities of these various entities of the airport platform will be a source of wastewater generation. Thus, wastewater will mainly come from sanitary facilities and kitchens, emptying aircraft toilets, washing and repairing airport commercial vehicles and technical workshops.

As described in the human environment, the regions benefiting from this project have a deficit in sanitation and waste collection systems. Therefore, central and local airport authorities will have to introduce very stringent hygiene and sanitation measures to familiarise workers and users with best practices in the field of waste management. The aim will be to set up a regular collection system for all solid waste generated, to sort it and to work together with the Commune of Saint-Louis or with approved service providers for its disposal, while giving priority to recovery methods (material or energy).

In the absence of possible recovery, the waste is considered as final and must be landfilled (area to be defined with the municipality) or incinerated in a cement plant.

The same will apply to sanitary wastewater, which will be collected in septic tanks regularly removed by authorized local service providers. For other types of wastewater, TRANSCON must propose an autonomous management system for these liquid discharges that is adapted and sized according to the nature and quantity of the liquid effluents to be treated.

The living environment is a fundamental value. The value of this environmental component will be considered high and the impact medium.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Average	Local	Long	Average

Mitigation measures

- Set up a solid waste management procedure and provide all companies on the platform with an area dedicated to the sorting of non-hazardous and hazardous waste;
- Optimize the recovery of different materials by sorting waste as much as possible at source;
- Consider that, at a minimum, sorting should separate hazardous waste, inert waste and common waste;
- Place garbage cans and skips in the airport area and protect them from waste spills (lids, nets, screens, etc.);
- Inform and raise awareness of waste management among staff in airport infrastructure assistance and maintenance services;
- Regularly empty septic tanks by an approved body;
- Work to reduce waste at the source and avoid landfilling of recoverable waste as much as possible.

Water and energy consumption

The water supply will probably be provided by the Senegalese Water Company (SDE), which is the current supplier of the airport, which has its own internal network. The upgrading and operational activities of the airport will result in increased airport use and inevitably lead to increased water consumption levels.
Thus, TRANSCON will ensure the adequate resizing of the internal network and this new situation must be taken into account in local water policy in order to minimize its impacts.

The power supply source will be the SENELEC network which provides the electricity supply for the current airport. A power plant will be installed for emergency power supply and night lighting of the aircraft parking area.

The operation phase will be accompanied by an increase in its electrical energy needs. TRANSCON will work to submit a request for a power increase, in order to ensure that this aspect is effectively taken into account at the level of the electricity grid concessionaire.

Mitigation measures

- submit to SENELEC the assessment of the needs of airport equipment brought up to standard to enable the study and technical opinions of their electrical energy autonomy;
- reassess the files on the electrical energy needs of airports that will be shared with SENELEC's Distribution Department;
- set up a water storage device equipped with a booster for an autonomy of 3 to 4 days;
- choose water-saving equipment and install specific meters to monitor water consumption and detect any discrepancies;
- avoid the proximity of the SDE connection to the ONAS network if it exists because the latter could contaminate the SDE pipes in the event of a defect and install a non-return valve at the entrance to the airport's private network;
- disinfect the network set up in airports before it is put into service with concentrated bleach;
- avoid a frequency conflict between airport equipment and the remote management system of SDE facilities by approaching ARMP.

VIII.3.3. IMPACTS ON HEALTH, SAFETY AND SECURITY

VIII.3.3.1. IMPACTS IN THE REHABILITATION PHASE

Operations relating to the rehabilitation of the Saint-Louis airport will have an impact on the hygiene, health and safety of workers and the populations around the site.

The identification of these impacts will make it possible to propose measures to avoid and reduce their likely effects on the various targets.

Impacts on hygiene

Activities related to the demolition and reconstruction of the airport can degrade hygiene in and around the construction site.

Indeed, the health needs of workers, their restoration, the washing water of certain machinery or equipment, as well as rubble and scrap metal from demolition can affect hygiene on and around the site.

Similarly, poor waste management, poor health conditions for employees, lack of staff awareness and waste management procedures may affect hygiene on and around the site.

Hygiene is essential for the well-being at work, health and safety on the site.

It is not only about body care and nutrition. On a construction site, the reception conditions, the cleanliness of the premises, clothing, the provision of clean sanitary facilities, drinking water and waste management policies are all essential to ensure hygiene.

Taking these aspects into account will make it possible to limit the impact, which will be of little importance.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Punctual	Short	Low

Mitigation measures

The following recommendations are made to the company manager who is responsible for good hygiene on the site:

- raise awareness among workers on the importance of hygiene preservation;
- ensure the sorting and elimination of site waste and monitor it on a daily basis;
- set up visible signage to facilitate the collection and sorting of waste;
- recycle and recover non-hazardous waste (e.g. cardboard, plastics, wood, rubble, concrete, scrap metal, crushing inert waste, etc.);
- carry out special and appropriate treatment for the disposal of hazardous waste containing toxic and harmful substances (empty paint pots, hydrocarbons, batteries, accumulators, etc.) for the environment and people;
- formalize actions concerning waste treatment in the form of a procedure;
- establish strict hygiene rules to be respected by any person working on the site;
- provide a sufficient number of well-maintained sanitary facilities according to the proportion of workers;
- guarantee access to toilets for workers of all categories;
- set up one or more drinking water points accessible to all;
- provide changing rooms for staff.

Health Impacts

Studies show that the health status of construction workers deteriorates throughout their working lives due to poor working conditions, strenuous work and physical constraints. The most important risk factors for the health of construction workers are:

- the noise;
- repetitive gestures;
- carrying heavy loads;

- exposure to chemicals;
- harsh climatic and environmental conditions;
- the vibrations of the tools used;
- work-related fatigue.

Workers are exposed to risks of occupational deafness related to noise exposure. Driving vehicles on site, working in a very noisy environment, using noisy machinery can affect hearing.

The vibrations of the tools used, the rhythmic and repetitive gestures adversely affect the health of workers.

Demolition activities of concrete structures are subject to the risk of dust and fibre inhalation. The hazardous chemical agents contained in the mixture as well as the ambient temperature are risk factors that can affect workers' health.

Air quality will be temporarily affected by the emission of dust and exhaust gases produced by demolition and construction activities, the movement of demolition equipment, earthworks and trucks. Inhalation of dust and breathing in air contaminated with harmful particles can create respiratory problems such as acute respiratory infections.

Awkward postures, carrying heavy loads, repetitive movements can lead to MSDs, fatigue and falls in the long run.

Given the environment of the construction site (nearby dwellings), populations can also suffer from noise, dust pollution and deterioration of air quality.

The worker's health must be preserved in the performance of his duties. The company manager is responsible for implementing all security conditions to ensure that they are in place.

The environmental value is considered high with a moderate degree of disturbance and a moderate impact significance.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Punctual	Short	Average

Mitigation measures

In order to avoid or reduce the negative impacts of the activity on the health of workers and residents, the following recommendations are recommended:

- favor wet working processes;
- use a dust collection device;
- use suction devices at source;
- wear suitable PPE and work clothes;
- provide shower(s) on site;
- carry out noise measurements and provide the PPE adapted to the measured values;
- choose machines that are less noisy;
- favor remote-controlled machines (distance from the noise source);
- provide vehicles and machinery with soundproof cabins;

- periodically maintain and check equipment;
- avoid as much as possible the use of manual handling with the risk of injury;
- train workers in load handling techniques;
- provide workers with handling and lifting equipment;
- use visual warning devices instead of audible warning devices;
- stop the engine of unused machinery.

Safety Impacts

During demolition work, workers are exposed to noise, risks of falling from heights, electrical risks, as well as risks of fire and explosion.

Work near electrical lines and installations or near live bare parts involves the same risks as work involving electrical machines, electrification or electrocution.

From the high floor or from a staircase, stepladder or scaffolding, the worker is exposed to the risk of falling from a height. A failure or instability of the support platforms is also a source of fall.

The use or storage of gas cylinders (torch), dismantling or working near the kerosene storage area exposes workers to the risk of fire and explosion.

Coactivity as well as traffic flows in the construction site lead to risks of accidents.

Poor organization of demolition debris, poor management of material inventories and uncontrolled deposition of materials on the site can lead to level falls leading to injuries and work disabilities.

The transportation of construction materials, the circulation of machinery and the transportation of rubble and rubble can lead to traffic accidents and harm workers and populations.

The environmental value is high and the significance of the impact is high.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	High	Very Strong	Punctual	Short	Strong

Mitigation measures

Safety on the site is a key factor to be taken into account in order to guarantee the health of workers and local populations and thus be able to respect the site's deadlines. In order to avoid or reduce safety risks on the site, the following recommendations are made:

- implement a traffic plan;
- establish safety procedures for co-activity on the site;
- appoint an HSE manager in charge of supervision and prevention against occupational risks;
- require or have a diagnosis carried out before work;
- identify and detect networks before intervention;
- materialize the electrical risk in situ;
- respect the safety distances if it is not possible to switch off the power supply, for example for reasons of continuity of service;
- issue mandatory electrical authorisations to workers requiring them and give them the prescription booklet and specific PPE;
- require the systematic wearing of PPE during the construction phase of the project for better worker safety;
- set up secure access (ladders, temporary stairs, etc.);
- use people lifts and make scaffolding and shoring plans;

- use individual rolling platforms for work up to 4 metres high and regularly check the working platforms;
- set up collective protection and wear appropriate personal fall protection devices;
- limit the traffic speeds of cars and machinery within the site and when they pass on the roads;
- establish a traffic plan on the site and train operators and drivers in safe driving;
- keep the site clean and properly organize the depots;
- ensure the proper functioning of the equipment before use;
- regulate access to the site and place hazard symbols, protective markers and prohibition and warning signs in all areas where there is a danger;
- carry out information and awareness campaigns for the population;
- provide space for customs, police and health services.

VIII.3.3.2. IMPACTS DURING THE OPERATING PHASE

An airport involves several processes and attracts many people. Its operation induces aspects related to the hygiene, health and safety of all persons who use it and of the populations living in its immediate environment.

Impacts on hygiene

The absence of procedures for managing the cleanliness of premises, toilets and employees' comfort can have an impact on the hygiene of the premises and the surrounding area.

An airport drains a lot of people’s waste and there are activities that generate various types of waste. The uncontrolled management of this waste, the unhealthy conditions in the premises, the lack of comfort of employees (lack of changing rooms, refectory, etc.) can have an impact on the hygiene of the premises.

The environmental value is high. However, its degree of disruption remains low and the significance of the impact moderate.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Low	Average	Local	Long	Average

Mitigation measures

It is important to maintain hygiene in the site and surroundings for this purpose, the following measures are proposed:

- set up a procedure for managing the various types of waste;
- set up visible signage to facilitate the collection and sorting of waste;
- place garbage cans with lids in places where it is needed;
- recycle and recover non-hazardous waste (e.g. cardboard, plastics, wood, etc.);
- carry out special and appropriate treatment for the disposal of hazardous waste containing toxic substances that are harmful to the environment and people;
- establish a reliable sanitation system to prevent the discharge of wastewater or contaminated water into the natural environment;
- set up a rainwater collection system;
- raise staff awareness of the importance of maintaining hygiene;

- keep workplaces, gathering places, equipment, furniture clean;
- provide adequate and hygienic toilets in sufficient number and by gender;
- ensure the permanent healthiness of the premises and sanitary facilities;
- provide workers with changing rooms;
- contract with specialized cleaning services in good standing to manage the site's sanitation.

Health Impacts

Workers are exposed to various risks that can affect their health. Depending on the position and working conditions, they are exposed to the screen, noise, exhaust gases from aircraft and car engines, and awkward postures.

Thus, they may have hearing problems following exposure to noise, vision problems, headaches due to long screen exposure, ergonomic difficulties due to awkward postures or poor quality work tools.

Some types of work require physical and mental isolation (air traffic controllers) and prolonged exposure to a screen with high concentration, this can affect mental and visual health and lead to stress.

Airside personnel are exposed to high noise levels that can affect hearing. Workers, depending on the position held, may be exposed to high noise from the movements of aircraft, ground service vehicles and other noisy installations. They are also exposed to exhaust gases from aircraft and car engines that can cause them breathing problems.

Workers are also exposed to the risk of falling from a height and colliding with moving vehicles or aircraft, resulting in sprains, open injuries, etc.

Working on or near high-voltage active components exposes the employee to electrical risks. In addition, poor hygiene in the premises exposes both workers and passengers to the risk of disease.

Noise and air pollution induced by aircraft activities can affect the health of local populations.

Failure to comply with health checks exposes the population, travellers and crew members to diseases because travellers will come from all walks of life.

If the appropriate vaccines are not taken by travellers, those carrying a contagious disease may carry the disease, contaminating workers, the population, etc.

Some workers may be exposed to radio frequencies.

Ground handling service providers may be exposed to chemical risks, in particular when, in the course of their work, they are in direct contact with fuels or other chemicals. Fuels can pose a risk of exposure to volatile organic compounds through inhalation or dermal contact both in normal operations and in the event of a spill.

The environmental value is high and the importance of the impact is high.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	Average	Strong	Local	Long	Strong

Mitigation measures

Since it is essential to protect the health of the crew, passengers, staff and populations, the following recommendations are made:

- require the wearing of personal acoustic protection devices;
- encourage shift work to allow team rotation to reduce the risk of cumulative noise exposure;
- make noise measurements and provide PPE adapted to the noise level required by the tests;
- carry out the pre-recruitment medical check-up and periodic check-ups every six months;
- provide first aid kits;
- make workers aware of the actions that save lives;
- carry out risk assessment at each workstation;
- require passenger health screening;
- provide the health control services with adequate means to carry out their work.

Safety Impacts

Various aspects of security can be developed.

Workers, in addition to noise, are exposed to various physical risks depending on the position occupied and the workplace.

Carrying heavy loads, repetitive movements, handling operations, aircraft service operations can cause sprains, TMS, etc.

Coactivity in the movement area leads to accident risks. Collisions with ground or moving service vehicles or aircraft are possible and can cause injuries.

The risk of slipping and falling cannot be ruled out because certain categories of workers are exposed to it. Workers may also be exposed to suction risks associated with working near reactors.

Workers are also exposed to fire and explosion risks due to fuel handling and also to electrical risks.

The animal hazard and the presence of FOD on the runway can also pose safety problems. The presence of stray dogs, oxen, sheep and other domestic animals on the runway and taxiways can seriously compromise operational safety as it can lead to collisions between aircraft and animals and damage the aircraft or even cause its structural failure. The presence of birds increases the likelihood of a collision with an aircraft. The suction of the FODs by the aircraft's engines causes destruction of the aircraft and can cause accidents.

The urbanization of the immediate environment of the site can affect the safety of the site and activities. The establishment of landfills in the vicinity of the airport, the planting of vegetation, agricultural activities (fields, orchards, etc.) create an environment conducive to the frequentation and reproduction of birds, which are risk factors for the activity. They promote accidents through incursions into sensitive parts of the aircraft or by collision.

Occupations in the airport environment (dwellings, market spaces, etc.) are elements that, just as they can affect security, can also be vulnerable and suffer the consequences of a possible disaster at the airport or resulting from airport operations.

Aircraft failures, although very rare, can be catastrophic for populations, if a crash occurs. The take-off and landing phases are the most at risk and can lead to runway overruns and collisions that affect safety. They are also sources of noise.

The introduction of foreign persons for the purpose of vandalism or malicious acts is a risk to take into account.

As Saint-Louis is a border area, safety and security must be greatly increased to avoid the risk of a terrorist attack.

The environmental value is high and the degree of disturbance high; this leads to a very high impact significance.

VCE	Disruption	Intensity	Scope of the project	Duration	Importance
Great	High	Very Strong	Local	Long	Very Strong

Mitigation measures

Safety is one of the most important pillars in aviation. Staff, travellers and the entire system must be protected to preserve their integrity. The following measures are proposed for good safety management:

- install safety signs (warning signs, speed limits, etc.)
- mark pavements to facilitate traffic and avoid the risk of collision;
- delineate safety areas in high-risk areas;
- train and certify all workers with access to apron operations;
- ensure that safety procedures are mastered by the agents in charge of handling aircraft support equipment;
- automate baggage handling and minimize the use of manual handling;
- provide training to all baggage handling employees;
- provide workers with PPE adapted to the risks to which they are exposed
- limit the frequency and duration of workers' assignments to handle heavy baggage and introduce rotations and rest periods;
- train workers in thermal risk prevention;
- establish a traffic plan;
- develop an airport emergency plan;
- provide the customs, police and hygiene brigade installed in the airport with the latest generation equipment to carry out their work properly;
- provide the inspection bodies with the latest generation equipment to ensure the screening of baggage and passengers;
- have sufficient equipment and materials for firefighting;
- provide training on terrorism warning and security;
- promote regular maintenance and periodic verification of tracks to identify and remove FODs;
- use herbicides in the vicinity of the trails to prevent vegetation from growing;
- avoid the accumulation of waste near the runways;

- work with local authorities to prevent the establishment of structures that can attract birds (landfill, retention basin, agricultural operation, livestock, landscaped green space, etc.) into the airport environment;
- raise awareness of the importance of not having vegetation, birds or landfills in the vicinity of the airport;
- prohibit access to the land for livestock;
- make a high fence topped with barbed wire, the ends of which are turned outwards;
- use repellent substances to keep wild animals away from the airport;
- use scaring techniques (chemicals, audio or visual means) to keep birds away;
- implement a plan to combat bird and animal diseases;
- make regular indoor and outdoor rounds;
- establish strict baggage security standards.

IX. HAZARD STUDY

IX.1. INTRODUCTION

IX.1.1. OBJECTIVES OF THE PROJECT

This hazard study is carried out in order to understand the technological and environmental risks that may occur or affect the airport and its immediate environment. Thus, it sets out the dangers that the establishment may present in the event of an accident, by presenting a description of the events likely to occur, whether their causes are internal or external, related to the products handled or the processes and equipment used.

It describes the nature and extent of the consequences that a possible accident can have. In addition, this study summarises all the technical and organisational means of prevention and protection planned to eliminate or reduce the hazards identified in the airport risk analysis.

IX.1.2. EXPECTED RESULTS

In accordance with the Methodological Guide for Hazard Analysis of the Ministry of the Environment of Senegal, the objectives of a hazard study are summarized as follows:

- serve as a reference for decision-makers to take security measures into account;
- identify potential issues and dangers;
- analyze risks;
- evaluate the consequences;
- propose means of prevention, control and intervention;
- reduce risk inside and outside the facility;
- provide the basic elements necessary for the development of the POI and other emergency plans;
- inform and raise awareness among staff;
- develop a risk culture among executives, employees and populations.

In summary, the hazard study makes it possible to develop a preventive risk policy towards the public and airport staff.

The results of this hazard study will be used as a guide for decision-makers to take the necessary steps to design suitable premises, set up means of prevention, protection and warning for any future unfortunate event.

IX.1.3. METHODOLOGY OF IMPLEMENTATION

The structuring of the hazard study report follows a chronology that identifies all potential hazards in and around the airport. This makes it possible to characterize all possible risks and study their effects on the environment in order to establish a good forecast of probable damage.

The following methodology was adopted:

- description of the natural and human environment of the site;
- description of the facilities, activities and products used;
- identification and characterization of hazardous phenomena;
- preliminary analysis (characterisation of the intensity of the effects of dangerous phenomena) then detailed risk analysis ;

- identification of the accident scenarios selected;
- detailed risk analysis;
- risk reduction study: prevention measures, safety barriers, etc.

IX.2. DESCRIPTION OF THE SITE ENVIRONMENT

IX.2.1. NATURAL ENVIRONMENT

IX.2.1.1. CLIMATIC CONDITIONS

The climate of the project area is characterised by the alternation of a long dry season (October to June) marked by the predominance of trade winds (maritime and continental) and a short rainy season (June to September/October) dominated by the monsoon flow from the St Helena High.

- **Wind**

Over a 30-year period, the average annual wind speed is 3.8 m/s. The maximum average speed is recorded in April (5 m/s) and the minimum in September (3.1 m/s). The highest speeds are recorded between January and July (dry season) and the lowest between August and November (rainy season). From November to June, winds from the north to east quadrant dominate with an average intensity of 4.7 m/s. In contrast, from July to October, north to west quadrant winds dominate.

- **Temperature and exposure**

The project area, due to its location on the coast, benefits from a microclimate characterized by moderate temperatures. Over a period of 30 years (1987 to 2016), the recorded temperatures are relatively low overall with an annual average of 26.2°C. The lowest average temperatures are recorded between December and June. However, the highest are observed between July and November.

Sunstroke, a parameter dependent on cloud cover and rainfall, is of a fairly constant average daily duration in the project area. The lowest insolation values are recorded during the rainy season.

- **Rainfall measurement**

The Saint-Louis airport is located in the Sahelian coastal climate domain. Rainfall is low and rarely exceeds 300 mm. The normal over a 30-year period is 270 mm. There is an interannual irregularity in precipitation. The year 2016 was the most loss-making year of the series.

- **Lightning**

The keraunic level (Nk) corresponds to the number of thunderstorms and more precisely, the number of thunderclaps heard in a given area.

It is to be distinguished from the lightning strike density (Ng) which is the number of lightning strikes per km²/year. These two (02) parameters are not known.

IX.2.1.2. HYDROLOGY AND HYDROGEOLOGY

The hydrographic network is quite dense in the project area. Indeed, it records a period of high and low water, respectively, from June/July to October/November and from November/December to May/June. The maximum flood is generally recorded in early November in Saint-Louis. This flood supplies groundwater and other aquifers. The river is located 10 m north of the airport site. Its regime is marked by an interannual irregularity characterized by wet and dry years. Mangroves have been identified 80 m west of the site.

IX.2.1.3. GEOLOGY

The Saint-Louis airport is located on mud and shellfish sands. The relief of the project area is relatively flat. Altitudes vary between 0 and 15 m over the entire municipality.

IX.2.2. MAN-MADE ENVIRONMENT

The Saint-Louis Airport is located in a highly urbanized environment with various activities and infrastructures being developed.

IX.2.2.1. RESIDENTIAL AREAS

In the immediate environment of the site, there are dwellings located 11 m away on both the west and south sides. Others have been identified in the site's footprint on the east side.

Khar Yalla is located less than 200 m south of the airport and is densely populated.

IX.2.2.2. ACTIVITY AND LEISURE AREAS

In the vicinity of the site, the populations practice market gardening and domestic breeding. Animal intrusion is often observed on the airport runway.

There is a football field 10 m east of the site.

IX.2.2.3. ESTABLISHMENT RECEIVING THE PUBLIC (ERP)

The Dakar-Bango military camp is located 300 m north of the site.

IX.2.2.4. TRANSPORTATION NETWORKS

The Bango-Khor road and the N2 national road are located 145 m east of the site and 186 m south of the site respectively.

IX.3. DESCRIPTION OF EQUIPMENT, PROCESSES AND PREMISES AT RISK

For this project to rehabilitate the Saint-Louis airport, the existing one will be dismantled and new facilities will be set up, except for the fuel storage area, which will be preserved.

IX.3.1. AERONAUTICAL PLATFORMS

Aeronautical platforms include different pavements used by aircraft or ground support vehicles for different reasons.

The manoeuvring area is the part of an airport to be used for take-offs, landings and aircraft traffic on the surface, excluding aprons. It includes the runway (landing area) and taxiways.

The apron is the part of an airport used for embarking and disembarking passengers, loading and unloading cargo, refuelling, servicing, maintenance and parking aircraft. It includes parking areas, maintenance areas, garage areas and apron taxiways.

These platforms must be free of obstacles in order to avoid a possible accident.

IX.3.2. RISK MATERIALS, EQUIPMENT AND PRODUCTS USED

The characteristics of the various installations to be used are listed in the following table.

Table 34: Characteristics of the facilities planned by the project

Installation	Usefulness	Features and characteristics	
Power plant	Night lighting of the tarmac Emergency electricity	140 kVA generator set	
Pumping station	Feeding of tank trucks to refuel aircraft	Connected to the tanks by an underground pipe	
		Pump flow rate	20 m3/h
Storage of JET A1	Refuelling of turbine aircraft	Storage capacity	2x 50 ^{m3}
		Method of storage	Aerial

AVGAS 100 LL will be used for aircraft equipped with piston engines. This fuel will not be stored on site. If necessary, it will be delivered in 200-litre drums.

IX.3.3. RISKY PROCESSES

The landing and take-off phases are the most risky stages in aircraft navigation. Other potentially dangerous processes such as refuelling and aircraft refuelling are practised in the airport.

Manoeuvring within the movement area is also a risk process because crossings between vehicles, people and aircraft can lead to serious accidents depending on the intensity of the impacts.

IX.3.4. FACILITIES AND UTILITIES FOR THE PROJECT

The smooth running of activities around the aircraft is facilitated by vehicles with various functions.

An empty toilet vehicle will be provided to allow the aircraft to be emptied. This activity will be done at a height of about 5 m.

Aircraft tractors are vehicles used to push or tow the aircraft to its departure area or to transport it between areas remote from the airport.

The airport will have a refuelling truck to supply the aircraft with fuel, drawn from the pumping station. This truck has a lifting platform to access the refuelling outlets under the aircraft's wings.

The project also includes three (03) fire vehicles, one drinking water vehicle to supply the aircraft at a height of approximately 5 m, and an ambulance.

IX.3.5. HAZARDOUS WASTE GENERATED

Hazardous waste generated at the airport includes maintenance waste (waste oils, oil/fuel filters, soiled rags and packaging, batteries), and waste from electrical and electronic equipment (WEEE), as well as batteries, fluorescent tubes and lamps. These wastes are those that present one or more hazardous properties represented by danger pictograms (explosive, flammable, dangerous for the environment, toxic, carcinogenic, etc.). If not properly treated, this waste can cause harm to people and the environment.

IX.4. IDENTIFICATION AND CHARACTERIZATION OF POTENTIAL HAZARDS

IX.4.1. SOURCES OF EXTERNAL HAZARDS

IX.4.1.1. NATURAL EXTERNAL HAZARDS

IX.4.1.1.1. POOR WEATHER CONDITIONS

Poor weather conditions such as gusts of wind, heavy rain, fog, dust, etc. can reduce visibility, hinder airworthiness and lead to potential accidents.

Because of the airport's proximity to the river, a flood of the river can cause the runway to flood. This will lead to the temporary closure of the site, the diversion of aircraft to the nearest airports and a risk of damage to the facilities. Lightning is an atmospheric manifestation of electricity, with an electrical discharge accompanied by bright light and a violent detonation. It can fall directly onto the ground, structures or power lines. In all these cases, the consequences can be harmful through propagation by radiation or by the conductor.

Airport runways are large, sensitive open spaces that can be struck by lightning during an electrical storm. The effects of lightning (thermal, electromagnetic, electrodynamic, etc.) can lead to consequences such as fire, burns, destruction of electrical equipment, breakdown, electrocution, hearing and eye damage, etc.

Weather control is essential for air traffic. Rigorous monitoring of these, using sophisticated equipment, is therefore essential in addition to visual observations. It is necessary to provide a storm detector to prevent a storm from occurring and thus limit damage. The constructions will have to be adapted to the type of soil in order to avoid the premature ruin of the installations and buildings to be installed.

IX.4.1.2. NON-NATURAL EXTERNAL HAZARDS

IX.4.1.2.1. HUMAN ENVIRONMENT

The airport is located in a highly urbanized environment. The airport is as much a danger to this population as it is to it; through its buildings, its activities and its attitudes.

High-rise buildings and cultivation activities around the airport are not compatible with the facility. Indeed, the floors are shielded from the pilots' visibility. In addition, cropping areas are favorable places for birds whose presence can cause an avian risk.

In fact, tree, shrub and thick herbaceous vegetative thickets are used, directly or indirectly, for various species of birds, as nesting sites, perches, quiet oases in relation to the agglomeration, foraging sites, dormitories, etc. Some species also find on the site or its surroundings, others with their specific needs such as water. Their stay may of course be seasonal, but constitutes a definite risk for aircraft.

The anthropisation of the immediate airport environment and the lack of sanitation systems for household waste are leading people to create illegal landfills around their homes. However, they are not only attractive places for birds but also places for feeding.

Malicious populations may also try to break down the fence wall to shorten their path. This will lead to the intrusion of animals, free access of foreigners to the airport, and weaken security within the airport.

IX.4.1.2.2. ACTIVITY AREAS

The Dakar-Bango military camp is located northeast of the airport. It will be considered an asset since it will enhance security.

Domestic livestock farming and cultivation activities in the vicinity of the site are not recommended. In the event of a breach in the airport fence or a lack of vigilance on the part of the guards, animals can enter the site and create accidents, resulting in clashes between living beings and vehicles/aircraft or even create panic among passengers and employees.

Cultivation activities attract birds, which remain enemies of aviation. They can collide with aircraft and cause harmful consequences.

IX.4.1.2.3. PROXIMITY TO THE RIVER

The proximity of the river to the airport can be a problem as this body of water can be attractive to birds.

However, this risk may be unlikely given that the project area is not very rich in avifauna resources.

In the event of a flood, the river can also spill over the airport and flood it. Preventive measures adapted to this environment will have to be taken into account.

In the event of a crash on the river, the airport must be able to intervene. Suitable aquatic immersion equipment must then be provided.

IX.4.2. SOURCES OF INTERNAL HAZARDS

The risks that may arise from activities related to the operation of the airport would be due to the use of aeronautical platforms, refuelling and aircraft refuelling. The storage and handling of fuel involves potential risks that must be taken into account.

IX.4.2.1. CHARACTERISTICS OF THE HAZARDOUS PRODUCTS USED

Based on the Safety Data Sheets (SDS), the physico-chemical characteristics of the products used are discussed below.

IX.4.2.1.1. PHYSICAL AND CHEMICAL CHARACTERISTICS OF JET A1[35]

- **Description**

JET A-1, also known as jet fuel or commonly kerosene, is the most widely used aviation fuel. It is suitable for jet-powered aircraft and turbine-powered helicopters.

Kerosene is lighter than diesel, but heavier than gasoline. It is located in the refining section between diesel and gasoline. It is a product that meets particularly stringent international specifications.

[35] SDS n°: 30141-TOTAL

Due to its extreme operating conditions at high altitudes (low temperature and air pressure), it is strictly controlled at several stages during its manufacture, transportation, storage and loading. This operation is carried out by bunkering companies that require very specific personnel and equipment.

Physico-chemical properties

This product is flammable. The friction due to its flow creates static charges capable of generating sparks causing ignition or explosion. Kerosene vapours can also form explosive mixtures with air.

Table 35: Physico-chemical properties of JET A-1

Physical state: Liquid	Auto ignition temperature: >230°C
Appearance: Clear	Evaporation rate: Not applicable
Color: Colorless to light yellow	Hydrosolubility: Not applicable
Odor: Characteristic	Explosive properties: Not considered explosive depending on oxygen content and chemical structure
Boiling point/boiling range: 130-300°C	
Flash point: ≥ 38°C	

Extinguishing media

For small fires, it is recommended to use carbon dioxide, dry powder, sand or earth as a means of extinguishing.

In case of fire extension, the most appropriate extinguishing media are foam and water mist, which should only be used by trained personnel.

It is strictly forbidden to use a water jet stick because it could spread the fire instead of putting it out. The simultaneous action of foam and water on the same surface is prohibited because they are not compatible.

Decomposition

Incomplete combustion and thermolysis produce more or less toxic gases such as CO (carbon monoxide), CO_2 (carbon dioxide), various hydrocarbons, aldehydes and soot.

At high concentrations or in a confined atmosphere, their inhalation is very dangerous. If sulphur compounds are present in significant quantities, the combustion products may contain H2S (hydrogen sulphide) and SOx (sulphur oxides) or H2SO4 (sulphuric acid).

Incompatibility, reactivity

This product is stable under recommended handling and storage conditions. However, it is incompatible with strong oxidants, strong acids, strong bases, herbicides, halogens, etc.

It does not react dangerously under normal conditions of use. Conditions to avoid are heat (temperatures above flash point), sparks, flash points, flames and static electricity.

Toxicity

Acute exposure studies show no evidence of systemic toxicity, other than the possibility of causing central nervous system depression and narcosis with exposure to higher concentrations. Repeated-dose toxicity of the substance was studied after oral, dermal and inhalation exposure of different durations. Only moderate to severe skin irritation was observed.

By suction, fluid can enter the lungs and cause damage (life-threatening chemical pneumonia).

Potential health and environmental effects

Prolonged or repeated contact with this product may cause skin irritation. Its vapours or mists are irritating to the mucous membranes of the eye in particular. It causes risks of depression of the central nervous system with the appearance of nausea, headache, dizziness, vomiting and loss of coordination.

In case of accidental ingestion, the product may be aspirated into the lungs due to its low viscosity and cause serious lung damage within hours (medical supervision required for 48 hours).

This product is toxic to aquatic organisms. It can cause long-term adverse effects on the environment. It is then advisable not to reject it.

IX.4.2.1.2. PHYSICAL AND CHEMICAL CHARACTERISTICS OF AVGAS[36]

- **Description**

AVGAS 100 LL also known as aviation gasoline is a gasoline specially designed for piston aircraft engines. It is a special blend with a high performance index, produced in refineries. It has very low levels of benzene and sulphur. It is very volatile and decomposes rapidly in air.

The AVGAS 100 LL is distinguished in airport distribution stations by its white lettered label on a red background.

This distinction is intended to avoid any risk of confusion with JET A-1, which is marked in white letters on a black background. The "100" rating is that of aviation octane and "LL" stands for Low Lead.

- **Physico-chemical properties**

This product is extremely flammable and sensitive to static electricity. It can accumulate electrostatic charges and possibly cause ignition. The choice of container (e. g. storage tank) can affect the accumulation and dissipation of static electricity.

This extremely flammable product can release vapours that quickly form flammable mixtures.

Accumulated vapours may cause instantaneous vaporization or explode if ignited. Vapours may spread along the ground to a distant ignition source and then flash back. AVGAS 100 LL is considered dangerous under the regulatory guidelines.

Table 36: Physical and chemical properties of AVGAS 100 LL

Physical state: Liquid	Auto ignition temperature: 439°C
Color: Clear (can be colored)	Hydrosolubility: Negligible
Odor: Oil/Solvent	Flash point: -42°C
Boiling point/boiling range: 70-170°C	

- **Extinguishing media**

Suitable extinguishing media in the event of a fire are water spray, foam, dry chemical powder and carbon dioxide. Extinguishing with direct water jets is inappropriate for an aviation gasoline fire.

In the event of a fire, it is also advisable to evacuate the area and spray water to disperse the vapours and protect those responsible for sealing the leak, if it has not ignited.

[36] FDS Aviation Gasoline 100 LL-Imperial-01/12/2017

Decomposition

The substance does not decompose at room temperature. The hazardous combustion products are aldehydes. In the event of incomplete combustion, carbon oxides, vapours, fumes and sulphur oxides are released.

Incompatibility, reactivity

AVGAS is stable under normal storage and use conditions. However, it is incompatible with materials such as alkalis, halogens, strong acids and strong oxidizers. Conditions to avoid are heat, sparks, flame and static electricity accumulation.

Toxicity

Based on the evaluation of the components, this product is considered to be of minimal toxicity but irritating to the skin and may cause mild short-term eye discomfort. It can be fatal if swallowed or if it enters the respiratory tract.

Potential health and environmental effects

Injection under the skin at very high pressure can cause serious injury. This product may irritate the eyes, nose, throat and lungs.

Health studies have shown that exposure to this chemical can cause human health risks that vary from person to person. This product is toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

Table 37: Summary of hazards related to the products used

Product	Physical state	Symbols/Hazard symbols	Risk Phrase R	Toxicity	Hazard statement H	Precautionary statement P
JET A-1	Liquid		**R10; R38; R51-53 R65**	Toxic to the environment, especially the aquatic environment	**H226** **H304** **H315** **H336** **H411**	**P210** **P261** **P280** **P301 + P310** **P331** **P273** **P501**
AVGAS 100 LL	Liquid				**H224; H225; H300(2) ;H304** **H310(1); H315; H330(1)** **H336 ;H360(1A)(D) ;H361(F)** **H373; H400; H401; H410** **H411; H412**	**P210; P233; P240; P240**; **P241; P242;** P243; **P260**; **P264; P271; P273**; **P301 + P310; P302 + P352 ;** **P303 + P361 +P353** **P304 + P312** ; **P332 + P313** ; **P362 + P364** **P370 + P378** ; **P403 + P235** ; **P405;** **P501**

IX.4.2.2. DANGERS RELATED TO REFUELLING

Fuel handling is associated with a risk of pollution in the event of a product spill. This accident can occur in the unloading area, in the distribution circuit or in the storage tank.

In fact, tank corrosion or a defect in the pipe can cause the hydrocarbon to be spread. The degree of pollution will depend on the quantity involved in the spill or leak.

Fuel dumping, tank truck refuelling and aircraft refuelling are hazardous processes that can result in fuel spillage, poisoning and severe burns if safety conditions are not met. Indeed, the unloading of fuel must comply with instructions and methods in order to ensure safe filling.

In the presence of an ignition source or under high temperature, the hydrocarbon can catch fire, cause a fire or explosion of a tank which will cause, in addition to material damage from human damage, soil pollution by fire extinguishing water, as well as air pollution by combustion smoke.

The refuelling of aircraft (100 LL or kerosene) is an often underestimated and dangerous operation. But, as part of this project, the filling of aircraft tanks with AVGAS will be done via a manual pump as drums will be used.

Fuelling aircraft poses significant risks because they are powered under pressure (between 3 and 10 bars depending on the type of aircraft) using pump trucks and rigid pressurized connections, close to the engines. This pressurized filling system presents the risk of possible fuel leaks being projected at a long distance from the filling point. This factor is therefore a contributor to the risk of fire, since engines are potential sources of fire.

IX.4.2.3. DANGERS RELATED TO THE SERVICE STATION

The pumping station will be supplied from the kerosene storage tanks via an underground pipeline. This distribution station will be used to refuel the tank trucks, which will then refuel the aircraft.

Accidental risks related to service stations include fire, explosion, water pollution, air pollution and soil pollution. They can be induced by an accidental fuel spill or by the emanation of explosive vapours in the presence of static electricity or ignition sources.

Chronic risks include health risks related to volatile organic compound (VOC) emissions, water, air and soil pollution, and pollution related to fuel flows.

Cell phones, although unlikely, can also be a source of danger. Handling them near gas stations or fuel storage areas can theoretically produce sparks that are capable of igniting the emitted vapours. Cell phones with an indicator light that lights up when they are in working order or when they ring emit enough energy to produce a spark.

IX.4.2.4. HAZARDS RELATED TO THE USE OF THE MOVEMENT AREA

The airport runway, one of the components of the manoeuvring area, is used for aircraft landing and take-off. It is one of the most at risk parties in aviation. In fact, poor air traffic control and traffic management can lead to runway accidents. There are a series of fairly complex and closely related causes such as airline operations, a lack of vigilance and a lack of communication that are at the root of runway accidents.

Indeed, any abnormal presence of an aircraft, vehicle or individual on the runway and the corresponding protected area is a source of conflict and can lead to collisions or strikes. Also, at the time of take-off or landing, aircraft are likely to make unintentional runway excursions that may sometimes be without consequences provided that they do not encounter any obstacles in their path.

The apron is the area of highest intensity and variety of movement. It is the only place where airport employees, passengers, vehicles, aircraft and sometimes casual visitors cross and pass each other. Coactivity in this space leads to risks of collision between aircraft, collisions between aircraft and vehicles as well as collisions between aircraft, vehicle and people. This area is an area with a high probability of accidents.

IX.4.2.5. FOREIGN OBJECT HAZARDS ON AIRCRAFT TAXIWAYS

FODs, also known as foreign object debris, are materials or objects that can be sucked up by an aircraft engine or cause damage to an aircraft's structure. To be more explicit, FODs are bulk materials (padlocks, glasses, plastics, labels, metal, tools, stone fragments, suitcase debris, coins, soda cans, etc.).) that can be sucked up by an aircraft engine or cause damage to the aircraft structure. They represent a danger to aircraft on both landing and take-off because they can cause engine failure, aircraft destruction and accidents that can result in injury or death.

Freight operations, cleaning and maintenance of aircraft generate FOD. Poor maintenance of the movement area promotes the incursion of this debris into the open areas of the aircraft, leading to accidents.

IX.4.2.6. DANGERS RELATED TO COACTIVITY AROUND THE AIRCRAFT

Working together around the aircraft exposes pedestrians and vehicle drivers to the risks generated by simultaneous activities. These risks may lead to others or reinforce those specific to each activity.

Working near moving vehicles, machinery or equipment involves risks that can lead to serious accidents.

Coactivity leads to exposure to noise and exhaust gases. It also encourages traffic on congested areas when neither procedures, nor traffic plans or preliminary consultations have been established between the various platform stakeholders.

In a coactivity, the most prevalent dangerous situations are the presence of hot spots in the event of refuelling, track congestion, noise generation and exhaust fumes. Possible damage in the event of an accident is the appearance of burns or serious trauma, open wounds, etc.

IX.4.2.7. DANGERS RELATED TO ELECTRICAL INSTALLATIONS

Electrical installations can cause short circuits or electrification if insulation systems are not properly installed or the electrical network is undersized. These electrical risks can cause fires, destruction of equipment or even injuries.

IX.4.2.8. DANGERS RELATED TO HUMAN ERROR

Many ground incidents at airports are due to human failure. They may be related to the behaviour of the pilot, air traffic controller, ground agents, etc.

Failure to follow procedures and miscommunication can lead to disastrous incidents and accidents.

Lack of communication during simultaneous work or incompetent agents can lead to errors.

IX.5. ACCIDENTOLOGY AND FEEDBACK

The feedback is an open window on accidentology in various sectors of activity around the world. It makes it possible to learn from past experiences by reviewing the various technological accidents listed, in order to know their causes and consequences. This feedback thus provides an opportunity to identify any weaknesses in an organization with a view to strengthening the prevention and protection system against failures (human, technical or organizational), in order to improve risk management.

Such information is taken into account in the preliminary risk analysis and helps to propose the best possible options to prevent or combat these types of accidents and protect the environment and possible targets.

IX.5.1. METHODOLOGY

Research on the accidentology of this project to rehabilitate the Saint-Louis airport was carried out from several sources, including:

- the ARIA database of the Office of Industrial Risk and Pollution Analysis (BARPI), which lists technological accidents that have occurred in various countries around the world (see http://aria.developpement-durable.gouv.fr);
- the French website http://www.crash-aerien.aero which lists air accidents and incidents;
- the website http://airinfo.org which deals with news on French and international civil aviation;
- the database of the Office of Investigation and Analysis for Civil Aviation Safety (BEA), which lists several types of accidents and incidents related to the aviation industry (see https://www.bea.aero/).

Documents, the press and scientific publications relating to events in the aviation industry were also consulted.

Several types of accidents have been taken into account in the sector. These accidents and incidents have been identified from a variety of sources.

Some details of the selected accidents are given in the annex to this report.

IX.5.2. ACCIDENTOLOGY RESULTS

The results of the accidentology reveal the existence of several accidents and incidents that have occurred in this sector of activity. The types identified are multiple and come from different causes.

According to the results of the accidentology, most accidents occur at the airport and during landing, taxiing and gluing. An analysis of these different results is provided in the following paragraphs.

IX.5.3. IDENTIFIED INCIDENTS

The incidents recorded have several origins and most often take place in mid-flight and a few times on the ground. In the accidentology results concerning the incidents, several cases developed below have been reported.

IX.5.3.1. RETURN BY PLANE TO THE AIRPORT

Aircraft that have already taken off have had to return to the airport due to various causes, such as technical problems, most often related to the engine or poor maintenance of the aircraft. A return case was also detected following a pilot's discomfort.

IX.5.3.2. AIRCRAFT DIVERSION

Aircraft were forced to land at the nearest airport during their flight due to technical problems during the flight. Most of these are hydraulic leaks.

Other causes of aircraft diversions such as bird ingestion in an engine or a smell of smoke inside the aircraft have also been detected.

IX.5.3.3. RUNWAY EXCURSION

Runway exits during take-off and landing have been noted and the causes are unknown.

A report published by the BEA indicates that 62 runway overruns occurred, 44 of which were reported to have resulted from a loss of control of the aircraft pilot during the landing roll.

IX.5.4. ACCIDENTS RECORDED

Several types of accidents have been identified through the review of accidentology. For the most part, the cause is unknown. The consequences range from minor injuries to human death and destruction of equipment.

An analysis of the various accidents identified is made in the following paragraphs.

IX.5.4.1. CRASH

According to the results of the accidentology, an aircraft crash with unknown causes caused 38 deaths and material damage. Another plane that missed its airstrip ended up in a village, killing 32 people and losing equipment.

Other results reveal that after a failed landing, an aircraft landed abruptly on a gas station, killing 200 people and causing the aircraft to burn quickly.

Senegal has had to record a few cases of aircraft crashes, some of which are listed below.

On September 05, 2015, a plane of Air Senegal disappeared, after a collision in flight with a 737-800 of the Equatorial Guinean company Ceiba Intercontinental which operated the Dakar-Cotonou (Benin) route. The Air Senegal aircraft on a medical evacuation flight from Ouagadougou, Burkina Faso to Dakar has disappeared from the radar and the seven (07) people on board are reported dead. The BEA's report, following his expertise, revealed that the pilot had not followed his flight plan.

On February 01, 1997, an Air Senegal Hawker Siddeley 748 crashed into the ground thirty seconds after takeoff from Tambacounda airport. The causes are not stated, however, there were 23 deaths and serious injuries.

In February 1992, an aircraft crash occurred at Cape Skirring. A Club Med plane on its way to a holiday village in Cape Skirring crashed, killing about 30 people and injuring 26, some of them seriously. The aircraft was not in compliance with safety standards and the 67-year-old pilot had exceeded the age limit, was "near-sighted and practically deaf" according to the Senegalese investigation commission. He could have confused the lights of a road with the track (source http://www.crashdehabsheim.net). According to the judicial inquiry and testimonies of former passengers who had alerted ClubMed, the flight to the "Cap Skirring" had for years been very frequently subject to technical problems without unduly affecting the organisers of trips to Cap Skirring.

IX.5.4.2. COLLISION

On the ground and in the air, aircraft can be subjected to impacts that can be violent. The results of the accidentology showed the existence of a collision between an aircraft and a truck on the runway but also the passage of an aircraft in a turbulent area.

The causes of the impact between the aircraft and the truck were not mentioned, but this accident resulted in 8 injuries in the truck but none in the aircraft.

The turbulence occurred in a clear area. So it was unpredictable. As a result, passengers were unable to fasten their seat belts in time; 27 people were injured in this accident.

IX.5.4.3. AVIAN RISK

According to a document on waste management with regard to aeronautical avian risk published in 2015 by the CGEDD, avian risk is a major risk for international civil aviation. It has caused 79 accidents worldwide since 1960, with more than 210 victims. In France, on average over the period 2003-2013, there were 650 collisions each year. 8.8% of collisions are classified as serious, with damage to the aircraft.

In the United States, according to the same document, there were 137,000 collisions between birds and aircraft between 1990 and 2013; more than 10,000 in 2013, 62% by day, 9% at nightfall, 29% at night, 92% at an altitude below 1,000 m. They caused 25 deaths, 279 injuries and significant damage to 62 aircraft with damage estimated at an average of $1 billion per year.

At the same time, according to a study commissioned by ASECNA in June 1995 on the control of bird risk at ASECNA airports, it was found that this risk was indeed present at Léopold Sédar Senghor airport in Dakar and that the maximum number of significant incidents is still reported in September/October, during and after the rainy season. This report was based on the results of research on the collision rate on 10,000 movements of Air France aircraft. Of these 10,000 movements through several airports, LSS recorded collisions between birds and aircraft; statistics by year are presented below:

- Year 1993 (Dakar LSS airport): 30 per 10,000 ;
- Year 1994 (Dakar LSS airport): 50 per 10,000.

This report mentions that the LSS airport was a good place to attract birds because of its configuration and its highly urbanized neighbourhood. Thus, birds would find their nesting and resting places through trees and wild dumpsites and other areas. For Dakar Yoff airport, various factors and contextual elements seemed to be major factors attracting birds to the airport site.

IX.5.4.4. Fire

Fires under different conditions and involving various airport equipment and premises have been reported. For some accidents, the causes are unknown.

The following table summarizes the various types of fires identified in the reports.

Table 38: Airport Fires

Type of fire	Causes	Consequences
Aircraft fire on landing	Technical failure of the aircraft-wing collision with the fence wall	3 slightly injured Apparatus totally destroyed
	Poor weather conditions Forced landing	No injuries Material destroyed
Fire in an airport restaurant	Unknown	Spread of fire to neighbouring shops Panic, flight delays
Fire in one of the airport offices	Unknown	No injuries were reported. Flights redirected to other airports
Airport Fire	Criminal origin	Destruction of the electronic landing system
Fire in an airport parking lot	Unknown	Destruction of cars
Fire in a tank truck during refuelling of an aircraft	Unknown	No injuries or material damage to the aircraft
Fire in an airport hangar	Inflammation of white-spirit vapours, used when cleaning an aircraft	9 people injured
Aircraft fire in a maintenance hangar	Unknown	1 seriously injured 2 planes destroyed by fire 2 planes destroyed by the collapse of the hall
Fire in the computer system that controls runway lighting	Unknown	Aircraft diverted to other airports
Airport fuel depot fire	Leak in a valve pit and ignition by electric motor	Hydrocarbon spill Damage to tanks

Other fires involving premises within the airport have been identified without providing information on their causes or consequences.

IX.5.4.5. Explosion

The only reported explosion is that of an oxygen cylinder in an aircraft in mid-air. The causes have not been stated. The aircraft that had some damage must have landed at the nearest airport.

IX.5.4.6. Kerosene spill

Kerosene spills have been noted as a result of various factors such as tank truck rollover due to driver mismanagement, human errors in valve handling, tank level sensor malfunctions and flange seal failures.

These kerosene discharges, sometimes on the ground, have resulted in soil and water pollution because in some cases the hydrocarbon has entered the rainwater pipeline and mixed with seawater in other cases.

IX.5.5. SYNTHESIS ON THE FEEDBACK OF EXPERIENCES

Of all the accidents recorded in the airport environment, fires are the most prevalent with the greatest impact on equipment. Human casualties are most often observed during aircraft crashes. The incidents did not reveal any human consequences. Bird hazard is a present risk and is capable of causing several damages.

The lessons to be drawn from the feedback are that these types of accidents or incidents are indeed possible at the Saint-Louis airport and that preventive measures should already be taken into account in order to avoid them or limit the consequences in the event of an accident. The following would also be necessary:

- to fight against the avian danger;
- to implement a wildlife management program with habitat modifications and relocations;
- to provide methods for dispersing or spacing birds to reduce aviation safety risks;
- to rigorously inspect aircraft after each landing and before takeoff;
- to raise awareness among all airport managers of the usefulness, implementation and use of procedures for each activity;
- to set up a specific regulatory environment for the operation of airport equipment;
- to ensure that pilots are cleared, in particular in terms of approach stabilization and landing technique control when weather conditions are unfavorable and in landing rolling technique;
- to compartmentalize the airport;
- to provide a fire detection system and an automatic extinguishing system where necessary;
- to provide mobile fire or panic response teams;
- to put a containment tank in the hydrocarbon storage air;
- Etc.

IX.6. PRELIMINARY RISK ANALYSIS

Risk can be defined as the possibility of damage occurring as a result of exposure to the effects of a dangerous phenomenon. Indeed, it is the cross between the probability of occurrence of a dangerous phenomenon and the severity of its induced effects.

Preliminary risk analysis is the quantification of all the causes and consequences of dangerous phenomena feared in the installation or that could come from its equipment. Thus, it makes it possible to list the different risks and classify them according to a flat-rate hierarchy through a rating grid; this then makes it possible to define the different risk categories as indicated in Senegal's hazard study guide.

Its argument is based on the identification of potential hazards, accidentology and issues.

As a result, the PRA makes it possible to classify the risk according to a rating grid and, at the same time, to rank them according to their criticality degree defined by the color assigned to them.

It makes it possible to confirm or deny the existence of major risks, i.e. the feasibility or not of a detailed risk study. At the same time, the PRA makes it possible to provide means of prevention against feared events and means of protection against the effects of probable dangerous phenomena.

Following the results of the PRA, only the most significant feared events will be analysed in detail. These provide information on the most likely hazardous phenomena that occur in the facilities.

For each component of the project, it is a question of identifying:

- the feared events;
- the dangerous phenomena that result from it;
- their causes, the preventive measures planned by the project and completed by the consultant;
- the consequences, the control measures planned by the project and completed by the consultant.

IX.6.1. METHODOLOGY

IX.6.1.1. ESTIMATION OF THE RISK LEVEL

Estimating the level of risk amounts to making a rating on the basis of which risks will be prioritized. Beforehand, the installation must be divided into systems to better understand the likely risks. The estimation is done according to several methods.

The Preliminary Risk Analysis (PRA) is the method used in this hazard study for the rehabilitation of the Saint-Louis airport.

The results of the PRA make it possible to identify the feared events, the dangerous phenomena induced as well as the harmful effects that they can generate.

Thus, depending on the severity of the effects and their probability of occurrence, flat-rate values will be assigned and will be entered in a grid in accordance with the Senegalese hazard study guide. The allocation of these scores is also based on information obtained from feedback on accidents that have occurred in other similar facilities.

Table 39: Risk allocation grid[37]

Probability scale (P)		**Gravity scale (G)**	
Score	Meaning of the word	Score	Meaning of the word
1 = unlikely	-Never seen in this industrial sector; -Almost impossible in the establishment	1= negligible	-Minor impact on staff -No downtime -Low environmental impact

[37] Source: Senegalese Hazard Study Guide

Probability scale (P)		Gravity scale (G)	
Score	Meaning of the word	Score	Meaning of the word
2 = rare	-Already met in this industrial sector; -Possible in the establishment	2 = minor	-Medical care for staff -Minor damage -Small loss of products -Minor environmental effects
3 = occasional	-Already met in the establishment; -Occasional but may occur occasionally in the facility	3 = important	-Seriously injured personnel (extended work stoppage) -Limited damage -Partial shutdown of operations -significant environmental effects
4 = frequent	-Arrives two to three times in the establishment	4 = critical	-Disabling injury for life, (1 to 3 deaths) -Significant damage -Partial shutdown of operations -significant environmental effects
5 = constant	-Arrives several times a year in the establishment (more than 3 times a year)	5 = catastrophic	-Several deaths -Extensive damage -Long production shutdown time

The combination of the two scores assigned to each risk factor will allow it to be rated as tolerable, significant or unacceptable risk according to the color code assigned to it in the following table.

Table 40: Risk Rating Grid[38]

Risk level		Consequences				
		5	4	3	2	1
Probability	5					
	4					
	3					
	2					
	1					

By crossing probability and severity, the risk incurred will be on one of the three levels represented by the following colors.

Green: **tolerable risk;** According to Senegal's hazard study guide, no action is required.

Yellow: significant risk; According to the guide, a short, medium and long-term reduction plan must be implemented.

Red: high, unacceptable risk; Any risk contained in this red section is considered major and therefore, in accordance with the guide, a detailed study including the development of accident

[38] Source: Guide d'étude de dangers du Sénégal

scenarios that could lead to it is required. Subsequently, prevention and protection measures must be immediately put in place to reduce and control the risk.

IX.6.1.2. SYSTEM BREAKDOWN

In order to better understand the risks, especially those that are major and induced by the various components of the site, the airport will be subdivided into different systems reflecting the different platforms or activities that are developed there. These systems are as follows:

- System 1: Aeronautical platforms;
- System 2: Fuel depot, storage and refuelling of aircraft;
- System 4: Internal and external circulation.

IX.6.1.3. PRESENTATION OF THE RESULTS

The results of the PRA are recorded in the table below. The identified feared events were analyzed in order to know their causes and consequences. Means of prevention directed against these dangerous events and of controlling the consequences have been proposed.

Table 41: Preliminary risk analysis

System 1: Aeronautical platforms													
N°	**Feared event**	**Causes**	**Consequences**	**Kinetics**	**Pi**	**Gi**	**Ri**	**Preventive measures**	**Pf**	**Measures to control the consequences**	**Gf**	**Rf**	**Residual risk**
1.1	Runway accidents : Incursion Runway Excursion	Lack of crew vigilance Failure to communicate Presence of obstacles on the track Poor weather conditions Technical problems	Collision Aircraft fire Injuries	Fast	3	3		Adopt air traffic control and management systems and processes Leave the runway strip and RESA free of obstacles Ensure the authorization of all personnel involved Carry out a roadworthiness test on each aircraft before takeoff and as soon as it lands Provide a sufficient supply of foamer	2	Provide an ambulance and a fire-fighting vehicle for each movement on the runway	2		Material damage
1.2	Presence of foreign bodies in the manoeuvring area	Incivility of passengers Poor pavement maintenance Poor waste management	Damage to the reactor Partial or total destruction of the aircraft	Slow	4	4		Implement a debris risk prevention plan Training of people working on the movement area	2	Medical assistance for the injured Rapid removal of any debris on the runway	3		Damage to equipment

			Injury or loss of life					Organisation of awareness campaigns Pavement surface maintenance Provide automated foreign object detection systems Provide secure bins for the collection of FODs Regular and daily inspection of the runways					
1.3	Accident	Coactivity in the apron	Material damage Injuries Spreading fuel Fire and fire	Fast	4	3		Establish procedures for each activity Communicate between the different stakeholders in a platform Avoid uncontrolled storage and track congestion Periodically train and sensitize staff	2	Immediate intervention by the emergency services	2		Minor damage
1.4	Invasion of birds or	Breaches in the fence area	Avian risk Wildlife risk	Fast	3	4		Implement a plan to prevent animal danger	2	Use frightening techniques	3		Limited damage

	animals on the track	Presence of vegetation on or around the site Presence of a landfill near the site	Injuries Damage to the device					In collaboration with the municipality, avoid the establishment of cultivation and landfill fields in the vicinity of the airport Carry out periodic weeding within the site enclosure Establish an airport waste management policy		Immediate assistance to the injured			
1.5	Aircraft crash	Poor weather conditions Device failure Pilot Inadvertence Lack of fuel	Injuries Human loss	Fast	2	5		Have sophisticated equipment for monitoring weather conditions Inspect the condition of the aircraft before takeoff and landing Check the fuel supply Insure yourself against people working on the plane	2	Mobilize emergency resources Implement the emergency plan Securing the area	4		Significant damage
System 2: Fuel depot, storage and refuelling of aircraft													

2.1	Spill of kerosene when refuelling tanks or tank trucks	Overturning of the tank truck Incorrect handling of the valves Level sensor malfunction Wear and tear on the discharge hoses Loss of tank containment Lack of reliability of the tank Shock, projectile impact or tank corrosion Removing the supply pipe	Spreading the product on the ground and pollution Fire if ignition source present	Fast	2	4		Set up procedures for the unloading Mark the unloading area Limit access to the storage area Ensure the good condition of tank trucks and related accessories for manoeuvring Post in a visible place the safety instructions to be observed before, during and after the operation Put hazard pictograms corresponding to the risks associated with the activity Carry out regular inspections and maintenance of the tank Store the tanks on a sealed retention with product recovery device	2	Immediately use the anti-pollution kits Emergency stop of the petrol station pump Recover the spilled product Alert the fire department Clean up the contaminated area	2		Minor environmental effects

								Respect the dimensions of the retention in accordance with the regulations Ensure that the emergency switch on the service station pump is working properly					
2.2	Fire in the fuel storage area: Bowl fire Tank fire	Kerosene spill in the presence of ignition source Heating of the tank due to the propagation of a fire Static electricity Lightning impact Malicious act Malfunction of an electrical installation in the vicinity of the tank	Emission of toxic smoke Emission of dangerous heat flows Risk of fire extension to other installations Appearance of Boil over Shock wave emission Impact of projectiles in the event of an explosion	Fast	2	5		Provide, after proper sizing, fire-fighting equipment (RIA, fire extinguishers, hydrant, specialized fire vehicle, foam tank, etc.) Prohibit smoking or approaching open flames in fuel handling and storage areas Ensure staff empowerment Maintain a security logbook Installing a lightning rod	2	Activate fire-fighting means Vigilance of airport firefighters Evacuate injured persons Implement the emergency plan Trigger the POI	4		Material damage Injuries

								Put the earth clamp to balance the electrical potential Keep the fuel tank away from other hazardous installations					
2.3	Leak of pressurized fuel during aircraft refuelling	Procedural error Poorly executed manoeuvre Uncoupling the hose Equipment failure	Pollution	Fast	2	3		Establish organisational and safe procedures for refuelling aircraft Quality control of distribution hoses Ensure electrostatic protection	2	Interruption of refuelling as soon as a leak is detected Stop the leak and recover the spilled product Provide fire-fighting equipment during refuelling	2		Small loss of product Limited pollution
2.4	Human error in refuelling procedures	Incorrect operation Distraction Lack of experience Incompetence Fatigue Stress	Fuel leakage Fuel spray to the still hot engines and ignition of kerosene		2	4		Fuelling the aircraft when it is stopped, the engine cooled and empty of any person Ensure staff empowerment Regularly train and sensitize staff Establish good coordination between the crew and fire safety personnel before refuelling	2		2		Limited damage

								Periodic check of the good condition of fire-fighting equipment Visual check before each refuelling of the fixed installation of the foam lance and the condition of its hose					
2.5	Emanation of kerosene vapours in the pumping station	Static electricity Presence of mobile phones Presence of smokers in the vicinity	Fire and fire	Fast	2	4		Turn off the engineDo not smoke Prohibit the use of cell phones in this area Provide fire-fighting facilities	2	Immediate intervention by the emergency services	3		Limited damage
2.6	Presence of electrical arcing during the filling of the storage tank or tank truck	Static electricity accumulation in the filling line	Fire and fire	Fast	3	4		Place the earth clamp to balance the electrostatic potential Ensure staff empowerment Ensure the availability of fire-fighting equipment	2	Use fire-fighting methods to smother the fire Rapid response by emergency services	3		Limited damage

2.7	Lightning impact	Natural phenomenon	Overcurrent overcurrent Fire and fire Injuries	Fast	2	4		Avoid refuelling during the storm Equip the site with lightning rod Install surge protectors at electrical equipment requiring them	2	Immediate repair of damaged equipment Emergency response to injuries	2		Limited damage
System 3: Internal and external circulation													
3.1	Malicious act Sabotage	Human action Failure to comply with airport security Lack of vigilance by security guards	General panic Accidents Accidents Airport closure	Fast	3	4		Provide space for Customs, Police, Gendarmerie, Health Services Provide the airport with the latest generation equipment to ensure safety Make periodic external and internal rounds Conduct simulation exercises to be prepared in the event of a real threat	2	Implement the airport emergency plan	3		Panic Limited damage
3.2	Accident during refuelling	Human error Mechanical failure of the tank truck	Soil pollution Fire and fire Injuries	Fast	3	4		Establish procedures for fuel convoys Install traffic signs and speed limits at	2	Immediately alert the emergency services Isolate the truck and the polluted area	3		Limited pollution

								the entrance to and within the airport Require identified and authenticated drivers during convoys Periodically review the condition of tank trucks Equip the vehicle with mobile fire-fighting equipment		Grid the accident area Clean up the site			

IX.6.2. SUMMARY OF THE RISK ANALYSIS

The preliminary risk analysis done previously makes it possible to present all the systems on the criticality matrix. Each system is represented by its corresponding number.

The table below is a summary of the risk levels of the identified feared events. Only the final risks were taken into account.

Table 42: Summary of risk levels of identified feared events

		GRAVITY				
		5	**4**	**3**	**2**	**1**
PROBABILITY	**5**					
	4					
	3					
	2		**1.5 ; 2.2**	**1.2 ;1.4 ; 2.5 ; 2.6 ; 3.1 ; 3.2**	**1.1 ; 1.3 ; 2.1; 2.3 ; 2.4 ; 2.7**	
	1					

Initial risks identified and events and deemed unacceptable have been identified. However, the implementation of means of prevention and consequence control makes it possible to reduce the occurrence of events and the severity of phenomena. A few scenarios considered important were derived from the preliminary risk analysis. They are:

1.2: The presence of FOD in the manoeuvring area;
1.4: Invasion of birds or animals on the runway;
1.5: Plane crash;
2.2: Fire in the fuel storage area;
2.5: The emanation of kerosene vapours from the pumping station;
2.6: Presence of electrical arcing during filling of the storage tank or tank truck;
3.1: Malicious acts;
3.2: Accident during refuelling.

Despite the absence of events deemed unacceptable after the implementation of prevention measures and risk control barriers, some aspects deserve detailed analysis to highlight their likely effects on targets and thus propose effective prevention and protection barriers.

Table 43: Accident scenarios to be modelled

Number	Scenario	References of feared events
Scenario 1	Jet A1 storage tank fire	2.2
Scenario 2	Jet A1 tank fire A1	2.2
Scenario 3	Boil over thin layer of a Jet A1 tank	2.2

IX.7. DETAILED RISKANALYSIS

Following the results of the accidentology and the conclusions of the preliminary risk analysis, simulations will be carried out on certain identified scenarios and likely to occur inside the airport. Thus, the effects (thermal and/or overpressure) associated with each type of accident will be identified in order to:

- Estimate the effect distances and characterize the intensity of the effects associated with each scenario studied. The necessary modelling will be carried out using appropriate software or deterministic models and will not take into account the preventive measures planned to ensure the safety of the site and its surroundings;
- Study all possibilities for reducing major risks by identifying all dangerous phenomena whose effects are likely to extend outside the airport;
- Identify all the environmental and social issues in the critical areas identified through modelling and to propose actions to control the consequences.

Only physical phenomena will be evaluated, and for each of them the distances of effects to regulatory thresholds will be given.

Potential targets are people, property and the natural environment.

IX.7.1. REGULATORY EFFECTS THRESHOLD

IX.7.1.1. THRESHOLD OF THERMAL EFFECTS

The phenomenon of heat flow occurs most often in the event of a fire. When the duration of the phenomenon is greater or less than two (02) minutes (tank fires, groundwater fires, UVCE, BLEVE, etc.), the calculation of the effect distances gives values expressed in kW/m^2 or (kW/m^2) 4/3.s.

The reference threshold values for men and structures are described in the following table.

Table 44: Threshold of thermal effects for humans and structures

REFERENCE VALUE		**EFFECTS ON HUMANS**
Phenomenon ≥ 2 mn Thermal flow (kW/m2)	**Phenomenon ≤ 2 mn Thermal doses$[kW/m2]^{4/3}$.s**	
3	**600**	Threshold of irreversible effects, blisters in 30 s for unprotected persons
5	**1000**	Threshold of the first lethal effects
8	**800**	Threshold of significant lethal effects delimiting area from very serious dangers to life humaine
REFERENCE VALUE (kW/m2)		**EFFECTS ON STRUCTURES**
5		Threshold for glass destruction by thermal effect
8		Threshold for domino effects and corresponding to the threshold for serious damage to structures

IX.7.2. PRESENTATION OF CALCULATION TOOLS

The values of the heat flows generated by the fires were modelled using a calculation tool developed by INERIS and taking into account the GT-DLI method. The calculation of the Boil over is based on the INERIS Omega 13 manual. The tool for calculating the pit and pit fire is a simplified version of the FNAP model described in the Omega 2 report on groundwater fires.

These calculation tools can be consulted on the Integrated Resources Platform for the control of major risks.

INERIS repositories were also consulted (list in the bibliography) in the development of the models and the proposal of prevention and protection measures.

IX.7.3. MODELING OF ACCIDENT SCENARIOS

IX.7.3.1. SCENARIO 1: JET A1 STORAGE TANK FIRE

IX.7.3.1.1. DESCRIPTION OF THE ACCIDENT

Corrosion of the Jet A1 storage tank or failure of a valve flange resulted in leakage and spillage of liquid over the entire retention surface. Following the propagation of a fire, the hydrocarbon slick ignites and emits thermal radiation.

IX.7.3.1.2. METHODOLOGY FOR EVALUATING DISTANCES OF EFFECTS

The evaluation of the intensity of the thermal effects of this pit fire was carried out using a tool based on the GT-DLI model developed by INERIS. This "Tablecloth fires" tool, available online under PRIMARISK, makes it possible to vary certain parameters that remain fixed in the GTDLI spreadsheet, such as wind speed, ambient temperature or relative humidity.

IX.7.3.1.3. INPUT PARAMETERS

The basic data required to make the calculations are listed in the following table.

Table 45: Input Parameters - Scenario 1

Parameter	Value (m)
Bowl length	17
Bowl width	17
Bowl height	1.04
Shape of the fire	Rectangular
Stored product	Hydrocarbon (Jet A1)
Ambient temperature	299.15°K
Wind speed	5m/sec.
Relative humidity	0.7
Target height	1.5 m

IX.7.3.1.4. MODELING RESULTS

The flame characteristics obtained are listed in the following table:

Table 46: Flame Characteristics-Scenario 1

Characteristic feature	Value
Calculated flame length	18 m
Calculated flame inclination	44°
Calculated flame height	13 m

The effect distances of the heat flux resulting from the fire of the kerosene slick in the retention tank are listed in the following table. The details of this modelling are in annex 6.1 of the document.

Table 47: Modelling results-Scenario 1

Reference values (kW/m^2)	Effect distance in m
3	32
5	26
8	20

IX.7.3.1.5. INTERPRETATION OF THE RESULTS

The results of the modelling of a pit fire on the retention of the kerosene tank show heat flow effect distances ranging from 32 to 20 m depending on the chosen reference values. All targets within a radius of approximately 32 m around the Jet A1 tank are susceptible to:

- irreversible and blistering effects for unprotected persons, for targets almost 32 m from the edges of the retention;
- the first lethal effects as well as the destruction of the windows by thermal effect if the targets are 26 m from the retention basin of the Jet A1 tank;
- significant lethal effects delimiting the area of serious danger to humans and domino effects corresponding to the threshold of serious damage to structures, for targets located 20 m from the Jet A1 retention basin.

Taking into account these possible dangers, prevention and protection barriers must be put in place to reduce the occurrence of this phenomenon but also to be able to deal with it in the event of an occurrence.

The storage area must be prohibited from being used by foreigners. Authorizations must be obtained for any intervention. Appropriate fire-fighting means must be put in place following prior sizing (in order to know the type, number and appropriate locations).

To fight bowl fires, foam weirs, monitor nozzles or mobile means can be used to create a foam mat that can contain or extinguish the fire. This foam mat must be permanently maintained to ensure its optimal effectiveness (because the foam after a period of time decomposes, giving water and foaming).

However, when extinguishing a bowl fire, it should be ensured that the tank contained in the bowl is not sprayed with water or foam to protect the foam film created above the bowl to contain and extinguish the bowl fire.

IX.7.3.2. SCENARIO 2: JET A1 TANK FIRE A1

IX.7.3.2.1. DESCRIPTION OF THE ACCIDENT

Welding work on the hydrocarbon tank entrained the fire after the appearance of sparks. The combustion of the hydrocarbon emits thermal radiation.

IX.7.3.2.2. METHODOLOGY FOR EVALUATING EFFECT DISTANCES

The evaluation of the intensity of the thermal effects of this fire was carried out using a tool based on the GT-DLI model developed by INERIS. This "Tablecloth fires" tool, available online under PRIMARISK, makes it possible to vary certain parameters that remain fixed in the GT-DLI spreadsheet, such as wind speed, ambient temperature or relative humidity.

IX.7.3.2.3. INPUT PARAMETERS

The basic data required to make the calculations are listed in the following table.

Table 48: Input parameters - Scenario 2

Parameters	Features and characteristics
Type of product stored	Jet A1
Tank shape	Circular Letter
Ambient temperature	299.15°K
Wind speed	5 m/s
Relative humidity	0.7
Tank diameter	3 m
Height of the bin	7.1 m
Target height	1.5 m

IX.7.3.2.4. MODELING RESULTS AND INTERPRETATION

The results of the modelling show that:

- the threshold of significant lethal effects is not reached;
- the threshold for first lethal effects is considered irrelevant;
- the threshold for irreversible effects reaches a distance of 11 m from the tank.

Details of the results are given in Annex 6.2 of the document.

In conclusion, the thermal effects associated with kerosene tank fire can reach a distance of 11 m and create irreversible or blistering effects of about 30 s in people. Prevention and protection barriers (organisational and technical) must be put in place to prevent this phenomenon and to deal with the risks in the event of its occurrence.

It is important to install a flame detector to detect any rise in temperature or the presence of products resulting from combustion.

Foam is the most commonly used means of coping with a bin fire because water is ineffective in coping with this type of event. It would then be necessary to provide a dimensioned foam tank equipped with a premixing device. Hydrocarbons are non-polar liquids, are hydrophobic and therefore do not dissolve in water. The most appropriate type of foamer on flammable liquid tanks is low expansion foam (heavy foam that can be sprayed over long distances).

To extinguish a tank fire, the bin fire should first be extinguished if the retention has caught fire.

IX.7.3.3. SCENARIO 3: BOIL OVER THIN LAYER OF A JET A1 TANK

Thin film boil-over is a dangerous phenomenon that can occur after a hydrocarbon tank fire such as diesel/diesel, Jet A1 and FOD.

IX.7.3.3.1. DESCRIPTION OF THE ACCIDENT

Due to the presence of static electricity, sparks occur and ignite the Jet A1 storage tank. The presence of water at the bottom of the tank exacerbates the fire. After several hours of combustion, a boil over is triggered.

IX.7.3.3.2. METHODOLOGY FOR EVALUATING DISTANCES OF EFFECTS

The evaluation of the intensity of the thermal effects of a "thin film" boil over was carried out using a calculation tool developed from the GT-DLI model. This tool applies the method used by INERIS to calculate the thermal effects of the fireball, the firing time of the boil over, as well as the characteristics of the flame.

IX.7.3.3.3. INPUT PARAMETERS

The input parameters of the model are shown in the following table:

Table 49: Input parameters of the model-Scenario 3

Product stored in the bin	Jet A1
Tank diameter	3 m
Height of the bin	7.1 m
Initial height of the product	6.39 m

IX.7.3.3.4. MODELING RESULTS

The modelling results show that the regulatory thermal effect distances are not achieved. This indicates that heat flows of 3.5 and 8 kW/m^2 are not reached during this boil over phenomenon, which will take 26 hours before it is triggered with a flame height of 5 m.

Details of the results are given in Annex 6.3 of the document.

IX.7.3.3.5. INTERPRETATION OF THE RESULTS

The reference heat flows will not be reached in the event of a boil over phenomenon. Thus, even if the phenomenon occurs (which is extremely rare), the damage will not be catastrophic on targets and structures.

The probability of major risk due to this phenomenon can be considered very small according to the results of the modelling.

IX.8. RISK PREVENTION AND CONTROL MEASURES

IX.8.1. AIRPORT EMERGENCY PLAN

When an aircraft accident or emergency occurs (sabotage, bomb threat, dangerous goods incidents, fires, natural disasters, public health emergencies, etc.), the first objective is to save human lives. In order to be able to act quickly, response measures must be planned and instructions established that clearly define the responsibilities of the various emergency services involved in rescue operations. Thus, it is imperative to put in place an airport emergency plan. This plan will ensure the coordination of measures to be taken in an emergency at or near the airport. Its purpose is to minimize the effects of an emergency, especially in terms of saving human lives and maintaining air operations. It also aims to outline the procedures for coordinating the activities of the various departments of the airport and those of neighbouring agglomerations that could deal with emergencies.

The emergency plan must contain, among other things:

- the types of emergencies it is intended to deal with;
- the bodies to be involved in the plan;

- the responsibilities and role of each body, the emergency operations management center and the command post, for each type of emergency situation;
- the names and telephone numbers of the services or persons to be alerted in the event of a given emergency situation;
- the grid plan of the airport and its immediate surroundings.

The emergency plan should coordinate the response or participation of all existing bodies that, in the opinion of the competent authorities, could help to deal with an emergency. These procedures will have to be approved by all authorities whose jurisdiction is exercised both inside and outside the airport.

At the airport level, air traffic control agencies, rescue and fire services, airport administration, medical and ambulance services, aircraft operators, security services and police are the concerned bodies. Outside the airport, however, fire services, police, health authorities (including medical, ambulance, hospital and public health services), military units and port or coastal surveillance services are the ones concerned.

Since the Saint-Louis Airport is contiguous to a body of water, approaches or aircraft departures may be made to a portion above the water level. The emergency plan should therefore provide for the implementation of appropriate specialised rescue services and good coordination with these services.

IX.8.2. PREVENTION OF ANIMAL DANGER

Given the location of the Saint-Louis airport, animal risk cannot be ruled out in the aviation business. It is therefore essential to set up a plan to prevent animal danger.

Prevention of animal danger can be defined as the awareness of the danger that animals represent for airport users and the implementation of appropriate measures to deal with them. The prevention of animal danger contributes to the safety of flights and, at the same time, of passengers. It aims to reduce the risk of collision between aircraft and animals during take-off and landing operations. It must be exercised within the airport's control and must include:

- all preventive actions aimed at making the environment inhospitable to animals through appropriate management of the natural environment and the installation of fences adapted to the risks and the environment, including the configuration of the land;
- the implementation, on an occasional or permanent basis, of one or more appropriate measures to frighten or remove animals.

For a secure runway, the following measures can be considered:

- Installation of a suitable fence in the area that is not freely accessible to the public to prevent the passage of animals likely to disturb air navigation;
- Implementation of scaring measures, i.e. the removal of birds or other pests that pose an immediate danger to runway safety (e.g. closing the airport for a day to make way for hunters to keep pests away from the infrastructure);
- Prohibition of all garbage dumping and certain crops in the airport right-of-way.

It is imperative to reduce the airport's attractiveness for animals in this area. The control of bird threat also requires the establishment of procedures to recognize land management around the airport and reduce its attractiveness for birds, and to monitor, in conjunction with public structures and local owners, any development projects that could contribute to the emergence of additional birds.

Land uses that attract birds include agriculture, livestock, aquaculture, storage, waste treatment, recycling or incineration, and golf course operations.

IX.8.3. FOD RISK PREVENTION

In the aeronautics sector, the presence of a foreign element in a component, assembly, system or even aircraft, due to lost or forgotten tools, can have important consequences. FODs can cause many problems in terms of safety but also productivity.

Foreign Object Debris, commonly known as FOD, is any item on an airport that can be sucked up by an aircraft engine or cause damage to the aircraft structure, thus posing a danger to aircraft.

The presence of debris on the ramp represents a potential risk to aircraft safety. The management of this hazard requires comprehensive action to mitigate the risks.

The prevention of FOD risk must be based on a program based on the following points:

- the active cooperation of all airport actors present on the movement area;
- the coordination of actions to prevent risks related to debris by an airport security manager;
- the training of people working on the movement area;
- the organisation of awareness and training campaigns.

It is also important:

- to identify the sources of FOD production;
- to insist on staff training and awareness;
- to put in place adequate signage;
- to install FOD bins in places where it is needed;
- to identify areas for the storage of collected debris.

The person in charge of the airport shall:

- set up equipment and trained personnel to clean the movement area;
- set up equipment to collect FODs;
- provide vehicles for the collection and transportation of waste;
- implement a plan for monitoring, tracking and control of airside areas.

S/he is also responsible for implementing principles for the exclusion of foreign bodies. For this purpose:

- All waste must be collected and placed in secure bins before being transported to a location outside the movement areas;
- All bins located on the airside must have a secure lid to avoid any loss of material;
- All operations likely to produce FODs must be governed by procedures that take into account the management of FODs and the clean-up of the site after work;
- Storage areas must be designed to store work tools;

- Vehicles and equipment using the runway must be regularly inspected to detect any moving objects that may become FODs;
- All operators must keep the areas they serve clean.

One of the actions prior to the implementation of the FOD risk prevention plan is the diagnosis of the inventory in order to identify the factors that contribute to the creation of FOD so that corrective measures can be taken.

The prevention of FOD risk is the responsibility of all airport personnel, including maintenance staff, baggage handlers, cleaning companies, pilots, etc.

IX.8.4. SAFE DEVICES FOR THE STORAGE AND HANDLING OF DANGEROUS PRODUCTS

Any hazardous product used on site must have a safety data sheet accessible to the product handlers. They must be stored in suitable containers and under the conditions prescribed in their respective SDSs. For each product, it will be necessary to study the volume to be stored, the size of the storage area and the location of the storage area.

Products likely to pollute the environment must be stored under retention. The size of the retention depends on the volume stored, the number of containers in a retention. The retention capacity must be at least equal to the greater of the following values:

- 100% of the capacity of the largest tank, where
- 50% of the total capacity of the tanks and containers.

Depending on the overall storage capacity, a minimum distance must be maintained between the tank wall and the nearest building.

Storage must be easily accessible by transportation and rescue vehicles in such a way as to facilitate the transit of products and intervention. It must be protected from any source of heat, away from installations at risk of fire or explosion, and away from workspaces and dwellings.

It is always necessary to establish a storage plan that includes the various elements that make up the fuel depot.

A stock register of products containing, among other things, nature, quantity of product, delivery date, must be kept up to date in order to control the flow of stock and in the event of a spill or leak, know the type and quantity of product involved.

The storage area must be of limited access and include signs indicating the nature of the product stored, the risks it entails and the safety instructions to be taken.

Smoking, use of the mobile phone and any device that may emit static electricity in the fuel storage room and in the open air near the service pump must be prohibited. This prohibition must be indicated by a regulatory display.

The fuel depot must be equipped with appropriate and sufficient extinguishing equipment. Manual transfer of a hazardous product from one container to another should be avoided. It must be secure and constantly monitored to prevent possible malicious acts. Strict security protocols must be established for both depot staff and visitors. The safety instructions must be periodically revised according to the changes that will have to be made in the depot or its immediate environment.

A ground marking must be made in the depot to indicate pedestrian crossings. Also, a POI for the fuel storage area must be completed.

IX.8.5. FIRE PREVENTION AND CONTROL

To prevent fires and fight against thermal effects, it is important to install flame detectors. The flame detector serves as a technical prevention barrier and can detect the presence of flames or burning products.

The safety function provided by a flame detector consists in detecting the birth of a fire and transmitting the information to a processing unit, which can trigger an alarm signal and/or watering and securing the site.

The location of the detectors (number, location) depends on the interests to be protected. They must be in an unencumbered area.

It is also important to install smoke detectors in areas where they are needed and to establish rules to prohibit the use of open flames, smoking, nylon clothing, etc.

It will also be necessary to install a lightning rod in the site but also, if necessary, lightning arresters for large electrical equipment at risk.

Following proper sizing, fire-fighting equipment should also be installed (RIA network, fire extinguishers, emulsifier with a pre-mixing network, fire vehicle, etc.).

Fire-fighting devices shall be selected according to the types of fires to be fought and placed in strategic locations allowing their quick and easy use.

The fire station within the site must be well equipped and regular training must be provided. Also, a direct line must be established between the airport fire brigade and the BNSP fire brigade to call for backup if necessary. It is also necessary in the context of collaboration with the BNSP fire brigade to develop common prevention policies describing procedures to be implemented, the utility and handling of airport specific firefighting equipment.

IX.8.6. UNLOADING AND REFUELLING PROCEDURES

It is imperative to set up procedures for the execution of any task, particularly dangerous ones.

The unloading and refuelling procedures are site-specific and depend on several factors such as: the configuration of the premises, the types of equipment in place, the number of personnel, etc.

In the event of unloading, it is imperative to set up, in addition to the prevention plan, a safety protocol linking the carrier to the person responsible for the fuel depot (SMCADY). This safety protocol should include all information relevant to risk assessment as well as preventive and protective measures in the event of an accident. Safety procedures such as those described below must be strictly observed at each operation to minimize the probability of an accident occurring:

- identification of the driver;

- verification of the requested quantity;
- visual inspection of the condition of the truck;
- checking the presence and condition of fire extinguishers;
- effective grounding;
- supervision of the entire unloading in the presence of the sworn agent in the depot and the truck driver; etc.

If a problem is detected during the unloading process (abnormal noise, spillage, leakage, etc.), the unloading operation must be stopped immediately and the motor of the unloading pump must be switched off. Thereafter, it will be necessary to find a solution to the problem encountered and inform the site security manager. Disposal can only resume once the problem is solved and all security conditions are in place.

Procedures must take into account organisational and security aspects in order to help operators in their tasks while preserving their safety. They must be written in a clear and comprehensible manner so as to facilitate their execution.

The procedures must be certified and regularly reviewed in the light of accidents or incidents that have occurred, but also in the light of technical developments or if changes have had to be made in this workstation.

IX.8.7. AIRPORT SAFETY AND SECURITY

Regarding security and safety at the airport, the latest generation of equipment will have to be put in place. Baggage and passenger screening must be systematically carried out at each departure or arrival. Sanitary control should also be required to rule out any possibility of disease transmission. To this end, premises must be provided for customs, police, and gendarmerie and health services. These bodies will be able to safely and effectively provide security on the premises.

- The human factor is the most crucial element to be taken into account in the airport security system. Whatever the help of high technology may be, the human element is the key to success in the fight to maintain airport safety and security. It is therefore imperative to pay more attention to the selection, recruitment, training and supervision of staff at all levels in the airport. Security controls will have to be carried out on passengers, baggage and access. To do this, it is necessary to plan X-ray equipment for the screening of hand luggage;
- Metal detector portals to ensure the passenger's sterility;
- Imaging and chemical trace detection technology;
- Separation of passenger flows: passenger crossings on arrival and departure must not occur;
- Protection of baggage belts, the sorting area, and hatches allowing baggage to pass through to the delivery rooms;
- Etc.

Access to the airport must be secure and constantly controlled. Preventive inspections must be carried out on all installations, particularly those at risk. Fire detection and suppression equipment must be available in the required number and location and be regularly inspected and maintained.

Internal and external rounds should be conducted regularly to identify any potential threats and take appropriate action.

IX.8.8. ORGANIZATIONAL ARRANGEMENTS

The internal organisation must be clearly defined through plans and protocols including the worker's behaviour, all prohibitions and the reasons for these prohibitions.

A CHST, if required, must be set up in accordance with Decree No. 94 244 of 7 March 1994 laying down the procedures for the organisation and operation of occupational health and safety committees.

Each service provider operating at the airport must have an HSE policy with a manager at the top, managing an entire team. HSE managers must ensure strict compliance with all necessary and established safety instructions.

Airport staff must be regularly informed and made aware of the risks related to their profession. They must also be aware of their role and responsibility in reducing these risks and the importance of complying with the wearing of PPE. They must be aware of and able to implement the first necessary safety measures in the event of an accident; for this purpose, periodic training sessions in occupational health and safety are necessary.

The identification of occupational hazards must be done for each workstation and an accident register must be kept and updated by the safety officer.

Employees must: have safety equipment adapted to their workstations; receive training in the use of PPE. The wearing of PPE must be required under penalty of serious penalties. Employees must also be placed in adequate working conditions in order to avoid as much as possible accidents at work and occupational diseases.

Employees must have periodic medical check-ups in order to monitor their health and prevent occupational diseases.

IX.9. OCCUPATIONAL RISK ANALYSIS

IX.9.1. OBJECTIVES OF THE PROJECT

Occupational risks lead to occupational accidents and diseases. In order to preserve the physical integrity and health of workers, an occupational risk analysis is required at each workstation.

The occupational risk assessment is an important part of the safety process, made to ensure that the necessary precautions are taken to protect the health of employees. It consists in identifying all the risks inherent to each position and working condition and proposing solutions for the prevention of these risks and the protection of exposed persons.

This occupational risk assessment is a regulatory obligation defined in Article 5 of Decree 2006-1256 on the obligations of employers in occupational health and safety. It is used to plan preventive actions and is the basis for any approach to improve safety and working conditions.

It is the responsibility of the employer and must be done at each workstation.

IX.9.2. METHODOLOGY

The assessment of occupational risks consists in identifying risks, prioritizing them and then planning prevention actions adapted to each identified risk.

The following methodology was adopted:

1. make an inventory of workstations;
2. identify the risks at each workstation (inventory the intrinsic properties of equipment, products, work methods that could cause damage to employee health);
3. classify risks according to a rating (frequency and severity) in order to prioritize prevention actions;
4. propose effective and appropriate preventive actions to reduce the frequency of occurrence of identified risks and mitigate their severity.

The identification of occupational risks is based on feedback (accidents and occupational diseases occurring in similar sectors of activity) and regulation.

A scoring system has been adopted to prioritize the different risks. It is based on:

- the frequency of the occurrence of the accident, incident or occupational disease and
- the seriousness of the accident, incident or occupational disease.

The levels required for frequency and severity rating are presented in the following table.

Table 50: Occupational risk rating scale

Frequency scale (F)		Gravity scale (G)	
Score	Meaning of the word	Score	Meaning of the word
F1	Once every 10 years or less	G1	Reversible lesions without TA or with TA less than 2 days
F2	Once a year, once a year	G2	Reversible lesions, with AT
F3	Once a month, once a month	G3	Irreversible injuries, permanent disability
F4	Once a week or more	G4	Death

This rating scale makes it possible to establish a criticality matrix represented by different color codes. These colors reflect the seriousness of the facts and provide guidance on the order of priority to be given to the prevention measure.

Table 51: Risk criticality grid

	F1	F2	F3	F4
G4	–	–	–	–
G3	–	–	–	–
G2	–	–	–	–
G1	–	–	–	–

The green color represents a low risk. In this case, the priority of prevention actions is of the order of 3.

The yellow color represents a moderate risk. In this case, the priority of prevention actions is of order 2.

The color red is a high risk. In this case, the priority of prevention actions is of order 1.

-	*High Risk-Priority 1*
-	*Moderate Risk-Priority 2*
-	*Low Risk-Priority 3*

All risks that could lead to death are of priority 1 even if their frequency of occurrence is low.

IX.9.3. PRESENTATION OF THE RESULTS

IX.9.3.1. INVENTORY OF WORKSTATIONS AND TYPOLOGY OF IDENTIFIED OCCUPATIONAL RISKS

The division of work units is based on the different activities performed. Activities with similar risk families have been grouped together.

The types of risks potentially faced by workers are as follows:

- risks related to the use of earth-moving machinery;
- risks related to the use of hand tools;
- risks related to noise;
- road risks ;
- risks related to the use of handling equipment;
- risks related to falling objects;
- risks related to the use of machinery;
- risks related to mechanical handling;
- risks related to manual handling;
- risks related to repetitive actions;
- risks related to falls (height, ground level);
- electrical risks ;
- chemical risks ;
- risks related to working on a screen;
- risks related to working in confined spaces;
- risks related to thermal environments;
- fire and explosion hazards;
- risks related to the provision of services (work and operations carried out by external companies);
- risks related to coactivity.

IX.9.3.2. IDENTIFICATION AND ASSESSMENT OF OCCUPATIONAL RISKS

The various risks to which staff may be exposed are presented in the following table.

Table 52: Occupational Risk Analysis

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
Construction phase	Demolition work on the structures	Personnel performing the work Machine Operators On-site staff	Risks related to the use of earth-moving machinery	Collision between gear and gear; gear and person Injuries	2	3		Set up signs and a traffic plan on the site Provide audible warnings Train machine operators on safe driving rules Do not obstruct traffic lanes Proper storage of excavated material Assist conductors during excavations	2	1	
			Risks associated with the use of hand tools	Cuts Fractures	3	4		Train staff in the handling of these tools Provide staff with protective gloves	2	2	
			Risks related to manual handling	TMS Muscle pain	2	3		Limit the daily load Train staff in manual handling techniques Provide employees with mechanical aids Establish rest periods	1	2	
			Risks related to repetitive actions	TMS Muscle pain	2	3		Introduce moments of rest Establish rotating teams Provide employees with mechanical aids	1	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			Risks related to level falls	Injuries Fractures	2	3		Organize storage facilities Tag and put signs on areas at risk	2	2	
			Noise risks	Temporary or permanent hearing loss	3	2		Use quieter equipment Provide workers with hearing protection and ensure its proper use	1	2	
			Risks related to working in high heat	Heat stroke Dehydration	2	4		Avoid working in open areas during the hottest hours of the day Provide shelters for workers (e.g. scrap metal workers) Provide refreshments to workers Incorporate breaks into work schedules	1	2	
Construction phase	Transportation of equipment on site by trucks and cranes	Driver or staff on site	Road risk	Vehicle/vehicle collisions Vehicle/pedestrian collision Injuries Death	4	2		Train drivers on driving rules Sensitize drivers on the respect of the highway code Use vehicles in good condition Avoid using busy arteries during peak hours	4	1	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			Risks related to the use of handling equipment	Collision between vehicle and vehicle Striking of vehicle/pedestrian Injuries Death	4	2		Implement a traffic plan Delimit and mark the area of influence of the device Train machine operators on driving rules Use persons authorized to operate this type of equipment Identify traffic and work plans Assist the driver when travelling	4	1	
			Risks related to falling objects	Injuries Fractures Death	4	2		Ensure the performance of the machine Provide on-site staff with helmets and safety shoes Limit storage heights Marking the work area	3	1	
			Risks related to working in high heat	Heat stroke Dehydration	2	4		Avoid working in open areas during the hottest hours of the day	1	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Provide refreshments to workers Incorporate breaks into work schedules			
Construction phase	Unloading of material	Personnel performing unloading Personnel present on the unloading circuit	Risks related to mechanical handling	Death Injuries Fractures	4	2		Implement a traffic plan Delimit and mark the area Train machine operators on driving rules Use persons authorized to operate this type of equipment Identify traffic and work plans Assist the driver when travelling	3	2	
			Risks related to manual handling and repetitive movements	TMS Muscle pain	2	3		Limit the daily load Train staff in manual handling techniques Provide employees with mechanical aids Establish rest periods	1	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			Risks related to falling objects	Injuries Fractures Death	4	2		Provide personnel on site with helmets, masks and safety shoes Limit storage heights Marking the work area	3	1	
			Risks related to working in high heat	Heat stroke Dehydration	2	4		Avoid working in open areas during the hottest hours of the day Provide refreshments to workers Incorporate breaks into work schedules	1	2	
Construction phase	Pavement construction	Personnel performing the work	Chemical risks (Bitumen emissions, exhaust gases from internal combustion engines) Risks related to atmospheric environments (heat)	Burn injuries Injuries Respiratory diseases Eye irritation (conjunctivitis) and skin irritation Allergies Strong sweating and dehydration	3	2		Choose the least dangerous additive products and operating procedures Ensure that the cabins of the equipment used are ventilated and that waste is extracted at source Ensure the automation of workstations	2	1	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			Noise risks					Ensure regular maintenance of the equipment to reduce unwanted noise and vibration Provide staff with fresh drinking water and sanitary facilities near the site (including changing rooms, toilets, sinks and showers, hand workshop soaps) Provide medical surveillance for workers exposed to bitumen Provide employees with appropriate PPE: Non-flammable clothing covering the whole body Cuffed gloves Safety boots or shoes, with heat insulating sole and resistant to asphalt aggressiveness			

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Mask with filter type P3 Hearing protection against noise			
Construction phase	Construction of buildings	Machine operators Pedestrians	Collision between machinery and pedestrians	Injuries Fractures	3	2		Comply with speed limits Comply with the rules of conduct in force on the site Ensure that vehicles are fit for their intended use, inspected and authorized for use Assign one seat per passenger Ensure that the seat belt is kept fastened for the duration of the journey Ensure that passengers are not transported in the area reserved for the equipment transported	2	1	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Prohibit the use of mobile phones while driving.			
		Welders Scrap Metal Workers etc.	Risks related to the use of energy-powered equipment	Electrification Electrocution	3	3		Lock equipment separation devices from energy sources if necessary Ensure that the intervener is of legal age, trained, qualified and instructed on risks Provide suitable PPE	2	2	
		Masons	Risks related to excavation work	Burial of the body Death	4	2		Ensure that workers have appropriate work permits, validated with all appropriate plans Identify, locate, mark, and, if necessary, isolate underground hazards Evaluate and define methods to prevent ground movements (e. g. trench wall collapse)	3	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
		All workers	Mechanical risks	Injuries Fractures TMS	2	4		Favor the use of ergonomic mechanized machines to limit manual handling and awkward postures Training in manual handling techniques Ensure good work organisation Provide employees with adequate PPE: High visibility warning vest class 3 or 2 Safety glasses or visor Construction site helmet	2	3	
		All staff members	Risks related to work at height	Fractures Death	4	2		Ensure that work at height is always carried out with supervision Ensure that fixed platforms or scaffolding have guardrails and are checked by an authorised person	3	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Provide workers with fall arrest equipment Implement secure work procedures			
		Machine operators Personnel carrying out the work	Risks related to handling and lifting equipment	Injuries Fractures Death	4	2		Ensure that the lifting equipment has been checked by qualified personnel Ensure that workers are trained and qualified Ensure that the machine guards are working properly Comply with the requirements defined by the manufacturer	3	2	
Operation phase	Interventions on the tarmac	Personnel performing work on the runway and on board aircraft	Risks related to moving aircraft	Injuries Fracture Death	4	2		Limit the number of participants Provide workers with appropriate PPE (high visibility vest, safety shoes, hearing protection)	3	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Ensure that personnel only cross or work on the tarmac when absolutely necessary Set up safety instructions Ensure that there are no vehicles or pedestrians in front of a moving aircraft Prohibit vehicles on the tracks Provide staff training Implement emergency plans			
			Risks related to moving vehicles	Injuries Fractures	2	3		Implement organizational measures Implement a traffic plan Raise staff awareness and set up instructions and displays Ensure the availability and effective wearing of high visibility clothing in	1	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								the external areas of airports; Ensure that drivers have appropriate training Provide conductors with suitable PPE (hearing protection, seat belt, vest)			
			Risks related to the presence of dangerous equipment (aircraft engines and propellers, helicopter rotors	Injuries Death	4	2		Ensure that personnel working on the tarmac have good training and work at a safe distance from aircraft engines Set up safety instructions in case of intervention: Always approach from an angle of "one hour" (assuming that the pilot faces "noon"); Make sure you stay down; Hold all objects that may fly away securely.	3	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			Risks related to aircraft noise emissions	Temporary or permanent hearing loss	3	2		Provide personnel working on the tarmac with hearing protection, mainly earmuffs. Limit the time spent by staff in a noisy environment Marking the areas where the wearing of EPBs is mandatory	2	2	
			Risks related to lighting	Injuries Fractures Death	4	2		Ensure that all precautions are taken around aircraft in poorly lit areas to ensure the safety of responders	3	2	
			Risks related to slips and falls on the ground	Injuries ; Fractures	2	3		Provide workers with appropriate safety shoes Ensure that equipment and vehicles are free of leaks	2	2	
Operation phase	Maintenance of stopovers	Civil or military mechanics	Risks related to noise, weather, traffic and	Hearing impairment Eye irritation	3	3		Provide mechanics with noise protection	2	3	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			movement of vehicles and aircraft Risks related to exposure to chemicals Risks related to work at height Risks related to the use of flames	Injuries Fractures				equipment (earplugs and earmuffs) Implement chemical management procedures Ensure effective ventilation of the premises Provide stakeholders with appropriate PPE Install fall protection devices Train personnel in lifting techniques Use mechanical lifting equipment Ensure a new ergonomic design of the equipment			
Operation phase	Intervention on board an aircraft	Personnel performing cargo inspection work, etc.	Risks related to access to aircraft	Injuries Fractures	2	2		Ensure that access equipment is safe Use the bridges provided for passengers and on-board staff	2	1	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Provide personnel with adequate PPE (safety shoes, vests) Establish safety instructions Establish secure working procedures for baggage and cargo handlers			
			Risks related to chemical, biological agents and soiled objects	Contaminations Diseases	3	2		Implement pest control campaigns Wear suitable safety clothing and equipment, mainly gloves, when searching toilets Ensure that hygiene requirements are applied	2	2	
			Risks related to the presence of sharp objects	Injuries ; Contaminations	3	2		Provide personnel with suitable PPE gloves when searching passenger areas Implement safety procedures and instructions	2	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
			Risks related to falling objects	Injuries	2	2		Staff training Implement safety procedures and instructions	2	1	
			Risks related to electrical equipment and heat sources	Burn injuries Electrocution Electrification	4	2		Ensure that operations on electrical installations are carried out by authorised personnel Isolate heat sources	3	2	
			Risks related to falls from a height and from the ground	Injuries Fractures	3	2		Raise awareness and train staff on the risks associated with movement in the bunkers Provide suitable PPE operators with access to suitable PPE operators	2	2	
Operation phase	Air Controls	Air traffic controllers and aeronautical information service	Risks related to working on the screen	Eye fatigue Mental fatigue Stress	2	3		Use electronic data screens arranged in a vertical or near-vertical plane at control centers Provide workers with glasses that absorb 80% of the light	2	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Reduce working time Ensure task rotation Ensure the ergonomics of workstations Ensure that employees are in good physical condition			
Operation phase	Inspection and maintenance of ground equipment	Ground installation and equipment technicians	Noise risks	Damage to the hearing system Deafness	3	3		Provide PPE (earplugs or earmuffs) to respond to operations near emergency generators or reactors	2	2	
			Risks related to electrical equipment	Electrification Electrocution	4	3		Install devices to prevent access to the radar antenna when it is in operation Train staff on safety procedures, deconsignment and deconsignment procedures	3	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								Provide personnel with appropriate personal protective equipment			
			Chemical risks	Diseases Burns	3	3		Ensure that the duration of interventions on radar microwaves is reduced to a minimum Provide appropriate PPE to stakeholders	2	2	
			Risks related to working at height	Injuries Fractures Death	4	3		Equip radar control towers with standardised guardrails around stairs and platforms Provide personnel with equipment to prevent falls	3	2	
Operation phase	Passenger orientation, ticket sales, passenger and baggage check-in	Commercial agents	Ergonomic risks Stress related risks	TMS Mental illnesses and disorders	1	4		Provide elastic floor mats and seats to mitigate the effects of standing up Limit manual handling operations Ensure that carousels and baggage belts have	1	3	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								emergency stop and protection devices Ensure the training of personnel on handling techniques and postures Install anti-reflective devices for screens Plan breaks and work organization methods			
Operation phase	Flight operation	Flight crew	Stress related risks Physical risks Psychological risks Risks related to biological agents Risks related to ambient air	Discomfort (dry eyes, nose and throat) Dehydration Dizziness, malaise and vomiting	2	3		Ensure that sufficient liquid (water and fruit juice) is available for personnel during flight operations Ensure that equipment meets standards Determine the extent of exposure to cosmic radiation in flight Implement work organization procedures Recruit specialists for psychological and	2	2	

Project phase	Activities	Exposed position or personnel	Risks identified	Potential damage (injuries, health damage)	Gi	Fi	Ri	Preventive measures	Gr	Fr	Rr
								physical stress management Ensure periodic medical check-ups for each crew member			

IX.9.4. RECOMMENDATIONS FOR ACTION

The occupational risk assessment reveals the existence of high risks, for which prevention actions are a top priority. Moderate and low risks were identified.

Recommendations have been made for the construction and operation phases to minimize the severity and frequency of risks and their severity.

IX.9.4.1. RECOMMENDATIONS DURING THE CONSTRUCTION PHASE

The persons in charge of the construction will have to carry out:

- an analysis of occupational risks at each workstation;
- a plan for the prevention of occupational risks.

This risk analysis and the prevention plan are not fixed. They should be revised periodically according to changes in equipment, processes or work phase.

Employees must be made aware of professional risks and the importance of respecting the preventive measures in place.

These documents must be presented to any subcontractor involved in the construction phase.

IX.9.4.2. RECOMMENDATIONS IN THE OPERATIONAL PHASE

During the operational phase, an occupational risk analysis at each workstation will also be required. Subsequently, a plan for the prevention of occupational risks will be required to be submitted.

The risk analysis should be updated periodically according to any changes that may be made.

All site employees, as well as subcontractors, are concerned and must be made aware of the risks involved and the means of prevention to be adopted.

It is necessary to set up a CHST if the number of workers required is reached or exceeded and to ensure that the 9 principles of prevention prevail:

1. avoid risks
2. assess the risks that cannot be avoided
3. combat risks at source
4. adapt work to people
5. take into account technological developments
6. replace what is dangerous with what is not or with what is less dangerous
7. planning prevention
8. give priority to collective protection measures
9. train and inform employees about risks and their prevention.

In general, it is important for management and employees to be involved in the process of reducing occupational risks. The management methods to be developed must comply with the rules of ethics and professional conduct.

Transparency in the procedures and procedures is a major asset allowing the appropriation of the rules implemented. The objectives must be clearly defined.

The chief of staff sets an example for his employees. Thus, for the management system to succeed, he must be the first to show his commitment and determination. It will have to be actively involved in the development and supervision of the prevention approach and its implementation.

The realities of working situations and conditions must be taken into account in the development of rules and procedures. Communication sessions on occupational health and safety are also necessary to raise awareness and develop a risk culture among employees.

Staff buy-in is a key condition in the implementation of a risk prevention policy. To this end, their opinion must be taken into account before any decision is taken concerning them and they must be involved in the choice of PPE to guarantee their safety.

Social dialogue must be integrated into the institution's routine. It involves employees and employee representatives in the implementation of the prevention policy.

X. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

X.1. PREAMBLE

The Environmental and Social Management Plan (ESMP) aims to ensure the correct and timely implementation of all measures to mitigate negative impacts and improve positive ones.

The ESMP relies on the regulatory measures in force concerning this project to establish guidelines that the promoter is required to comply with in order to comply with Senegalese legislation.

The objectives of the ESMP include the following:

- ensure that project activities are undertaken in compliance with all legal and regulatory requirements;
- ensure that the environmental issues of the project are well understood by the promoter and implemented both in the construction and operational phases.

The environmental management plan includes various measures:

- those to be included in the various specifications of the contracting companies for the works as part of the contractual measures which will therefore not be evaluated financially because they are included in the works CADs;
- accompanying measures to be carried out in addition to the technical and/or environmental actions that will be evaluated financially, for example awareness-raising and training actions (institutional strengthening of the actors).

The ESMP will be reviewed as required to ensure its relevance and effectiveness. The proposed amendments will be discussed with the appropriate government authorities.

This ESMP will include:

- measures to mitigate and improve impacts;
- the project's environmental monitoring and follow-up plan with follow-up indicators;
- the timetable for the execution of the various operations;
- social support measures;
- the institutional arrangements for implementation;
- the information, awareness and communication programme;
- the actors involved in the implementation of the ESMP and their responsibilities;
- the estimated cost of the recommended measures.

X.2. REGULATORY MEASURES AND PROCEDURES

It is a question of ensuring compliance with the regulations in force and administrative procedures.

X.2.1. REGULATORY MEASURES

X.2.1.1. FOREST REGULATIONS

For any deforestation, clearing or reforestation activity, the project promoter must approach the water and forest services.

The start of any activity that may affect existing vegetation will require prior compliance with all procedures established by the Forest Code and logging taxes will have to be paid in advance.

X.2.1.2. ENVIRONMENTAL REGULATIONS

Both in the rehabilitation and operational phases of the airport, the activities must comply with the standards for the management of pollutant discharges (Standards NS 05-061 on waste water and NS 05-062 on air pollution) and, at a certain level, those of the Environment Code and the World Bank (General and Specific Directives in HSE management).

They must also comply with standards and procedures concerning hygiene and site waste management.

X.2.1.3. AUTHORISATION TO OPERATE IN A CLASSIFIED INSTALLATION FOR ENVIRONMENTAL PROTECTION (ICPE)

In accordance with the provisions of the Environmental Code, the operator must, before commissioning, submit five copies (05) of an application for an operating permit to the Minister who is responsible for the environment (art. R. 5 of the Environmental Code). The said request must be the subject of a public inquiry by order of the Governor of the Saint-Louis Region for a period of 15 days (art. R.6 of the Environmental Code).

All recommendations and provisions of this report shall be implemented by the promoter after approval by the Technical Committee and issuance of the certificate of compliance.

X.2.1.4. AUTHORIZATION TO BUILD

In accordance with the provisions of the Town Planning Code, Act No. 2008-43 of 20 August 2008 on the Town Planning Code and Decree No. 2009-1450 of 30 December 2009 require the developer to obtain a building permit before starting any activity.

This authorisation is issued after consultation with the services responsible for health, the environment, spatial planning and civil protection.

Any application for a building permit must include the following information (art. R368):

- the nature of the establishment;
- the land registry plan of the land base certified by a surveyor and approved by the cadastral services and the architectural plans certified by an approved architect;
- the class in which it is to be placed;
- an impact study for first-class schools;
- a detailed description of the work;
- a safety notice;
- the method and conditions of treatment of the waste generated;

- the means of relief against the effects of a possible disaster and any measures taken to comply with the measures provided for by the regulations in force.

It is also necessary to submit to the authority responsible for issuing the authorization to build an execution file before the work begins.

X.2.2. ADMINISTRATIVE PROCEDURES

X.2.2.1. LAND ALLOCATION PROCEDURE

The lands that make up the land base dedicated to Saint-Louis airport are covered by ASECNA's **TF132 and TF107** Land Titles**.** The Ministry of Air Transportation and Airport Infrastructure (MTADIA) shall identify the owners of **irregular** dwellings, trees, market gardening activities and other property located within the airport right-of-way that are likely to be damaged. The regulatory provisions to be respected in the context of this operation are related to:

- Decree No. 77 - 563 of 3 July 1977 implementing Act No. 76 - 67 of 2 July 1976 on expropriation in the public interest;
- Decree No. 81 - 557 of 21 May 1981 implementing the State Domain Code with regard to the private domain;
- Decree No. 88 - 074 of 18 January 1988 repealing and replacing Decree No. 85 - 906 of 28 August 1985 on the price scales for bare and built-up land applicable to rent and expropriation in the public interest;
- Decree No. 91-838 of 22 August 1991 allowing all occupants to be compensated.

X.2.2.2. PROCEDURE FOR RECEIVING AND FOLLOWING UP COMPLAINTS AND GRIEVANCES

It seems important to develop a grievance procedure that will enable the entire population concerned, through the potential nuisances resulting from the airport's rehabilitation and operating activities, to report to the project team the problems encountered in their cohabitation with the airport.

The most frequent complaints that could be the most frequent concern:

- the emission of noise and/or dust in the vicinity of construction site activities and on the route of trucks transportationing various materials;
- complaints relating to non-compliance with the commitments initially made by the promoter.

Three (03) systems can be put in place to allow complaints to be traced back to the project promoter:

- the opening of a complaints booklet at each site entrance, where complainants can write their complaints. This document will be collected each week by the person in charge of the social aspect for possible processing;
- the provision of a complaints book at the level of the Commune of Saint-Louis in order to receive complaints;
- the identification of problems during regular site visits by the inspection mission.

The recorded complaints and solutions will be presented in a monthly activity report from TRANSCON, which is in charge of the control and monitoring mission of the rehabilitation project.
The results will be communicated to the complainants (by posting in villages, neighbourhoods, town halls, construction sites, etc.)).

X.2.2.3. Information and communication procedure for service providers' staff

During the rehabilitation phase, the study recommends the implementation of information and communication measures for service providers' staff, including training in environmental, health and safety issues. This information campaign may cover:

- methods for the management of hazardous products and site waste as well as care activities and emergency procedures in the event of spills of hazardous products;
- environmental awareness and responsibility in relation to the reception area and the local population;
- the environmental and social risks associated with the project and the recommended mitigation measures and implementation of the ESMP;
- the provider's staff should be sensitized/trained periodically in order to maintain a high level of HSE knowledge.

X.2.2.4. Waste management procedure

Optimal management of the waste generated will make it possible to limit its impact on the environment.

Waste will be sorted according to its nature and dangerousness, which will make it possible to:

- separate hazardous waste from non-hazardous waste;
- separate recoverable waste from non-recoverable waste;
- monitor the volume of production by type of waste;
- maintain a waste generation register;
- sorting, collecting and disposing of waste by a specialised body in accordance with national legislation.

The HSE team will set up a disposal slip to keep the waste management register up to date.

X.2.2.5. Accident prevention procedure

In order to limit the number of accidents occurring during the rehabilitation and operation phases, a risk study must be carried out for each workstation.

This will determine the risks inherent to the work carried out as well as the personal and collective protective equipment necessary to limit the risk of accidents.

The necessary awareness and training in relation to the level of risk associated with the work to be performed shall be provided by TRANSCON or an approved body.

The study recommends that only trained workers with their PPE should perform the work under this project. Workers will have to be punished for non-compliance with health, safety and environmental measures.

TRANSCON is responsible for monitoring the applicability of this rule.

X.2.2.6. Periodic audit and review procedure for the ESMP

The environmental monitoring recommended by the ESMP during the remediation work is the responsibility of TRANSCON, which, after obtaining the certificate of compliance, is required to submit a regular report of its monitoring activities to DEEC. During the operating phase, the operator designated by MTADIA will take over and the monitoring committee will use these reports as a basis for environmental monitoring.

X.2.2.7. Closure plan and post-operational site rehabilitation

In the event of a stoppage or abandonment of the project, the contracting authority must dismantle the installations, demolish the buildings and dispose of all types of waste generated.

The dismantling of the infrastructure at the end of its life will be carried out in accordance with the regulations in force. Equipment from airport and aeronautical facilities may be recycled as far as possible according to their materials.

It should be noted that the obligation to restore the site rests exclusively with the operator and that the redevelopment of the site is considered necessary for the enhancement of the space. The site will be returned to the state in which it was before installation.

The socio-professional reintegration of workers will also have to be taken into account by the promoter.

X.3. IMPACT MANAGEMENT PLAN

X.3.1. PREAMBLE

The airport's rehabilitation works and operating activities will inevitably generate positive or negative impacts.
These impacts will have to be managed through enhancement, mitigation or compensation measures in order to optimize or reduce them.

- **Optimization measures**

They are applicable to positive impacts and aim to give added value to positive impacts and to ensure the sustainability of the positive actions that emanate from the project.

- **Mitigation measures**

These measures consist of modifying certain aspects of the project in order to eliminate or reduce as much as possible its negative effects on the environment and socio-economic environment.
Changes may include, but are not limited to, three (03) aspects of the project: its design, implementation schedule and location.

- **Compensation measures**

They concern significant residual negative impacts that occur after the implementation of the recommended mitigation measures. They occur when no possibility of eliminating or reducing the impacts of a project has been identified. Their implementation makes it possible to replace or restore the initial conditions.

X.3.2. IMPROVEMENT AND IMPACT REDUCTION PLANS

The environmental management plan is summarized in the tables below. It takes into account the positive and negative impacts during the construction and operation phases. This plan also proposes accompanying measures by integrating the costs of implementation and those responsible for implementation.

Table 53: Measures to reinforce positive impacts

Component	Impact-causing activities	Potential impact	Bonus measure	In charge of implementation	Implementation period
Improvement of impacts during the rehabilitation phase					
Socio-economic activities	Rehabilitation work	Direct job creation	• Recruit local workers as a priority • Set up a local recruitment committee • Paying decent wages to workers • Involve IWHSS in the declaration and identification of workers	TRANSCON	Before starting work
		Indirect job creation Purchase of goods and services	• Develop and secure spaces around the airport • Define with the local populations the rules of good conduct for peaceful coexistence • Frame entrepreneurship ambitions around the airport perimeter • Raise awareness among workers, service providers and merchants of the importance of hygiene and safety instructions	TRANSCON	Rehabilitation phase
		Business opportunities for SMEs	• Provide national companies with the opportunity to accelerate their development • Promote access by local companies to goods and services offers • To offer, for office and other furniture, the opportunity for national craftsmen; • Develop subcontracting in favor of local medium-sized companies	TRANSCON	Rehabilitation phase
Improvement of impacts during the operating phase					
		• Job creation	• Use local companies for outsourced services	Airport operator	Operation phase

Component	Impact-causing activities	Potential impact	Bonus measure	In charge of implementation	Implementation period
Socio-economic activities	**Airport Operations**	● Development of commercial activities ● Purchases of goods and services	● Favor local companies for the purchase of goods and services ● Focus on local employment ● Promote the female workforce ● Get closer to the SDDC for women's organisations and their socio-economic activities ● Provide for capacity building of personnel involved after rehabilitation work		
		Strengthening regional air services	● Rehabilitate and equip the airport with the most modern technologies ● Revitalize and make pleasant the services provided to passengers on departure and arrival: waiting platform, passenger escort, cafeteria, wifi ● Equip the airport with the latest generation of hygiene equipment ● Assign qualified personnel and specialists to the various workstations ● Authorize and make available vehicles for shuttle service between the airport and travellers' final destinations	MTADIA Airport operator	Operation phase
		Revitalising tourism and economic activities	● Plan the construction of ramps to facilitate access for people with reduced mobility ● Create relaxation areas, dining areas for airport staff and airport users ● Create tours and tourist itineraries ● Initiate projects to develop and equip tourist sites in	MTADIA Airport operator Ministry of Tourism SRAT	Operation phase

Component	Impact-causing activities	Potential impact	Bonus measure	In charge of implementation	Implementation period
			the Saint-Louis Region ● Create agencies and train tourist guides ● Develop the ground transportation network to facilitate access to the airport ● Strengthening the security, safety and protection of airport space		

Table 54: Mitigation measures for negative impacts

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
Mitigation of impacts during the rehabilitation phase					
Air quality	● Transportation, storage and use of construction materials and equipment ● Operation of construction machinery and vehicles ● Civil engineering works ● Demolition and reconstruction activities ● Waste generation	● Localized deterioration of air quality due to dust emissions ● Emissions of pollutants ● Olfactory nuisances	● Establish the initial state of air quality before starting work ● Water the site soil and traffic lanes to minimize dust generation ● Restrict the speed of vehicles and machinery in residential areas, sensitive areas and on the construction site ● Cover construction site material transportation trucks with tarpaulins ● Implement demolition methods that minimize dust emissions ● Reduce open sand storage to a strict minimum or cover it if necessary	TRANSCON	During the entire rehabilitation phase

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			● Stop unused vehicles and equipment by avoiding the standby position such as idling engine ● Ensure preventive and curative maintenance of exhaust emission equipment ● Ensure the control and maintenance of vehicles to minimize pollution related to combustion problems ● Inform and raise awareness among local populations		
Soil	● Demolition activity, ● Civil engineering works ● Traffic and parking of vehicles and construction machinery ● Use of hazardous chemicals ● Waste generation	● Localized modification of the soil structure ● Erosion of the soil ● Soil waterproofing ● Soil compaction	● Conduct a soil survey ● Define heavy vehicle routes (work lanes) and work areas in such a way as to limit rolling surfaces and soil compaction ● Limit the site's footprint to the strictly necessary area ● Rehabilitate the site after the work	TRANSCON	During the entire rehabilitation phase
Soil, surface and groundwater	● Storage and handling of construction materials ● Use of hazardous chemicals ● Generation of solid and liquid waste	● Soil and surface water pollution ● Groundwater pollution ● Decrease in the rate and speed of infiltration of runoff water	● Provide a water drainage system before the rainy season to ensure that runoff water flows to natural circuits ● Ensure that no vehicle maintenance is carried out on site ● Ensure that vehicles and construction	TRANSCON	During the entire rehabilitation phase

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			machinery have a proper technical inspection ● Take into account NS 05-061 on waste water before discharging effluents into the natural environment ● Limit spills and accidental leaks by: ○ the provision of anti-pollution kits ○ storage of oils and other hazardous products in sealed retention basins ● Collect solid and liquid waste according to a waste management plan in accordance with national and international regulatory provisions ● Raise awareness and train staff on solid and liquid waste management ● Limit the site's footprint to the strictly necessary area ● Implement an HSE policy		
Water resources used by the population	● Rehabilitation activities (civil engineering, soil watering, cleaning operation, etc.) ● Health needs	● Decrease in the resource	● Collect and use rainwater to water the slopes if the work is carried out during the rainy season ● Implement a rational water management policy ● Repair in time any degradation that may cause water leakage	TRANSCON	During the entire rehabilitation phase

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			• If necessary, use water tarpaulins in good condition to prevent water leaks. • Raise employee awareness of the importance of the resource and the need to preserve it		
Fauna and flora	• Brushing • Excavation work • Use of hazardous chemicals • Presence and circulation of labor	• Loss of vegetation • Degradation or loss of wildlife habitat	• Limit the site's footprint to the strictly necessary area • Establish an effective system for the management of excavations and waste resulting from the work • Use machinery, vehicles and equipment that comply with noise emission standards • Prevent the wandering of animals inside the site • Implement an off-site reforestation plan and ensure follow-up, in collaboration with the Saint-Louis forest sector • Notify the IREF before any deforestation or clearing activity • Support community nature reserves in the project area • Avoid killing species encountered on site		Before the development work During the work

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
Land use and allocation	Release of the site	• Housing loss • Loss of market gardening land	• Relocate populations located on the airport right-of-way and ensure that they are relocated to a suitable site • Set up measures to support the populations affected by relocation • Comply with IFC Performance Standard 5 for involuntary movement of people and economic activities • Compensate the impacted people • Support populations in their relocation when releasing illegally occupied land bases • Secure and enhance these spaces for the airports concerned • Establish with the land registry the real boundaries of the airport and install a barbed wire fence	MTADIA	Before the start of the work
Living environment	Rehabilitation work	Noise pollution	• Establish the initial noise status before starting work • Use equipment and tools with low noise levels and respect the limit of 85 dB at 1 m • Carry out acoustic measurements in the noisiest areas and on the property line and implement corrective measures • Provide workers with adequate PPE to fight against noise pollution	TRANSCON	From the preparation phase to the end of the construction site

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			• Perform timely maintenance of pneumatic tools, machinery and equipment to keep the noise level generated at an acceptable level • Ensure that certain very noisy equipment such as site diesels, compressors, etc. is covered. • Set up a screen wall towards residential areas, especially in the nearest neighbourhoods		
		Waste generation	• Set up a waste disposal center as soon as the rehabilitation site opens • Ensure that waste is not abandoned, released into the natural environment or burned in the open air • Draw up a waste tracking form for so-called hazardous waste • Collect separately and recover waste as much as possible • Ensure that mixed waste is placed in storage in "all coming" bins or containers and disposed of in authorized landfills • Create a buffer area between the airport and the houses • Raise staff awareness of waste management	TRANSCON	From the preparation phase to the end of the construction site
		Traffic densification	• Inform stakeholders (municipalities, populations, AGEROUTE, etc.) about the date of the convoy (by radio, newspaper, telephone, mail), routes,	TRANSCON	From the preparation phase to the end of the construction site

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			risks and measures to be taken to avoid accidents • Inform the DPC and use a professional escort between Dakar and the site • Use trucks in good working order for technical inspection for transportation to the site and suitable container platforms / doors • Limit speed to 30 km/h to the right of the population and make drivers aware of the importance of respecting the rules of good conduct		
Cultural and historical heritage	Rehabilitation work	Moving cemeteries	• Communicate and consult with local populations (keep them informed) before starting work around cemeteries	MTADIA TRANSCON	Before the start of the work
Mitigation of impacts during the operational phase					
Air quality	• Operation of equipment • Operating activities • Increase in road traffic • Increase in air traffic	• Impaired air quality • Global warming	• Identify emission sources and implement an air quality management system • Work on measures to reduce polluting emissions • Assess air quality in the area of influence of the project in the operational phase • Ensure long-term monitoring of ambient air quality in the various sites identified as potential receptors • Ensure the use of good quality fuel during the operating phase • Create green spaces (grass) away from the track	Airport operator	During the entire operating period

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			• Conduct off-site reforestation campaigns • Ensure compliance with the requirements of current standards in terms of emissions • Minimize dust emissions		
Soil and water resources	• Operating activities • Transportation and unloading of fuel • Storage and handling of polluting products (fuel, lubricants, oils, etc.) • Maintenance and cleaning activities for aircraft, pavements, etc. • Waste generation	• Soil pollution • Contamination of runoff and groundwater	• Collect runoff water according to its origin and control its quality before any discharge • Implement a stormwater management plan • Treat waters likely to be polluted by hydrocarbons • Comply with NS 05-061 Wastewater Standard before any effluent discharge • Install watertight retention basins or containment basins for the storage of chemicals • Dispose of and handle fuel on prepared and sealed surfaces • Monitor bunkering and unloading activities • Implement an inspection and maintenance program for the various facilities • Establish procedures for responding to accidental spills or leaks • Implement procedures and safety measures that must be followed for all refuelling operations	Airport operator	During the operating period

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			• Implement an Internal Operation Plan (IOP) to deal with emergency situations • Sort and store waste in a sealed storage area • Regularly monitor solid and liquid waste likely to be polluting • Find approved channels for the transportation, storage and disposal of waste in accordance with current standards • Perform periodic tests (hydraulic and watertightness) at regular intervals to check the condition of the tanks and the operation of the trucks • Provide anti-pollution kits • Implement a good HSE policy		
Water resources used by the population	• Airport Operations	• Waste of the resource • Increase in water requirements in the project area	• Collect and use rainwater to water green spaces (lawn, flowers) • Implement a rational water management policy • Put signs on toilets and sinks to raise awareness among employees and travellers about the importance of water conservation • Repair in time any failure that could cause a water leak • Favor preventive maintenance of pipes and water points (taps, flushes, washbasins, etc.)	Airport operator	During the entire operating period

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			• Reuse treated wastewater if possible		
Fauna and flora	• Noise generation • Light emission • Aircraft Overflight	• Wildlife Disruption • Collision between birds and aircraft	• Avoid the divagation of animals in the airport • Create a buffer area between the airport and natural areas • Avoid the development of vegetation in the airport and its surroundings • Ensure the reduction of engine noise through regular maintenance and technical visits • Taking noise control into account in airport management • Develop an action plan to reduce aircraft noise pollution • Act on flight schedules and/or limit night flights • Use machinery, vehicles and equipment that comply with noise emission standards	Airport operator	Throughout the duration of the airport's commissioning
Living environment	Airport Operations	Noise pollution	• Carry out regular acoustic measurements in the noisiest areas and on the property line and implement corrective measures • Provide workers with adequate PPE to fight against noise pollution • Act on flight scheduling and choose time slots that limit night flights; • Favor airlines that regularly renew their fleets	Airport operator	During the entire operation phase

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			• Encourage airlines to raise awareness and train their pilots in flight techniques to reduce noise emissions • Create a framework for functional consultation between airport managers, local populations, administrative and local authorities, certain technical services		
		Waste generation	• Set up a solid waste management procedure and provide all companies on the platform with an area dedicated to the sorting of non-hazardous and hazardous waste • Optimize the recovery of different materials by sorting waste as much as possible at source • Place garbage cans and skips within the airport and protect them from waste spills (lids, nets, screens, etc.) • Inform and raise awareness among staff of airport infrastructure assistance and maintenance services about waste management • Regularly empty septic tanks by an approved body • Work to reduce waste at source and avoid landfilling of recoverable waste as much as possible	Airport operator	During the entire operation phase
Water and energy consumption	Airport Operations	Excessive water and energy consumption	• Re-evaluate the files on the electrical energy needs of airports that will be shared with SENELEC's Distribution	Airport operator	During the entire operation phase

Impacted component	Impact-causing activity	Potential impact	Mitigation measure	In charge of implementation	Implementation period
			Department ● Set up a water storage device equipped with a booster for an autonomy of 3 to 4 days ● Choose water-saving equipment and install specific meters to monitor water consumption and detect any discrepancies ● Avoid the proximity of the SDE connection to the ONAS network, if it exists, as the latter could contaminate the SDE pipes in the event of a defect and install a non-return valve at the entrance to the airport's private network ● Disinfect the network set up in airports before it is put into service with concentrated bleach		

Table 55: Measures to manage impacts on hygiene, health and safety during the rehabilitation phase

Mitigation of impacts during the rehabilitation phase					
Impacted component	**Impact-causing activity**	**Potential impact**	**Mitigation measure**	**Responsible for implementation**	**Implementation period**
Health and working conditions	Demolition and construction of structures: • Repetitive actions • Heavy load ports • Vibration of tools • Climatic conditions • Etc.	• Noise generation • Dust generation • Waste generation	• Ensure the sorting and elimination of site waste and monitor it on a daily basis • Recycle and recover non-hazardous waste • Establish strict hygiene rules to be respected by any person working on the site • Favor wet working processes • Use a dust collection device • Perform noise measurements • Provide the PPE adapted to the measured values • Choose less noisy machines • Avoid as much as possible the use of manual handling with the risk of injury • Train workers in load handling techniques • Provide workers with handling and lifting equipment • Use visual warning devices instead of audible warning devices	TRANSCON	During the rehabilitation phase
Public safety and security	Demolition and construction of structures: • Working at height • Use of electrical equipment • Coactivity • Traffic flow • Etc.	• Fractures • Open wounds • Handicap • Inability to work	• Implement a traffic plan • Establish safety procedures regarding coactivity on the site • Appoint an HSE manager in charge of supervision and prevention against occupational risks • Require or have a diagnosis made before work is carried	TRANSCON	During the rehabilitation phase

Mitigation of impacts during the rehabilitation phase					
Impacted component	**Impact-causing activity**	**Potential impact**	**Mitigation measure**	**Responsible for implementation**	**Implementation period**
			out ● Identify and detect networks before intervention ● Materialize the electrical risk in situ ● Set up collective protections ● Issue compulsory electrical authorisations to workers requiring them and give them the prescription booklet and specific PPE ● Regularly check the work platforms ● Limit the speed of cars and machinery ● Put hazard pictograms, protective markers and prohibition and warning signs in all areas where there is a risk ● Conduct information and awareness campaigns for the population		

Table 56: Measures to manage impacts on health, safety and hygiene during the operational phase

Mitigation of impacts during the operational phase					
Impacted component	**Impact-causing activity**	**Potential impact**	**Mitigation measures**	**In charge of implementation**	**Implementation period**
Health and working conditions	Airport operation: Transit Welcome and orientation Work on the	● Waste generation ● TMS ● Visual disorders ● Noise	● Establish a procedure for managing the various types of waste ● Carry out special and appropriate treatment for the disposal of hazardous waste containing toxic substances that are harmful to the environment and people ● Provide a sufficient number of adequate and hygienic toilets for men and women	Operator	During the airport operation phase

Mitigation of impacts during the operational phase					
Impacted component	**Impact-causing activity**	**Potential impact**	**Mitigation measures**	**In charge of implementation**	**Implementation period**
	screen Working at the runway level	generation • Air pollution • Diseases	• Contract with specialized cleaning services in good standing for the management of the site's sanitation • Encourage shift work to allow team rotation to reduce the risk of cumulative noise exposure • Make noise measurements and provide PPE adapted to the noise level required by the tests • Carry out the pre-recruitment medical check-up and periodic check-ups every 06 months • Conduct risk assessment at each workstation • Require passenger health screening		
Public safety and security	Airport operation: • Carrying heavy loads • Repetitive movements • Work on the track • Airport traffic • Coactivity • Traffic flow	• Fall from height • Bodily injury • Electrical risks • Fire risks • Animal peril • FOD risks	• Install safety signage • Mark pavements to facilitate traffic and avoid the risk of collision • Identify safety areas in high-risk areas • Ensure that safety procedures are controlled by the agents in charge of handling aircraft support equipment • Provide the screening bodies with the latest generation equipment to ensure the screening of baggage and passengers • Have sufficient equipment and materials for firefighting • Provide training on terrorism warning and security • Promote regular maintenance and periodic track checks to identify and remove FODs • Use herbicides in the vicinity of the trails to prevent vegetation growth	Operator	During the operation phase

Mitigation of impacts during the operational phase					
Impacted component	**Impact-causing activity**	**Potential impact**	**Mitigation measures**	**In charge of implementation**	**Implementation period**
			• Collaborate with local authorities to prevent the establishment of structures that can attract birds (landfill, retention basin, agricultural operation, livestock, landscaped green space, etc.) into the airport environment • Raise awareness of the importance of not having vegetation, birds or landfills in the vicinity of the airport • Create a high fence surmounted by barbed wire with the ends facing outwards • Make regular indoor and outdoor rounds		

X.3.3. RISK MANAGEMENT PLAN

The technological risk management plan is presented in the tables below.

Table 57: Risk Management

Risk facilities or activities	Feared events	Potential risks	Preventive measures	Persons responsible for implementing the measures	Implementation period	Protective measures
Aeronautical platforms	Runway accident Presence of FOD Collisions Invasion of birds or animals on the track Aircraft fire	Aircraft fire Injuries Spreading fuel Destruction of equipment Animal risk	• Adopt air traffic control and management systems and processes • Implement a debris risk prevention plan • Set up secure bins for the collection of FOD • Establish procedures for each activity	Airport operator Airport Security Officer	Before the airport is put into service	• Provision of ambulances and fire-fighting vehicles • Regular and daily inspection of the runways • Collaboration with external emergency services • Use of frightening techniques • Rescue for the wounded

Risk facilities or activities	Feared events	Potential risks	Preventive measures	Persons responsible for implementing the measures	Implementation period	Protective measures
			• Implement a plan to prevent animal danger • In collaboration with the municipality, avoid the establishment of cultivation and landfill fields in the vicinity of the airport • Setting up an SSLI • Provide adequate fire-fighting means and equipment			
Fuel handling: dumping area; refuelling	Kerosene spill Fire in the depot Aircraft fire	Pollution Emanation of toxic fumes Fire spread to other facilities	• Write procedures for unloading • Ensure the good condition of tank trucks and related accessories for manoeuvring • Carry out regular inspections and maintenance of the tanks • Store the tanks on a sealed retention with product recovery device • Provide, after proper sizing, fire-fighting equipment (RIA, fire	Responsible for the fuel depot Airport Security Officer	Before and during the commissioning of the airport	• Immediate use of anti-pollution kits • Use of fire-fighting equipment • Progress of the emergency plan • Vigilance of airport firefighters • Interruption of refuelling as soon as a leak is detected • Immediate intervention by the emergency services

Risk facilities or activities	Feared events	Potential risks	Preventive measures	Persons responsible for implementing the measures	Implementation period	Protective measures
			extinguishers, hydrants, specialized fire vehicles, foam tanks, etc.) • Prohibit smoking or approaching open flames in fuel handling and storage areas • Establish organisational and safe procedures for refuelling aircraft • Periodically check the good condition of fire-fighting equipment			
Internal and external circulation	• Malicious intent • Panic	• Accidents Accidents • Injuries	• Provide space for Customs, Police, Gendarmerie, Health Services • Provide the airport with the latest generation of equipment to ensure safety and security at the airport • Make periodic external and internal rounds • Plan a traffic plan • Fencing the airport	Airport operator	From the design stage of the project	• Implement the airport emergency plan • Security forces intervention

X.3.4. ENVIRONMENTAL MONITORING AND SURVEILLANCE PLAN

X.3.4.1. MONITORING PLAN

Environmental monitoring concerns the rehabilitation and operational phases of the airport. Its purpose is to ensure that the measures concerning the administrative, regulatory and environmental aspects recommended in the ESIA and ESMP are applied.

Table 58: Summary of monitoring measures

Components of the system	Recommended action	Implementation timescales	Cost[39]
Noise	• Check the sound power level of noisy equipment • Check the noise level at the airport property limits	From the beginning of the work and during operation	CFAF 2,000,000 (purchase of measuring equipment)
Waste products	• Collect and dispose of waste • Find an agreement with approved companies for waste disposal	From the beginning of the work and during operation	To be defined
Air quality	• Measure the concentrations of the main air and fine particulate pollutants	Before the work and during operation	CFAF 1,500,000 per measurement campaign
Sewage water	• Set up a pre-treatment system • Take samples and analyze them	During the construction phase and during operation	300 000 FCFA per sample
Water (use and consumption) and energy	• Install counters	During the construction phase and during operation	SDE, SENELEC rates
Local employment	• Monitor recruitment at the local level	Before the start of the work	No specific cost
Loss of housing and market gardening perimeters	• Ensure compensation for losses	Before the start of the work	To be defined with CDREI

X.3.4.2. SURVEILLANCE PLAN

Environmental surveillance makes it possible to assess the relevance and effectiveness of the measures implemented for environmental management. The observations made during the surveillance will make it possible to readjust, redefine if necessary the mitigation measures, and

[39] This cost is indicative and serves as a basis for determining the expenses to be incurred in connection with the environmental and social management of the project

also to revise certain provisions taken concerning the management of environmental impacts, taking into account new developments on the site (if necessary) and the evolution of techniques.

Table 59: Summary of surveillance actions

Component	Type of surveillance	Monitoring location	Surveillance method/indicator	Frequency
Noise	• Noise measurements by integrating sound level meter • Noise mapping	On site and within property boundaries	• Number of measurements performed • Noise measurement results • Number of noise protection devices installed	Monthly
Waste products	• Level of implementation of the waste management plan	On the site	• Quantity and type of waste generated • Volume of waste disposed of per day • Waste tracking forms	Weekly
Air quality	• Concentration measurement by diffusion tubes • Measurement of air quality at the edge of the runway, where reactor thrust is at its highest • Measurement of concentrations of key air pollutants	On site and in the vicinity of the airport	• Results of concentration measurements • Difference between the measurement results and the ELVs of the NS 05 062 Standard	Quarterly
Sewage water	• Sampling and analysis of pre-treated water	At the point of release	• Quantity of pretreated wastewater • Final processing report	Before wastewater discharge
Water (use and consumption) and energy	• Installation of the meters	On the site	• Quantity of water consumed • Energy consumed	Bi-weekly
Local employment	• Monitoring of local recruitment	Departmental/Municipal Council	• Number of local employees • Number of fixed-	Bi-weekly

			term and permanent contracts	
Loss of housing and market gardening perimeters	• Monitoring of compensation payments	Prefecture	• PV of payment of indemnities • Number of persons compensated	-

X.3.5. SURVEILLANCE SCHEDULE

Environmental monitoring and surveillance will begin with the rehabilitation phase and will be carried out periodically throughout the lifespan of the airport.

X.3.6. ESMP IMPLEMENTATION PLAN

X.3.6.1. IMPLEMENTATION MANAGERS

Responsibility for implementing the measures recommended in the ESMP is shared between the project promoter, the contracting company for the work, the airport operator and other stakeholders in the community.

X.3.6.1.1. PROJECT MANAGEMENT TEAM

- **Promoter (MTADIA)**

Throughout the entire process from rehabilitation to operation, the promoter is the first supervisor of the implementation of the measures. He must ensure strict compliance with environmental and social closures by project implementers.

During the operational phase, he must set up an HSE unit to ensure regulatory compliance regarding health, safety and security at the airport.

- **Contracting company of the project (TRANSCON)**

The company in charge of the works will be obliged to comply with the clauses of the Contract and the Environmental and Social Clauses Notice that will be sent to it.

Compliance with these practices will in particular condition the final acceptance of the site and the payment of the related financial deadline, if provided for.

- **Design and control office**

The recommended strategy for the successful implementation of the accompanying measures is based on their monitoring by a design and control office, under the supervision of **TRANSCON** in collaboration with the relevant government departments (DEEC, DREEC, IREF, IRTSS, etc.).

This approach takes into account the circumstances prevailing at the time of implementation of the measures recommended in the ESMP. Indeed, the companies in charge of the works are not always specialized in the implementation of certain actions such as mangrove reforestation, awareness raising, and subcontract to SMEs.

Finally, the design and control office recruited to carry out certain project support actions must comply with the terms of reference drawn up by the promoter for the actions to be carried out.

DEEC, DREEC and the Monitoring Committee

State responsibility for controlling the environmental management of the project is officially entrusted to DEEC through the Division of Environmental Impact Studies (DEIE).

In principle, copies of monthly environmental activity and monitoring reports should be sent to the Saint-Louis DREEC, which is the regional monitoring body for the environmental compliance of projects.

Structures such as NGOs, associations and local SMEs may also be called upon as neutral actors in the monitoring and evaluation of the ESMP.

The committee will be composed of the following members, but not limited to:

- local authorities (the Governor and the Prefect);
- municipal authorities;
- representatives of the population;
- the Directorate of Environment and Classified Establishments (DEEC);
- the technical services of the concerned State;
- the HSE consulting engineering firm;
- relevant stakeholders (NGOs, representatives of women's groups; youth representatives,);
- representatives of MTADIA and the Ministry of Interior, etc.

The committee will be supported technically and financially by MTADIA, which is responsible for the institutional supervision of this project, in order to ensure effective monitoring of the management plan. It will meet periodically to evaluate the experts' reports on the company's environmental, health and safety monitoring.

On this basis, the committee will make the recommendations to be implemented.

X.3.6.2. CAPACITY BUILDING OF THE MONITORING AND SURVEILLANCE COMMITTEE

For the proper implementation of the measures recommended in the ESMP and the monitoring of their implementation, it seems necessary to take into account the fact that the technical capacities to implement the various negative impact mitigation and monitoring measures are not the same for all categories of actors.

Therefore, to enable all actors to play their role, it is necessary to strengthen their capacities on environmental issues related to the project.

Thus, to ensure that environmental and social issues are properly taken into account when carrying out the activities planned in each component in accordance with the ESMP, MTADIA will have to develop a capacity building programme for the members of the National Technical Committee and those of the Regional Environmental Monitoring Committee involved in monitoring the implementation of the ESMP.

This capacity building programme should be based on information and awareness campaigns on:

- HSE management of the airport rehabilitation and operation project;
- good HSS practices related to airport operations;
- the mitigation measures to be implemented;
- etc.

This information and awareness program will be conducted by the promoter with the support of an HSE specialist.

The following table presents the different activities to be carried out as part of the capacity building of the members of the monitoring committee but also of the airport employees.

Table 60: Capacity-Building Program

<table>
<tr><th>Activities</th><th>Responsible Entity</th><th>Beneficiaries of the training sessions</th><th>Deadlines and duration</th><th>Indicative costs in CFA Frs</th></tr>
<tr><td rowspan="2">Training of airport space management administrators</td><td>HAAS</td><td>National Police</td><td rowspan="2">As soon as operations start up</td><td rowspan="2">10,000 Frs/ participant/ day + coffee break</td></tr>
<tr><td>MTADIA</td><td>Airport Customs</td></tr>
<tr><td>Training on airport fire safety</td><td>ASECNA</td><td>Airport Fire Brigade</td><td>As soon as operations start up</td><td>10,000 Frs/ participant/ day + coffee break</td></tr>
<tr><td rowspan="2">Training on HSE management of a rehabilitation site</td><td rowspan="4">MTADIA</td><td rowspan="2">Members of the Regional Environmental Monitoring Committee + members of the Technical Committee</td><td>Before starting airport operations</td><td>10,000 Frs/ participant</td></tr>
<tr><td>1 day</td><td>Coffee break</td></tr>
<tr><td rowspan="2">Training on Health, Safety, Hygiene, Health and Security standards in the airport environment</td><td rowspan="2">Airport hygiene and sanitation officers</td><td>Before airport operation and during the operation phase</td><td>5000 Frs per participant</td></tr>
<tr><td>2 days</td><td>Coffee break</td></tr>
<tr><td rowspan="6">Training on solid waste and liquid discharge management at airports</td><td rowspan="6">Airport operator</td><td rowspan="3">Surface technicians provided by the service provider in charge of airport hygiene and cleanliness</td><td>As soon as airport operations begin</td><td>5000 Frs per participant</td></tr>
<tr><td>1 day</td><td>Coffee break</td></tr>
<tr><td>A training session that can be replicated 3 times a year</td><td>-</td></tr>
<tr><td rowspan="3">Authorized service providers operating in the airport area</td><td>As soon as airport operations begin</td><td>5000 Frs per participant</td></tr>
<tr><td>1 day</td><td>Coffee break</td></tr>
<tr><td>A training session that can be replicated by the trainees.</td><td>-</td></tr>
</table>

X.3.6.3. OPERATIONAL MEANS AND PROCEDURES

To confirm its willingness to take the environment into account, the Ministry of Air Transportation and Airport Infrastructure Development (**MTADIA)** will be asked to

- recruit/design one (or more) competent manager(s) responsible for the management of environmental aspects as well as HSS aspects;
- to draw up a Site Environmental and Social Action Plan highlighting in particular the conditions for treating solid and liquid discharges from the site and equipment, the conditions for restoring the site, the traffic conditions of vehicles and construction machinery, the regulatory constraints in force, and/or the commitments made with third parties;
- to integrate into the environmental and social action plan a Health, Safety and Hygiene Plan that it will undertake to respect for works likely to produce impacts, namely: pollution of the environment by rubble, noise pollution (noise from machinery), risks of accidents, disruption of the movement of goods and people;
- to comply with national regulations on worker health and safety and to comply with ILO and STD conventions.

X.3.6.4. IMPLEMENTATION TIMESCALES

The monitoring and surveillance phase will begin with the work phase but will last at least one year beyond that.

During the years of operation, the activities supervised by the operator will be evaluated and the operator will be required to submit regular monitoring reports to DEEC and DREEC, in accordance with legislation.

X.3.6.5. BUDGET

The cost of environmental and social measures for the implementation of the ESMP is difficult to estimate at this stage of the project.

It should be noted that this budget may be updated and reassessed as the project progresses.

Table 61: Operating budget of the monitoring committee

<table>
<tr><th rowspan="3">Operating budget of the environmental monitoring committee</th><th>Activities</th><th>Frequency</th><th>Actors</th><th>Prices</th></tr>
<tr><td rowspan="2">Monitoring the implementation of the ESMP</td><td rowspan="2">Quarterly in construction phase
Semi-annual in operation phase</td><td>CRSE</td><td>10,000 CFA francs/day/person
Transportation fuel package 15 000 FCFA Saint-Louis city-airport</td></tr>
<tr><td>Members of the National Technical Committee</td><td>40,000 CFA francs/day/person
Transportation fuel package 100 000 CFA francs</td></tr>
</table>

XI. CONCLUSION

This project to rehabilitate the Saint-Louis airport will mark a new era in civil aviation in Senegal. In the long term, it will provide a better environment for aeronautical activity and will encourage the growth of air traffic in this area. In addition, this project is an opportunity to create jobs and will help revive the tourism sector. It will have many positive impacts on the socio-economy and will encourage the arrival of investors for the implementation of large-scale projects since the accessibility of the region will be easier.

Beyond the positive aspects, this environmental assessment prior to the execution of the project made it possible to identify negative impacts that could affect various environmental components. Noise and waste generation, pollution (soil, water, air), accident risks are generally the likely impacts that may result from project activities.

To mitigate all these negative effects and optimize the positive ones, the study proposed impact management measures as well as prevention and protection measures against possible risks related to the rehabilitation and operation of the airport.

The ESMP developed in this report will allow for the monitoring and surveillance of the implementation of these measures. For its successful implementation, the involvement of all stakeholders is necessary.