Air Quality Impact Assessment Report

1. Introduction

In a bid to harness the promising prospect of the agro-business sector in Guinea, Diaoune Agro-Industrie Sarl ("DAI or the Company") intends to construct and operate a Cashew nuts processing factory (10,000 metric tons per annum) in Boké, which is considered the largest cashew production basin in Guinea. The project will involve sourcing raw cashew nuts from licensed brokers and smallholder farmers in the Boke region and processing them into unflavoured cashew kernels majorly for export and a smaller percentage of local consumption.

Hence, Richflood International Limited was appointed by Diaoune Agro-Industrie Sarl to conduct an Environmental and Social Impact Assessment (ESIA) for the new Cashew nuts Processing Plant in Boke Region, Republic of Guinea. In executing this assignment, the studies will assess the impacts associated with the construction and operation of the new Cashew nuts Processing Plant in Boke region. The Environmental and Social Impact Assessment (ESIA) study has been conducted for the project in line with Presidential Decree No.199/PRG/SGG/89 of 18th November, 1989, made under Articles 82 and 83 of the Environmental Code which sets out the projects requiring an Environmental Impact Assessment (EIA) study.

Richflood International Limited undertook the air quality study for the ESIA. The regulatory requirement with respect to air quality, the scope of the study, the methodology, DAI cashew nut processing plant project phases, the potential sources of air pollution, overview of pollutants and potential impacts, impact assessment and recommendations for mitigation and management actions were provided.

2. Project Description and Air Quality

2.1 Project description

The Project Description sets out the scope of the Project features and activities, with particular reference to the aspects which can impact the environment and social settings. The proposed DAI cashew processing will be constructed in Boké, which is considered the largest cashew production basin in Guinea. Interestingly, the proposed plant in Boké will serve as DAI’s second cashew processing plant in Guinea, after successfully, establishing and currently operating one in the Kankan region. The facility will be constructed to transform raw cashew nuts into cashew kernels for local and international consumers with an annual production capacity of 10,000 tons.

The proposed Cashew nut processing project facility will be located in Boke prefecture, which is one of the prefectures in the Boke region of Guinea. The project will be situated in Kataba village on a land area of 30,0000sq m along the major Boke-Kalaboui Road. The site is situated approximately 14.3km due west along the main road, outskirts of the main Boke town. Accessibility by road through the project site to Boke town from Conakry is through the Boke-Kalaboui Road which serves as the only access to the part of Guinea. A map showing the project site with the entire Boke region is shown in Figure 2.1. Furthermore, the project site boundary coordinates are as indicated below:

- SW corner: 10° 50′ 11.1″N, 14° 21′ 23.2″W
- SE corner: 10° 50′ 11.8″N, 14° 21′ 25.2″W
- NE corner: 10° 50′ 4.3″N, 14° 21′ 28.2″W
- NW corner: 10° 50′ 3.9″N, 14° 21′ 24.4″W
- NW corner: 10° 50′ 3.9″N, 14° 21′ 24.4″W

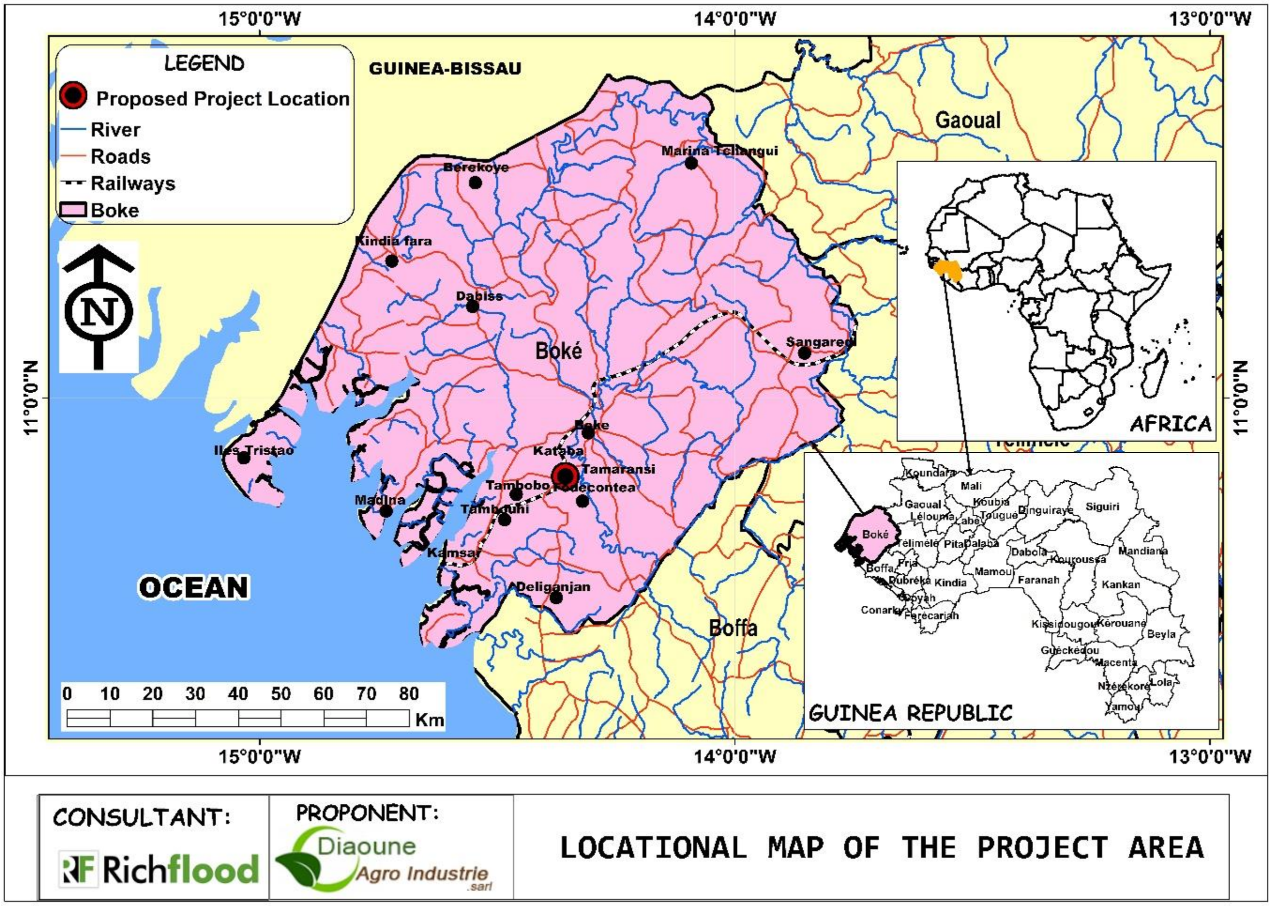


Figure 2.1: Location of the Proposed Project

Source: Richflood, 2022

2.1.1 Pre-construction Phase

This stage involves carrying out various studies to ascertain the economic, financial and environmental viability of the proposed Cashew processing project. Also, included in this stage are designing, feasibility studies, socio-economic surveys and community engagement etc. for the proposed project. More so, the construction of residential camps and offices for the contraction workers and provision of associated facilities.

2.1.2 Construction Phase

The Project facility with key features and sections is presented in Figure 3.3. The Project site is located on a fallow vegetation area and part of which had a gallery forest around the nearby stream on the west section of the site. The construction of the Project is not expected to lead to land taken beyond the proposed land plot allocated to the Project. At the time of the site visits undertaken in developing this ESIA (October 2022), the Project site has been cleared for setting up the various units of the plant with fencing structures. The description of the key sections of the cashew processing plant which is largely based on the knowledge of similar plants in Kankan includes the following:

- Administrative and service block
- Processing factory
- Processing and storage Warehouse
- Sorting and Calibration warehouse
- Security Gate and Weighing bridge area
- Car/ trailer park

The construction phase will involve works such as project site fencing, surface run-off channelization, drilling borehole water source, excavation and foundation work as well as factory and warehouse structure erection and installation. Construction-related nuisances such as noise and dust will be very limited given the temporary nature of the works.

The construction works for the cashew nut plant and the various activities will include:

- Vegetation clearance, surface stripping and topsoil stockpiling;
- Excavation works for structural foundation;

- Channelling and installation of site drainage;
- Establishment of hard standing for laydown areas, roads, paths; and
- Laying of concrete;
- Vegetation landscaping

2.1.3 Project Construction Contractor

Most of the raw materials (steel, cement) and other materials will be brought to the site by trucks. DAI has retained *Societe de Gestion Immobilière et de Construction* (SOGICO) for the construction of the proposed plant in Boke. SOGICO is a Guinea-based company with 15 years of experience in construction and civil works involving the similar project. Earlier, SOGICO was responsible for the construction of the DAI currently operating cashew plant in Kankan.

2.1.4 Operational Phase

Activities during the operational phase, the project will mainly focus on the following points:

- Sourcing and supply of raw cashew nuts to the factory;
- Processing of raw cashew nut into kernels;
- Distribution and export of finished raw cashew kernel; and

3. Air Quality Legislation and Standards

3.1 International Standards

There are a number of International Environmental and Occupational Health and Safety Laws, Regulations and Protocols that apply to the project. These were taken into consideration during the AQIA and include:

- International Finance Corporations (IFC)'s Performance Standards on Environmental and Social Sustainability, 2012.
- The IFC General Environmental, Health, and Safety Guidelines (EHS) (April 30, 2007).
- IFC's EHS Guidelines: Environmental Air Emissions and Ambient Air Quality, 2007.
- European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe (Directive 2008/50/EC).
- FD (06. 2012) and European/(EU) Emission Standards.
- OHSAS 18001 for Occupational Health and Safety and the "Pollution Prevention and Abatement Handbook" by the World Bank Group, 1998.

3.2 World Health Organisation

The World Health Organisation (WHO) provides guidelines to protect public health from the adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. The guidelines are based on expert evaluation of current scientific evidence and are intended to inform policy makers and to provide targets for air quality management in different parts of the world. In establishing pollutant levels below which exposure – for life or for a given period of time – does not constitute a significant public health risk, the guidelines provide a basis for setting standards or limit values for air pollutants. In general, the guidelines address single pollutants, whereas in reality, exposure to mixtures of chemicals occurs, with additive, synergistic or antagonistic effects. In dealing with practical situations or standard-setting procedures, therefore, consideration should be given to the interrelationships between the various air pollutants. It should be emphasized, however, that the guidelines are health-based or based on environmental effects, and are not standards per se. In setting legally binding standards, considerations such as prevailing exposure levels, technical feasibility, source control measures, abatement strategies, and social, economic, and cultural conditions should be considered.

3.3 Guinean Legislation

3.3.1 Regulations on Environmental and Social Impact Assessment

Presidential Decree No.199/PRG/SGG/89 of 18 novembre 1989, made under Article 82 and 83 of the Environmental Code (Code de l'Environnement) (Décret présidentiel 199/PRG/SGG/89 du 18 novembre 1989 portant Codification des études d'impact sur l'environnement, pris conformément à l'article 82 et 83 du Code de l'environnement), sets out the projects requiring an environmental impact assessment (EIA) study. This decree lists the types of projects that require an EIA and the content of the EIA study.

Order No. 990/MRNE/SGG/90 of 31 April defines the content, methodology and procedure of the EIA study), and establishes the content, methodology, and procedures to be complied with when carrying out an environmental impact assessment.

This content is also specified in the General Guide for Impact Studies (February 2013). Environmental impact studies must contain the following information:

- A brief description of the Project with its particular purpose(s); its geographical location; an estimate of its cost of implementation; the date on which the investment decision was taken and the timetable of the Project.
- A description of the environmental and social baseline situation of the site, on aspects likely to be affected by the Project such as sites, natural resources, landscape and socio-economic and cultural conditions. The aspects to be covered in the Project include geology and soils, hydrogeology, hydrology, fauna and flora, landscape and visual aspects, air pollution and noise, traffic and infrastructure, social and socioeconomic status.
- An analysis of the Project's impacts on the environment, particularly on the landscape and visual aspects; on the flora and fauna, natural habitats and biological balances and, where appropriate, the nuisances (noise, vibration, odour, etc.), hygiene and public health, and cultural heritage.

3.3.2 Climate and Clean Air Coalition

Guinea became a partner of the Climate and Clean Air Coalition (CCAC) in 2014, aiming to adopt measures to reduce short-lived climate pollutants (SLCPs) and to identify priority areas for near-term climate mitigation.

3.3.3 Air emissions

The following Guinean Standard defines the air emission limits: NG 09-01- 011:2012 / CNQ: 2004 relating to new standards for air pollutant emissions (Norme Guinéenne NG 09-01-011:2012 / CNQ: 2004 Sur la Pollution Atmosphérique– Rejet).

These texts apply to any new and existing fixed or mobile installation that emits atmospheric emissions (including vehicles).

The texts require that anyone that operates or intends to build a facility that emits air pollutants shall provide the competent authority with the following information:

- the nature and quantity of emissions;
- location and height of the point of discharge; and
- other characteristics of the discharge, are needed to estimate emissions.

In addition, limits for air quality standards are set. These are summarized in Table 3.1.

Table 3.1: Air quality standards: Guinean directives

Pollutants	Guinean Limits	Statistical definitions
SO_2	50 µg/m^3 125 µg/m^3	Yearly average Daily average
NO_2	40 µg/m^3 200 µg/m^3	Yearly average Hourly average
CO	30 µg/m^3	Daily average
PM_{10}	80 µg/m^3	Yearly average

Pollutants	Guinean Limits	Statistical definitions
	260 µg/m^3	Daily average
$PM_{2.5}$	65 µg/m^3	Yearly average

Table 3.2: Emission limits for stationary combustion units: Guinean directives

	Guinean standards (draft)	
Pollutants	**Heavy Fuel**	**Diesel (DO)**
CO	650 mg/Nm^3	450 mg/ Nm^3
NO_x	300 mg/ Nm^3	165 mg/Nm^3
SO_2	2,000 mg/ Nm^3	-
Dust / Particulate Matter (PM)	50 mg/ Nm^3	50 mg/ Nm^3

The IFC (International Finance Corporation) General EHS Guidelines (2007) set guidelines for ambient air quality. Table 3.3 presents international air quality standards, for the following pollutants: NO_2, CO, PM_{10}, $PM_{2.5}$ and SO_2. The international standards set by the IFC Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality published on 2007 refers to the WHO Air Quality Guidelines.

The IFC Guidelines are intended to confer a maximum degree of protection of human health. However, these also include a degree of pragmatism in recognising that achievement of the guidelines may not be achievable in all circumstances; in these cases, for some pollutants interim targets are identified. These are designed to confer a degree of protection of human health, with the aim that regulators should work towards achievement of the Guideline.

Table 3.3 Air quality standards: Guinean and IFC General EHS directives

Pollutants	Guinean Limits	IFC limits (WHO AQ Guidelines)	Statistical definitions
SO_2	50 µg/m³ 125 µg/m³ -	- 125 µg/m³ (Interim target 1) 50 µg/m³ (Interim target 2) 20 µg/m³ (Guideline) µg/m³ 500 µg/m³	Yearly average Daily average 10 min average
NO_2	40 µg/m³ 200 µg/m³	40 µg/m³ 200 µg/m³	Yearly average Hourly average
CO	30 µg/m³	-	Daily average
PM_{10}	80 µg/m³ 260 µg/m³ (1)	70 µg/m³ (Interim target 1) 50 µg/m³ (Interim target 2) 30 µg/m³ (Interim target 3) 20 µg/m³ (Guideline) 150 µg/m³ (Interim target 1) 100 µg/m³ (Interim target 2) 75 µg/m³ (Interim target 3) 50 µg/m³ (Guideline)	Yearly average Daily average
$PM_{2.5}$	65 µg/m³ -	35 µg/m³ (Interim target 1) 25 µg/m³ (Interim target 2) 15 µg/m³ (Interim target 3) 10 µg/m³ (Guideline) 75 µg/m³ (Interim target 1) 50 µg/m³ (Interim target 2) 37.5 µg/m³ (Interim target 3) 25 µg/m³ (Guideline)	Yearly average Daily average

4. Baseline Assessment

4.1 Meteorological Conditions

Meteorological data was taken to characterise the atmospheric dispersion potential of the DAI cashew nut processing plant area and surrounds. Meteorological parameters recorded include wind speed, ambient air temperature, relative humidity, and precipitation. The climate and meteorology of the area is described in this section and includes discussion of the local meteorological conditions pertaining to the site.

4.1.1 Regional Climate

Generally, the climate in Guinea is influenced by the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator and is characterised by wet and dry conditions controlled by the north-south movements of the Inter-Tropical Convergence Zone around the equatorial line. Climatic conditions specific to the Boke region are largely dominated by two dominant air masses, namely the Tropical-Continental air mass (cT) which brings the dry and dusty northeasterly wind from the Sahara Region and the Tropical-Maritime (mT) air mass which originates from the Atlantic Ocean and brings warm and wet southwesterly winds. Both air masses are controlled by the movements of the Inter-Tropical Convergence Zone. This interplay of two major air masses results in a distinct wet and dry season in the area.

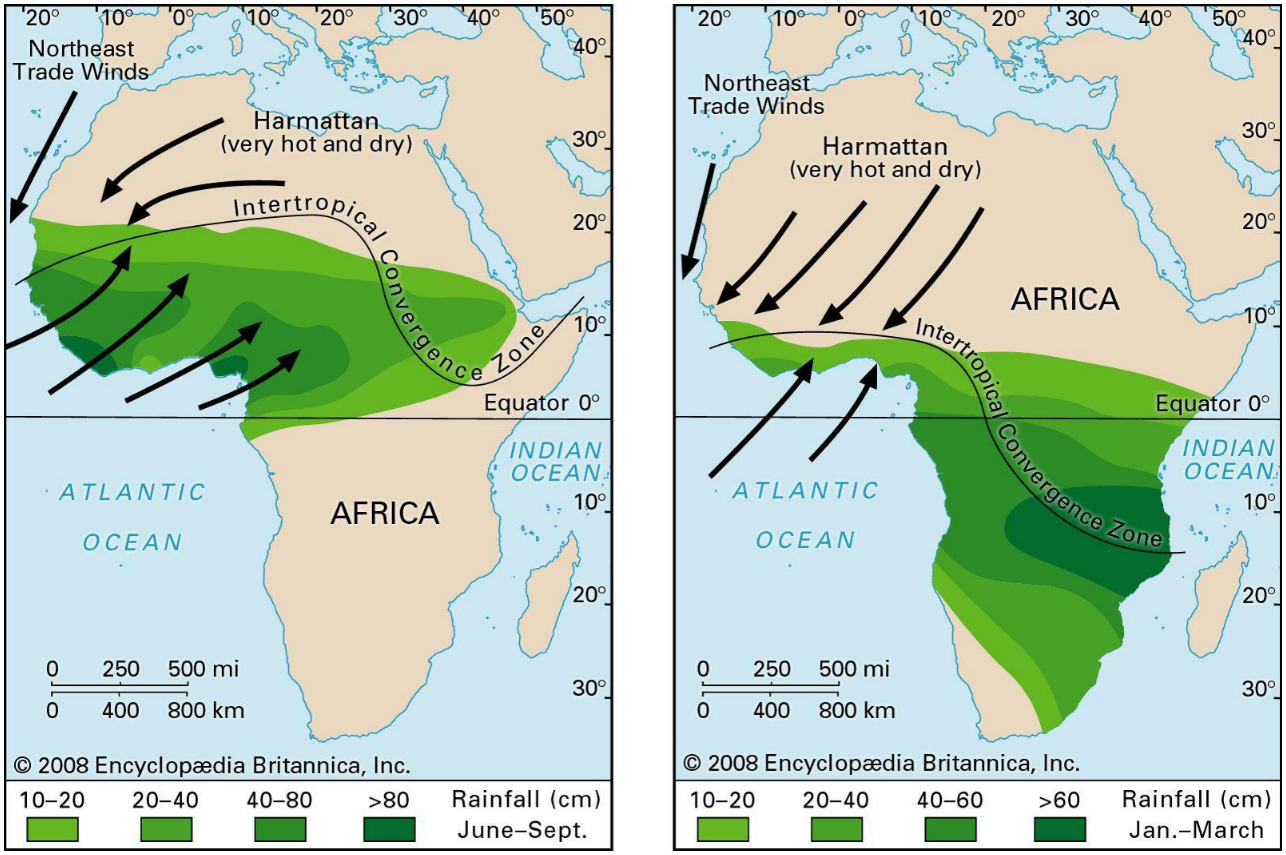


Figure 4.1: Schematic streamlines of near-surface flow in the Global Tropics

Source: *Encyclopaedia Britannica (2022)*

4.1.2 Local Climate

Boke region consists of an upper Proterozoic basement overlain by marine sedimentary rocks and volcanic deposits of the Palaeozoic age (Zhang *et al*., 2018). The proposed project area is characterized by Palaeozoic deposits, including sedimentary strata of the Pita suite (Ordovician), Télimélé suite (Silurian), and Faro Suite (Devonian). Fundamentally, in the project area, the Pita suite is represented by quartz sandstone, pebble conglomerate and conglomerate, the Télimélé suite by argillites, siltstones and shales, and the Faro suite by siltstones, argillites and fine-grained sandstones as shown in Figure 4.2

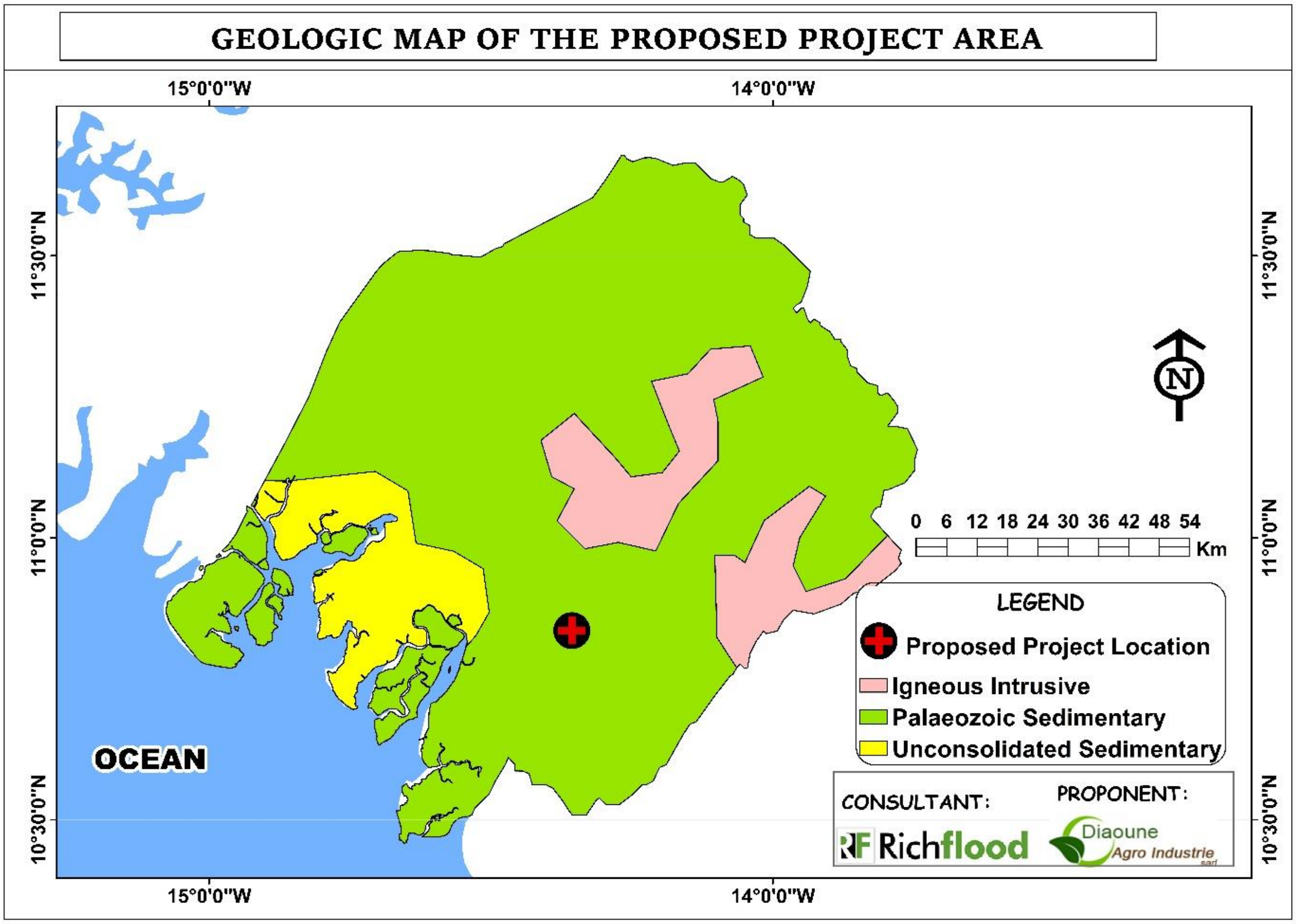


Figure 4.2: Geologic Map of the Proposed Project Area

(Modified from Stephen et al., 2022)

Rain and Temperature

Boke has a typically subequatorial tropical humid climate, which is characterized by a wet and dry season. With the arrival of the migratory Inter-Tropical Convergence Zone (ITCZ), the wet season starts from mid-May to mid-November, peaking in August, while the dry season starts from mid-November to mid-May, with its driest period in January. The dry season is typified by hot dry wind known as the harmattan, which blows from east and northeast, warm air and dust from the Sahara Desert.

The area experiences significant rainfall, with annual rainfall ranging from 2100 and 5000mm (mid-May to mid-November), and a monthly maximum of over 1000mm in August. The sub-

Guinean tropical climate in Lower Guinea extends over the Boké region. During the coldest month of the year which is August, temperature ranges from 23 to 28°C. The average annual temperature for Boké during the dry season ranges between 24 and 38ºC. The hottest month of the year is January with daytime temperatures exceeding 37ºC.

Boké experiences extreme seasonal variation in the humidity. Considering that the climate within the project area is essentially tropical, relative humidity tends to be high for much of the year. Based on historical climate data from 1961 to 1990, the average monthly Relative humidity for Boké as obtained from the World Meteorological Organisation indicates an average of 68% indicating relatively high conditions for most of the year.

Topography, Relief and Drainage

The general landscape of the project area consists of relatively flat and undulating land. The landscape within the project area is adapted to vegetation and crop cultivation with most of the area having slopes under 50 degrees. The elevation of the project AOI ranges from 8 to 44 meters above the mean sea level. The lowest elevation is at the northwestern side of the project area while the highest elevation is at the eastern part of the project area.

A Digital Elevation Model (DEM) of the terrain surface of 5 km Project AOI is shown with the height range in Figure 4.5. Contours of the Project AOI are generated from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) relief maps and relevant information are extracted from the Shuttle Radar Topography Mission (SRTM) DEM. All the processing was completed using the ArcGIS 10.7 and Surfer software.

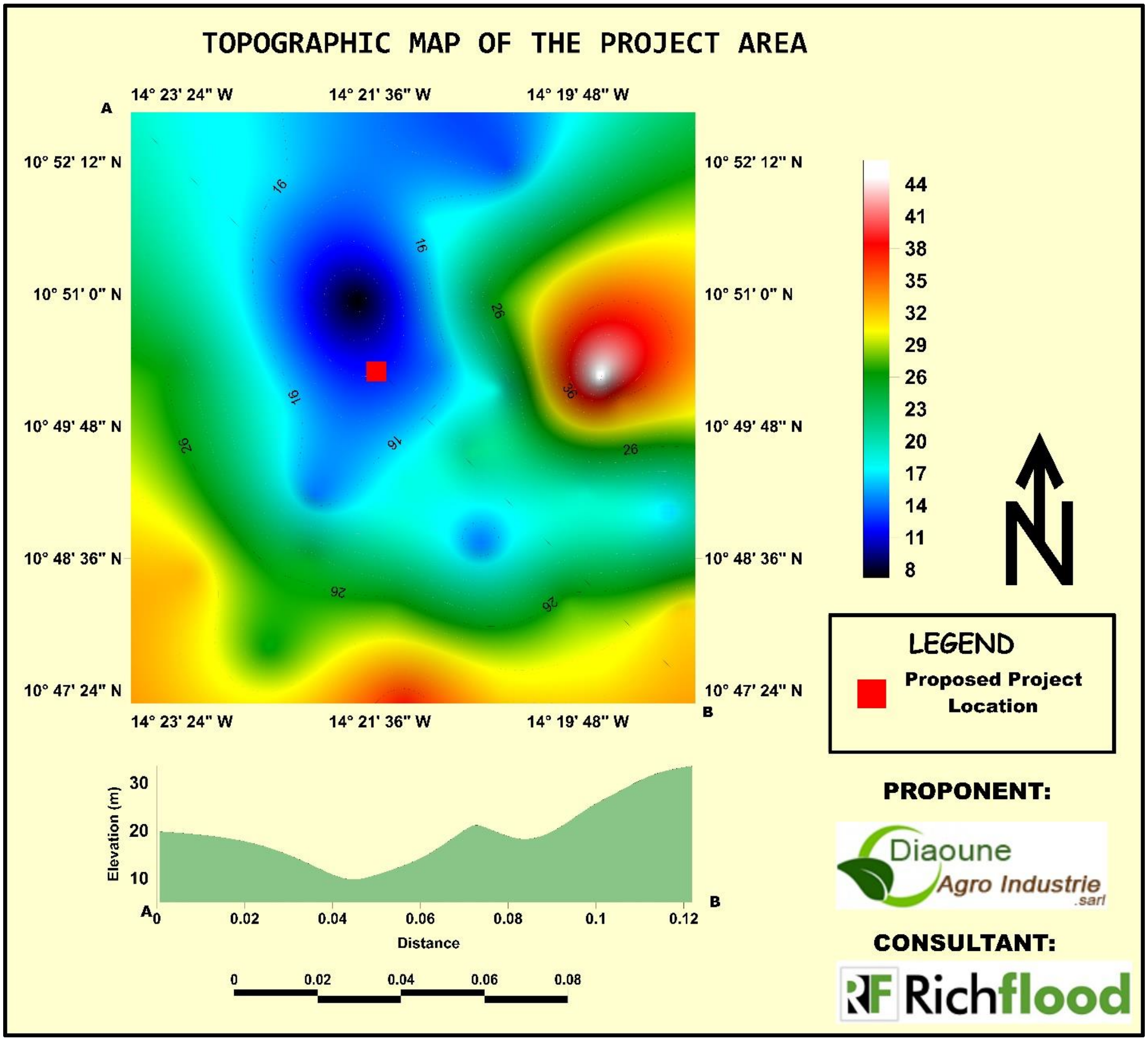


Figure 4.3: Topographic map of the project area

Source: Richflood, 2020

S/N	Sample Location	Temp (°C)	Dew Point (°C)	Wet Bulb (°C)	Relative Humidity (%RH)	Atmospheric Pressure (HPA)	Wind Speed (m/s)
		Avg.	**Avg.**	**Avg.**	**Avg.**	**Avg.**	**Avg.**
1.	Project Location	29.0	47.6	48.5	80.2	1009.6	0.00
2.	Project Location	28.0	47.4	48.2	60.0	1009,6	0.30
3.	Entrance	30.0	48.4	49.7	54.1	1009.7	0.10
4.	Kataba Village	31.0	46.7	47.6	72.5	1008.2	0.40
5.	Fodecontea Village	29.0	48.2	49.4	72.4	1007.5	0.20
6.	Tambouni Village	30.6	48.1	49.4	54.8	1005.2	0.00
7.	Tambobo Village	31.2	47.4	48.5	56.6	1005.1	0.03
8.	Kataba Fula	28.4	49.1	50.0	65.2	1003.5	0.00
9.	Tamaransi Village	29.0	47.6	48.1	82.1	1009.7	0.10

Source: Richflood fieldwork, 2022

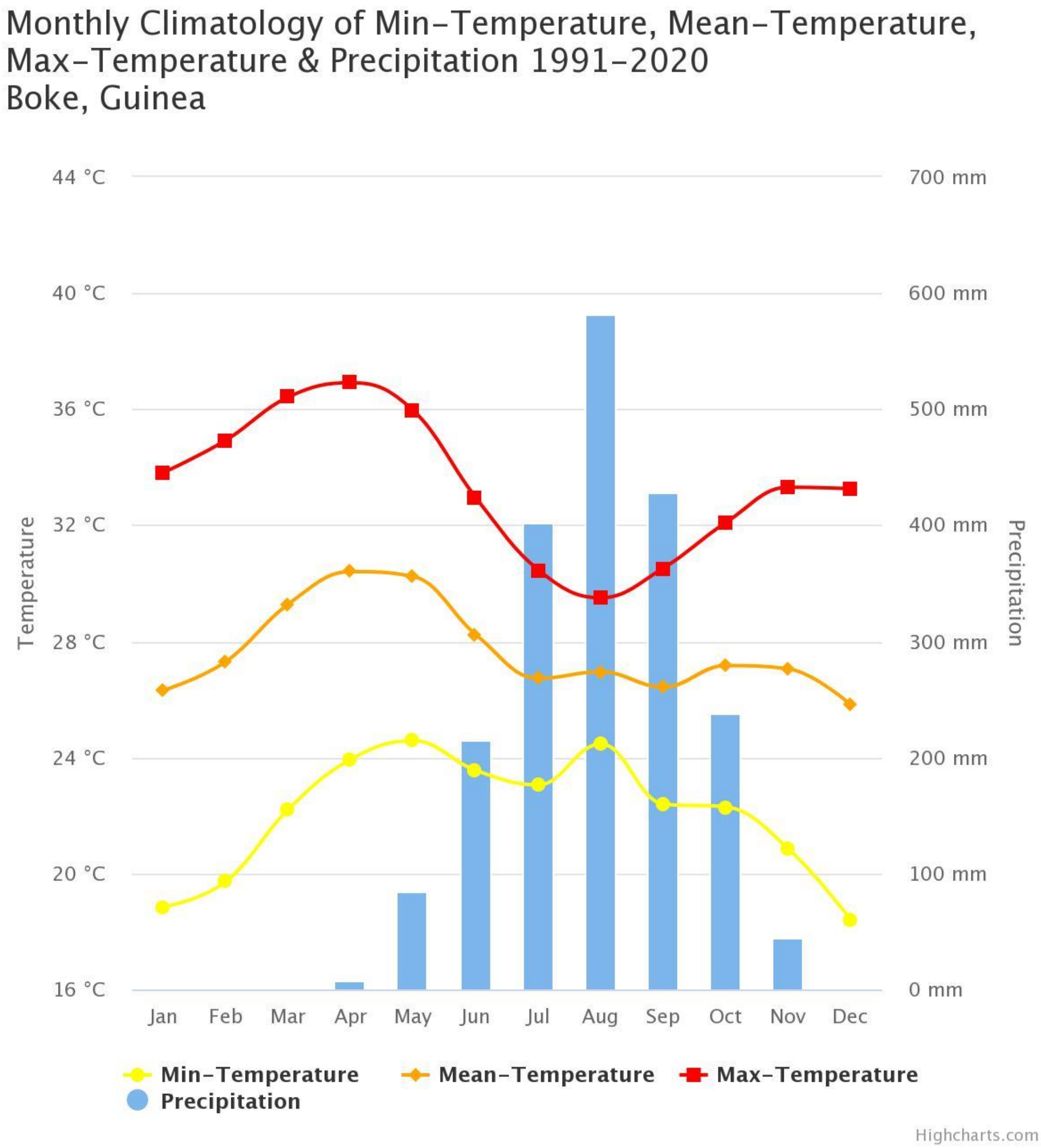
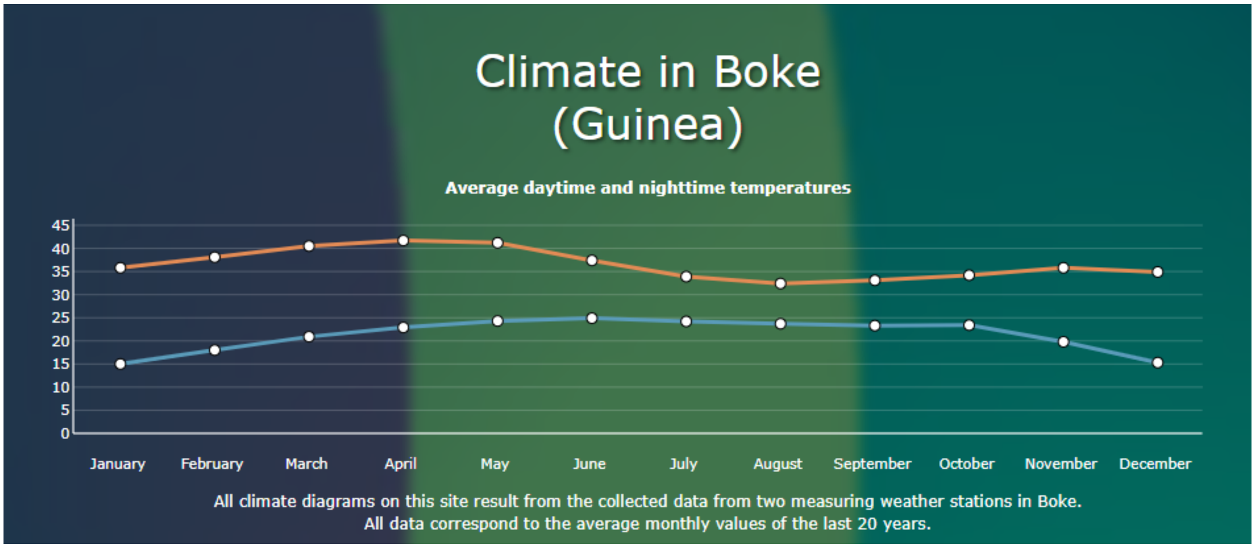


Figure 4.4: Mean Temperature and Mean Precipitation for Boke

Source: https://climateknowledgeportal.worldbank.org/country/guinea/climate-data-historical



4.5: Average daytime and nighttime temperatures in Boke

Source: https://www.worlddata.info/africa/guinea/climate-boke.php

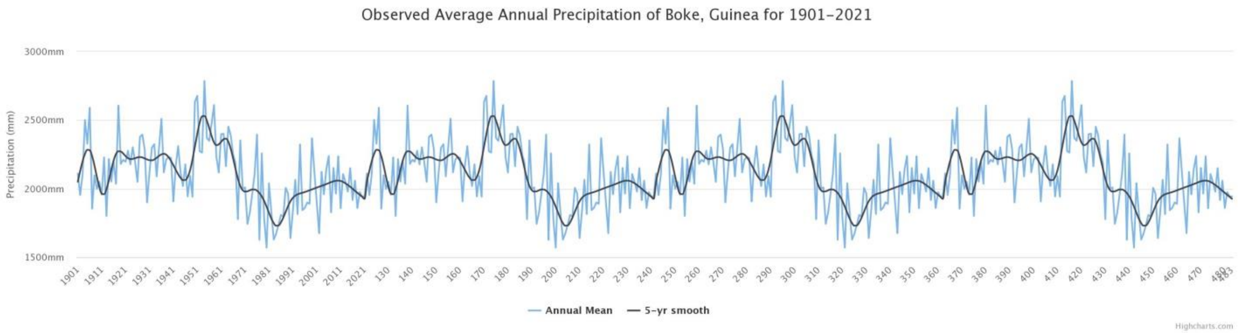


Figure 4.6: Observed Average Annual Precipitation of Boke for 1901-2021

Source: https://climateknowledgeportal.worldbank.org/country/guinea/climate-data-historical

4.2 Air Quality Assessment

Air quality varies with the season due to the variations in temperature, humidity, and rainfall. During the dry season, dusts that are suspended in the near-ground air layers may cause frequent, but not significant, hazes which reduce visibility. However, during the wet season, rainfall removes dust from the atmosphere and improves the air quality. The dry season is characteristic of very dry and dusty conditions in the proposed project area.

4.2.1 Air Quality Standards (AQS)

Current air quality baseline conditions at the project area have been assessed on the basis of the comparison of monitored concentrations against the National and International Air Quality Standards (AQS). Table 4.2 below summarizes the Guinean standards and the IFC standards.

Table 4.2: Guinean and IFC/WHO air quality standards

Parameter	Averaging period	Guinean AQS ($\mu g/m^3$)	IFC/WHO AQS ($\mu g/m^3$)
SO_2	Calendar year	50	-
	24 h	125	125 (Interim target 1)
			50 (Interim target 2)
			20 (Guideline)
NO_2	Calendar year	40	40
	1 h	200	200
	Calendar year	80	70 (Interim target 1)
			50 (Interim target 2)
			30 (Interim target 3)
			20 (Guideline)
			150 (Interim target 1)

Parameter	Averaging period	Guinean AQS ($\mu g/m^3$)	IFC/WHO AQS ($\mu g/m^3$)
PM_{10}	24 h	260	100 (Interim target 2)
			75 (Interim target 3)
			50 (Guideline)
$PM_{2.5}$	Calendar year	65	35 (Interim target 1)
			25 (Interim target 2)
			15 (Interim target 3)
			10 (Guideline)
	24 h	-	75 (Interim target 1)
			50 (Interim target 2)
			37.5 (Interim target 3)
			25 (Guideline)
CO		-	-

4.2.2 Air Quality Monitoring

Richflood has undertaken an air quality monitoring survey in the proposed project area. The atmospheric pollutants monitored in relation to air quality were: Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Suspended Particulate Matters ($SPM_{2.5\ \&\ 10}$), Hydrogen Sulphide (H_2S), Carbon Dioxide (CO_2), Carbon Monoxide (CO), Volatile Organic Compounds (VOCs), and Ozone (O_3).

- ***Particulate Matters (PMs)***

Particulate matters (PMs) are airborne particles that include dust, smoke, and soot. PMs can either be emitted naturally (e.g. windblown dust of loose soils) or through human activity (e.g. as a results of vehicular emissions). It is defined by size, with coarse particles being between 2.5-10 microns (PM_{10}), fine particles less than 2.5 microns ($PM_{2.5}$), and ultrafine particles less than 0.1 microns in aerodynamic diameter. Globally, PM_{10} and $PM_{2.5}$ have been identified as priority pollutants and they need to be monitored and managed where the source activity has the potential or is generating PM emissions.

- ***Sulphur Dioxide (SO_2)***

Sulphur Dioxide (SO_2) is a colourless gas and is characterised by a strong odour. It is a primary pollutant, which can react easily with other substances and form secondary pollutants such as sulphur trioxide and sulphuric acid, amongst others. SO_2 is formed by human activities through mainly industrial processes that contain sulphur.

- **Nitrogen Dioxide (NO_2)**

Nitrogen Dioxide (NO_2) is a naturally forming gas, characterised as having a strong odour. Small quantities can be produced by plants, soil, and water, but anthropogenic activities such as the combustion of fossil fuels and biomass are also seen as sources of NO_2 in the atmosphere.

- ***Carbon Dioxide (CO_2)***

Carbon Dioxide (CO_2) is the main product of fuel combustion in vehicle engines, along with water. CO_2 is the most significant greenhouse gas (GHG) influencing climate change, posing a threat to public health and the environment. Carbon Monoxide (CO) is released into the atmosphere as a results of an incomplete combustion, which occurs when the carbon in the fuel is only partially oxidised, forming CO and not CO_2. It is a colourless and odourless but a highly toxic gas. Direct exposure to CO reduces the flow of oxygen in the bloodstream and is particularly dangerous to people with heart disease. Like Hydrocarbons (HCs), CO also contributes to the formation of ground-level ozone and smog.

- ***Hydrogen Sulphide (H_2S)***

Hydrogen Sulphide (H_2S) is a colourless, poisonous, corrosive and flammable gas, with trace amounts in ambient atmosphere having a characteristic foul odour of rotten eggs. It is most commonly formed due to the microbial breakdown of organic matter in the absence of oxygen.

- ***Ozone (O_3)***

Ozone (O_3) is a molecule made up of three oxygen atoms, often referenced as O_3. Ozone is formed when heat and sunlight cause chemical reactions between oxides of nitrogen (NO_X) and Volatile Organic Compounds (VOCs), which are also known as Hydrocarbons. This reaction can occur both near the ground and high in the atmosphere.

- ***Volatile organic compounds (VOCs)***

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products. VOCs are often components of petroleum fuels, hydraulic fluids, paint thinners, and dry cleaning agents. VOCs are common ground-water contaminants.

A total of Nine (9) monitoring stations were established within and around the project area. Three (3) monitoring stations (AQ_1 to AQ_3) are located within the proposed project boundary area while six (6) monitoring stations (AQ_4 to AQ_9) are located in the surrounding communities. There were no nearest sensitive receptors that could be affected by a Project-related degradation of ambient air quality.

The GPS coordinates as well as the descriptions of the monitoring stations are as shown in Table 4.3, while Table 4.4 presents the monitoring results as obtained during the survey.

Table 4.3: Air Quality sampling location

Code	**Location Description**	**Coordinates**		
		Latitude (N)	**Longitude (E)**	**Elev. (m)**
AQ_1	Project Location	10° 50' 7.8″	14° 21′ 23.8″	11
AQ_2	Project Location	10° 50' 2.0″	14° 21′ 25.2″	27
AQ_3	Project location Entrance	10° 50' 3.9″	14° 21′ 24.5″	13
AQ_4	Kataba Village	10° 50' 10″	14° 21′ 6.4″	66

Code	Location Description	Coordinates		
		Latitude (N)	**Longitude (E)**	**Elev. (m)**
AQ_5	Fodecontea Village	10° 49' 59.7″	14° 21′ 55.2″	21
AQ_6	Tambouni Village	10° 48' 59.6″	14° 22′ 44.1″	41
AQ_7	Tambobo Village	10° 50' 12.0″	14° 23′ 13.9″	22
AQ_8	Kataba Fula	10° 48' 47.8″	14° 20′ 2.3″	33
AQ_9	Tamaransi Village	10° 52' 29.0″	14° 18′ 38.6″	18

Source: *Richflood fieldsurvey, 2022*

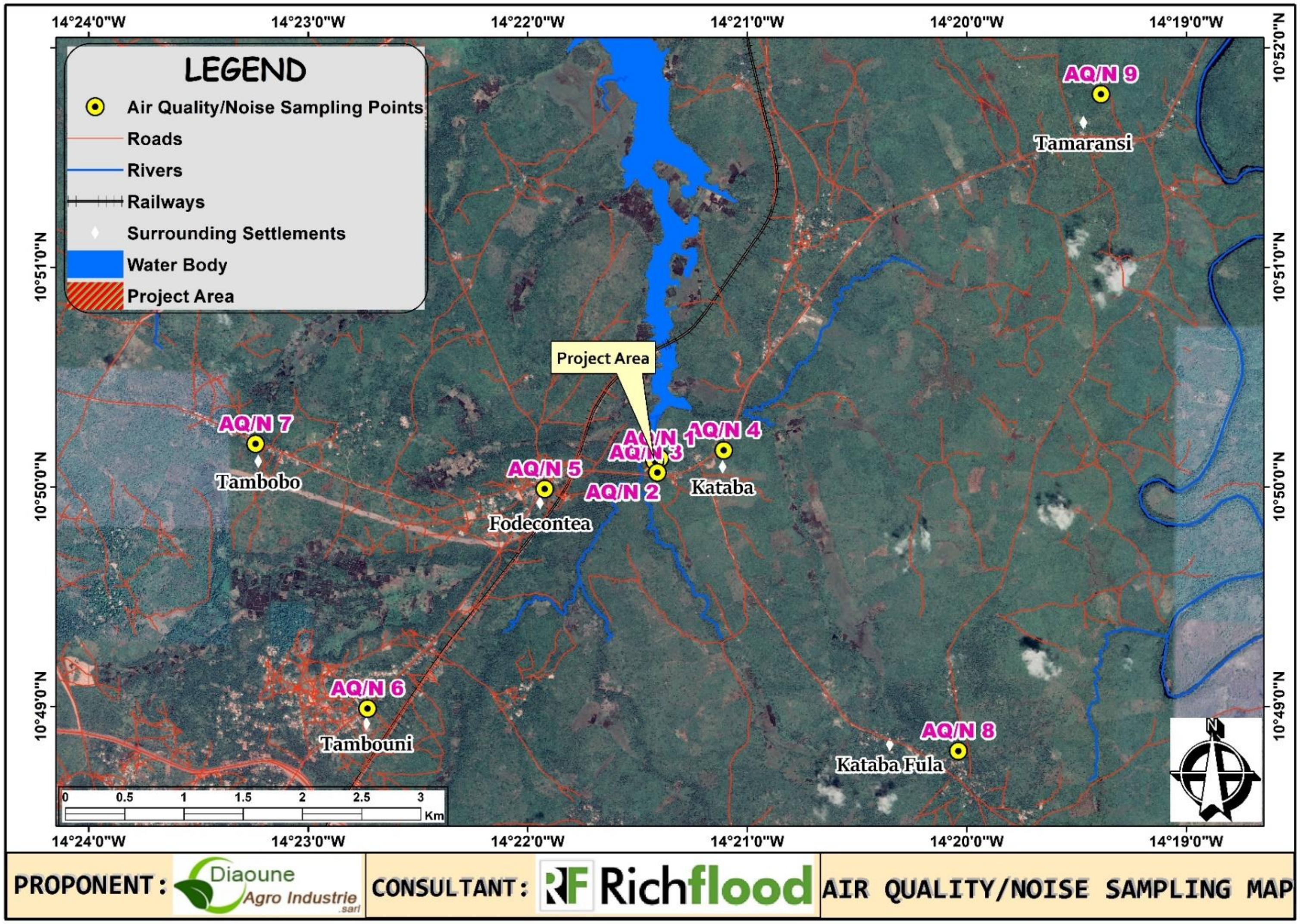


Figure 4.7: Air Quality and Noise Sampling Map

Source: Richflood, 2022

Table 4.4: Results of the Air Quality Monitoring

Sample Points	**Sample Location**	**O_3 (µg/m^3)**	**CO (µg/m^3)**	**SO_2 (µg/m^3)**	**NO_2 (µg/m^3)**	**H_2S (µg/m^3)**	**CO_2 (µg/m^3)**	**VOCs (µg/m^3)**	**SPM (µg/m^3)**		**Illumination (lx)**
									$PM_{2.5}$	**PM_{10}**	
AQ_1	Project Location	14.00	0.00	0.00	100.00	0.00	585000	3820.00	0.00	0.00	5550.00
AQ_2	Project Location	12.00	0.00	0.00	5.00	0.00	511000	1510.00	0.00	0.00	5659.00
AQ_3	Entrance	9.00	1360.00	0.00	0.00	110.00	517000	1020.00	0.00	0.00	5664.00
AQ_4	Kataba Village	11.00	0.00	0.00	38.00	10.00	477000	1120.00	0.00	0.00	5613.00
AQ_5	Fadecontea Village	0.00	0.00	0.00	2.40	0.00	485000	2550.00	0.00	0.00	5528.00
AQ_6	Tambouni Village	11.00	0.00	0.00	11.00	0.00	506000	1660.00	0.00	0.00	5692.00
AQ_7	Tambobo Village	6.00	420.00	0.00	0.00	10.00	466000	1350.00	0.00	0.00	5510.00
AQ_8	Kataba Fula	3.00	10.00	0.00	6.00	0.00	512000	1650.00	0.00	0.00	5670.00
AQ_9	Tamaransi Village	5.00	0.00	0.00	82.00	70.00	496000	1920.00	0.003	0.006	5660.00
Guinean AQS				**50**	**40**					**260**	
IFC/WHO AQS		**100**		**20**	**200**			**-**	**25**	**50**	

Source: Richflood, 2022.

5. Impact Assessment

5.1 Impact Assessment Methodology

The key elements used to assess impact significance are described in Table 5.1 and the characteristics that are used to describe the consequence of an impact are outlined in Table 5.2

Table 5.1: Impact Characteristic Terminology

Impact Magnitude	
Type	**Direct** – impacts that result from a direct interaction between the project and resource/receptor. **Indirect** – impacts that follow from direct interactions between the project and its environment as a result of subsequent interactions. **Induced** – impacts that result from other activities that happen as a consequence of the project.
Extent	**Local** – impacts are limited to the Project area and the surrounding area. **Regional** – impacts that are experienced beyond the local areas to the wider region. **International** – impacts that are experienced at an international scale i.e. affecting another country.
Duration	**Temporary** – predicted to be short-lived, of the order of hours to weeks. **Short-term** - predicted to last only for the duration of the drilling or construction operations (i.e. up to approximately two years). **Medium-term** - predicted to last from two years to the end of the project life **Long-term** - predicted to continue beyond the project life but will cease in time. **Permanent** – impacts that cause a permanent change in the affected receptor or resource that endures substantially beyond the project lifetime.
Frequency	**Continuous** – impacts that occur continuously or frequently. **Intermittent** – impacts that are occasional or occur only under specific circumstances
Likelihood*	**Unlikely** – the event is unlikely but may occur during the project. **Possible** – the event is likely to occur at some point during the project. **Likely** – the event will occur during the project (i.e. it is inevitable).

* For unplanned events only.

Table 5.2 Significance Matrix

Sensitivity / Vulnerability / Importance	Magnitude of Impact			
	Negligible	**Small**	**Medium**	**Large**
Low	*Negligible*	*Negligible*	*Minor*	*Moderate*
Medium	*Negligible*	*Minor*	*Moderate*	*Major*
High	*Negligible*	*Moderate*	*Major*	*Major*

Using the matrix, the significance of each described impact is initially rated. This rating assumes the management measures inherent in the project design are in place. Where necessary additional mitigation measures have been recommended and the impact assessed for significance assuming implementation of the recommended mitigation measures. The impacts identified for assessment below include:

- Construction
  − Contribution to human health impacts associated with air pollutant emissions during construction
- Operational
  − Contribution to human health impacts associated with PM and dust emissions during operation
  − Contribution to human health impacts associated with gaseous SO2 emissions during operation
  − Contribution to human health impacts associated with gaseous NO2 emissions during operation
- Decommissioning and Closure
  − Contribution to human health impacts associated with air pollutant emissions during decommissioning.

5.2 Construction Impacts

During construction air pollutant emissions is anticipated. Emissions from construction activities may affect the immediate project area and villages within the project study area but will decrease further away from the sources and in areas beyond the project footprint. Activities associated with the construction phase that is likely to result in emissions of the priority pollutants were identified as:

- Vegetation clearance/Habitat fragmentation/Habitat disturbance/Wildlife displacement
- Excavation works/Soil erosion and generation of site run-off.
- Vehicle exhausts emissions and vehicle entrainment of dust from vehicles traveling on the siteroads.
- Removal of topsoil and overburden by vehicles.
- Chemical storage/solid waste generation/Dust/Wastewater generation/waste storage and disposal
- Noise pollution
- Equipment/material/worker transport
- Construction of buildings and structures associated with the Project, and installation of equipment associated with its operation.
- The physical presence of workers/Workers' safety

The emissions during construction are temporary and often are not at a consistent location. Further they are extremely difficult to quantify as they depend on the activities being undertaken by specific equipment on any given day at any location subject to construction and the activity, equipment and location will vary each day during the construction phase.

Impact significance is expected to be low for air quality given that the impacts are short term and of low consequence. While impacts are rated as low there are opportunities to easily reduce dust emissions. These mitigation measures are included below and it is expected that they would be incorporated into a construction ESMP.

Table 5.3 Impact to human health associated with air pollutant emissions during construction

	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Residual Significance
Before Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	**Minor**

The following mitigation measures are proposed:

- Maintain all construction equipment in good working order and do not leave running when not in use.
- Undertake Awareness training on emissions to be carried out at all levels for the workforce (workers, supervisors, managers), and can be included in induction courses. Training should focus on promoting understanding as to why mitigation measures are in place.
- Set speed limits to minimize the creation of fugitive dust within the site boundary.
- Wet exposed surfaces and unsurfaced roads with water to minimise wind-blown dust.
- Use enclosed processing and transportation equipment
- Avoid open burning of waste
- Establish indigenous vegetation on topsoil stockpiles that are to remain as stockpiles for extended periods.
- Develop and implement a complaints system and make the community aware of the complaints procedure.
- Locate stockpiles within site boundaries considering the location of potential sensitive receptors and the predominant wind directions.
- Ensure machines and equipment planned for project use are installed with EMS to abate accentuating contributors of climate change.

After Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	*Minor*

5.3 Operational Impacts

The monitored PM concentration is below the Guinean Standard and IFC/WHO AQS. The main contributor of PM concentration in the cashew nut processing plant is the operation activities. As such, to effectively minimise impacts associated with these activities a mitigation programme should be developed and incorporated.

Table 5.4: Impact to human health associated with PM and dust emissions during operation

	Magnitude	**Duration**	**Scale**	**Consequence**	**Probability**	**SIGNIFICANCE**	**+/-**	**Residual Significance**
Before Management	*Moderate*	*Medium*	*Local*	*Medium*	*Possible*	*Low*	-	*Minor*

• The following specific mitigation measures are proposed: • Use of cyclone dust collectors and scrubbers as air pollution control measures to control the emission of particulate matter in the flue gas arising from boilers and power generating sets respectively • Odour (VOCs) generation from the cashew nut steaming process will be treated/ controlled using odour control technologies/equipment • Ensure an adequate water supply on the site for the effective dust/particle suppression, using non-potable water where possible and appropriate. • Solid waste generated from process activity will be collected and stored in closed bins to minimise the odour problem near storage areas • Ensure all villages are aware of the grievance mechanism and ensure that all issues raised are actioned. • Use of PPE (like nose mask, helmet, ear plugs and glasses) shall be mandatory for workers/ employees/ visitors working in these areas. • Routine inspection and maintenance of engines, vehicles, generators and other equipment to minimise air emissions • All site employees will receive appropriate training to ensure that they are conversant with the site dust control strategy • Any exceptional incidents giving rise to dust and or air emissions, either on or off-site should be recorded and the action taken to resolve the situation should be recorded.								
After Management	*Minor*	*Medium*	*Local*	*Medium*	*Possible*	*Low*	-	*Minor*

Baseline concentrations of SO_2 are substantially below the Guinean AQS and IFC/WHO AQS so cumulative exceedances are not anticipated.

Table 5.6: Impact to human health associated with gaseous (SO_2) emissions during operation

	Magnitude	**Duration**	**Scale**	**Consequence**	**Probability**	**SIGNIFICANCE**	**+/-**	**Residual Significance**
Before Management	*Minor*	*Long*	*Local*	*Medium*	*Unlikely*	*Low*	-	*Low*
The following mitigation measures are proposed: • Biannual SO2 screening								
After Management	*Minor*	*Long*	*Local*	*Medium*	*Unlikely*	*Low*	-	*low*

Baseline monitoring undertaken by Richflood demonstrates low NO_2 concentrations to be below IFC/WHO Air Quality Standard limit.

Table 5.7: Impact to human health associated with gaseous (NO2) emissions during operation

	Magnitude	**Duration**	**Scale**	**Consequence**	**Probability**	**SIGNIFICANCE**	**+/-**	**Residual Signifance**
Before Management	*Major*	*Long*	*Regional*	*High*	*Possible*	*Medium*	-	*Medium*
The following mitigation measures are proposed: • Continuous ambient NO_2 monitoring should be implemente								
After Management	*Moderate*	*Long*	*Local*	*Medium*	*Unlikely*	*Low*	-	*Low*

5.4 Decommissioning and Closure Impacts

During decommissioning and closure air pollutant emissions are anticipated from the dismantling of equipment, earthworks to rehabilitate the cashew nut processing plant and vehicles and equipment used to undertake decommissioning. If undertaken correctly no emissions after closure are expected. The emissions during decommissioning are temporary and localised.

Table 5.8: Impact to human health associated with air pollutant emissions duringconstruction

	Magnitude	**Duration**	**Scale**	**Consequence**	**Probability**	**SIGNIFICANCE**	**+ /-**	**Residual Significance**
Before Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	*Medium*
The following mitigation measures are proposed: • Maintain all equipment in good working order and do not leave running when not in use. • Develop and implement a complaints system and make the community aware of the complaints procedure. • Monitoring air quality during decommissioning.								
After Management	*Minor*	*Short*	*Local*	*Low*	*Possible*	*Low*	-	*Medium*