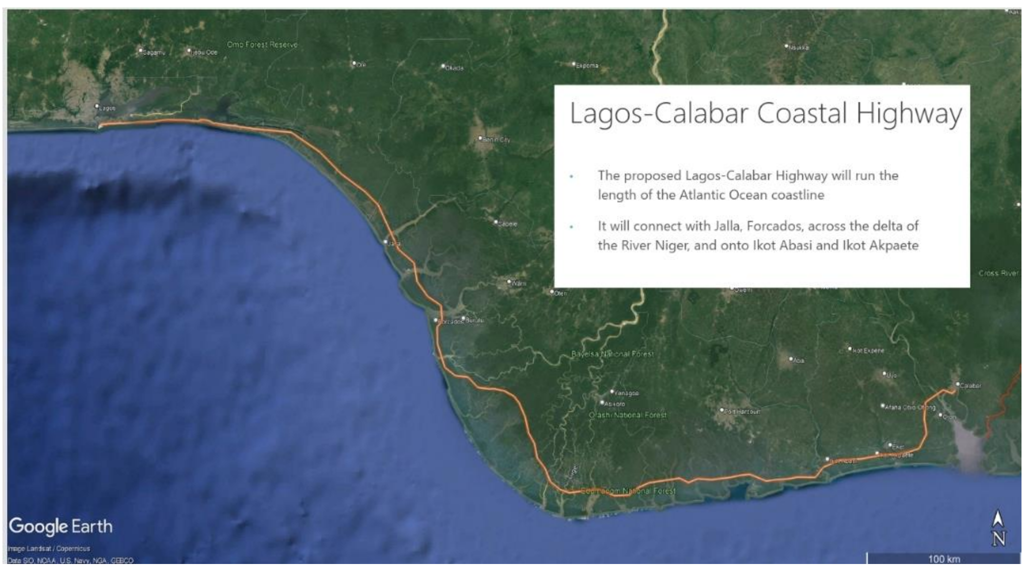
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

Draft Report

OF THE PROPOSED

LAGOS – CALABAR COASTAL HIGHWAY

SECTION 1 (0KM – 47.5KM)



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THE FEDERAL MINISTRY OF ENVIRONMENT
Abuja, Nigeria

BY

Federal Ministry of Works

Mabushi, Abuja

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Report Preparation Summary

Project Title:	Environmental and Social Impact Assessment of the proposed Lagos – Calabar Coastal Highway **– Section 1**
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Table of Content

LIST OF TABLE

LIST OF FIGURES

LIST OF PLATES

APPENDICES

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Executive Summary

Introduction

Nigeria is Africa's most populous nation, home to an estimated 229 million people, with a rapid growth rate projected to reach 400 million by 2050. Despite abundant natural resources and burgeoning commercial activities, the country faces significant challenges in maximizing its potential. A critical bottleneck hindering development is the underdeveloped inland transportation infrastructure. This hampers the exploitation of natural resources, leading to substantial waste, and negatively impacts the agricultural sector, a key economic driver. Post-harvest losses due to inadequate transportation networks remain a significant challenge.

Nigeria's transportation infrastructure comprises Roads, Railways, Ports, Airports, and Inland Waterways. Although recent investments, such as the modernized Abuja-Kaduna railway, have shown progress, the sector faces significant hurdles. Challenges include inadequate maintenance, severe congestion, and overall inefficiency. Nigeria necessitates substantial investments and strategic planning in its transportation system to meet the burgeoning demands of its growing population and economy.

The Federal Road Network, spanning approximately 36,000 kilometres, is the backbone of transportation. However, inadequate maintenance and increasing traffic volumes have led to deteriorating road conditions. Recognizing these challenges, the federal government has initiated the proposed Lagos-Calabar Coastal Highway, designed to improve connectivity and facilitate economic growth.

The Lagos-Calabar Coastal Highway is an ambitious 700-kilometer project stretching from Victoria Island in Lagos to Calabar in Cross River State. This transformative project promises improved transportation, economic growth, and connectivity for Nigeria. This highway aims to connect Nigeria's western and southeastern regions, enhancing cross-country connectivity and trade relations.
The highway will traverse several states, including Lagos, Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom, before reaching its destination in Calabar. It's designed to link major urban centres, industrial hubs, and seaports along the southern coast.

The Lagos-Calabar Coastal Highway will serve as a vital link, connecting the coastal States. Additionally, it will intersect with several north-south vertical routes:

- A1: Lagos to Sokoto
- A2: Warri to Kaduna, Zaria, Kano, and Daura
- A3: Port Harcourt to Makurdi, Bauchi, and the Kano/Maiduguri Road
- A4: Calabar to lkom, Ogoja, Jalingo, Numan, and Maiduguri

The Lagos-Calabar Coastal Highway project requires an Environmental and Social Impact Assessment (ESIA) due to the potential environmental and social impacts associated with its construction to comply with international standards and Nigerian regulations. The ESIA is a crucial tool for identifying, assessing, and mitigating the potential negative impacts of the Lagos-Calabar Coastal Highway project while maximizing its benefits. Alongside the ESIA is the preparation of a Resettlement Action Plan (RAP) for the Highway. A Resettlement Action Plan (RAP) is essential for a highway due to the potential for involuntary resettlement.

Objectives of the Study

The ESIA aims to ensure the project is developed and implemented sustainably, protecting the environment and benefiting the local community. The primary goal of the Environmental and Social Impact Assessment (ESIA) for the Lagos-Calabar Coastal Highway is to **identify, assess, and mitigate potential negative impacts** on the environment and society.

Specific Objectives include:

- Understand the existing environmental, social, and **health** conditions.
- Determine the project's potential impacts on both the natural and human environment.
- Evaluate the potential risks associated with the project.
- Develop strategies to avoid, minimize, or compensate for negative impacts.
- Create an Environmental and Social Management Plan (ESMP) to implement mitigation measures.
- Document findings and recommendations in a comprehensive ESIA report.

Scope of the ESIA

The Lagos-Calabar Coastal Highway project is a significant infrastructure development spanning over 700 kilometres and divided into nine sections. Work will begin with Section 1, which spans from 0km to 47.5km in Lagos. Section 1 includes development activities related to transportation, coastal resort facilities, hotels, and recreational facilities in national parks and marine parks.

The project's impact assessment has a phased approach to demonstrate a commitment to environmental and social considerations. This ESIA report specifically focuses on Section 1, providing a foundation for subsequent sections. The ESIA evaluates the environmental and social impact of a plan, policy, program, or project before deciding to proceed with the proposed action. It covers various aspects, including the environment's physical, biological, socio-economic, and **health** elements. The ESIA will describe project activities and identify potential impacts on air, water, soil, vegetation, wildlife, land use, and affected individuals and assets.

Project Entities

The Lagos-Calabar Coastal Highway project is structured under an Engineering, Procurement, Construction, and Financing (EPC+F) model with the following key entities: **The** Federal Ministry of Works (FMW): Project Proponent responsible for overall project management and development with responsibilities for the construction, rehabilitation, planning, design, and monitoring of **Federal Hig**hways. Hitech Construction Africa Ltd is the EPC+F Contractor responsible for project execution, **while** Natural Eco Capital Limited prepares the Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP).

Thus, the project is a Public-Private Partnership (PPP) between the **Federal Government and the Private Sector.** The EPC+F model ensures efficient project delivery and risk allocation. Environmental and social considerations are integrated into the project through the involvement of a dedicated consultant.

Project Justification and Alternatives

The Lagos-Calabar Coastal Highway is promising for Nigeria's development, economic growth, and improved connectivity. The specific benefits and opportunities associated with the Lagos-Calabar Coastal Highway include Enhanced National Integration, Economic Opportunities and Trade,
Community Connectivity and Relationships, Infrastructure Corridor **development,** Improved Travel Efficiency, Enhanced Connectivity, Unlocking Development Potential, Scenic Views and Beach Proximity, Relieving Congestion, Multi-Modal Transit Artery, Integration with Existing Routes and Rail Lines and Transportation Flexibility:

The Lagos-Calabar Coastal Highway Project represents a transformative opportunity for Nigeria, combining economic development with environmental considerations. It's a step toward a more connected, prosperous, and sustainable future. While the project primarily focuses on transportation, its positive impact on the environment can contribute to a greener economy:

- Reduced Emissions: Efficient transportation reduces carbon emissions, benefiting air quality and sustainability.
- Promoting Sustainable Practices: The project can incorporate eco-friendly materials and energy-efficient designs.
- Enhanced Livelihoods: Job creation and economic growth can lead to better living standards and increased environmental awareness.

The Lagos-Calabar Coastal Highway is a transformative project with far-reaching implications for Nigeria's economic growth and regional connectivity. Integrating rail systems and enhancing transportation options promises to create a seamless and sustainable network for passengers and cargo.

The coastal region around Lagos, Nigeria, has undergone significant changes due to natural processes and human development. A major consequence of these changes is coastal erosion, significantly impacting various communities along the shoreline. These coastal communities face a constant threat as the coastline retreats alarmingly. Media sources, such as Channels Television and Al Jazeera English, report annual retreats of 1-2 meters due to erosion.

Here are some relevant video links for further information:

- **Lagos Coast Erosion Section of Coastline in Marwa, Lekki, Faces Threat** (Channels Television): https://www.youtube.com/watch?v=CVpIQwKJdS4
- **Lagos Coastal Erosion** (Channels Television): https://www.youtube.com/watch?v=62uHzyoSz84 or https://www.youtube.com/watch?v=lGDfPAgM4K8
- **Washed Away: The Lagos Erosion Crisis** (Arise News): https://www.youtube.com/watch?v=lGDfPAgM4K8
- **Erosion in Lagos chases communities away: More than 180 kilometres submerged in a decade** (Al Jazeera English): https://www.youtube.com/watch?v=zDKLYep8A98

This erosion threatens homes and communities and poses a risk to vital infrastructure, including buildings, railroads, bridges, and roads. Understanding the long-term erodability history of the shoreline is crucial for designing sustainable solutions to this ongoing challenge which this report has provided.

Managing coastal erosion along the proposed project's entire Right of Way (RoW) requires a holistic approach that balances development with environmental preservation. The proposed project would ensure careful planning to address accretion and erosion challenges.

To ensure that the activities necessary for the project ultimately lead to intended or observed impacts on the Lagos-Calabar Coastal Highway project, the Theory of Change model that brings the strategic planning (inputs and activities) and the effects (outputs, outcomes and impacts) was adopted.

Strategic Planning		Effects		
Inputs:	**Activities**:	**Outputs**:	**Outcomes**:	**Impacts**:
Funding: Financial resources allocated for construction, maintenance, and operation. **Land Acquisition**: Land along the coastal route for road construction. **Skilled Labor**: Engineers, construction workers, and project managers. **Materials**: Cement, steel, etc., required for building the highway.	**Design and Planning**: Detailed engineering plans, environmental impact assessments, and alignment studies. **Construction**: Building the highway, including earthworks, bridges, tunnels, and drainage systems. **Maintenance**: Regular upkeep, repairs, and safety measures.	**Physical Infrastructure**: Completed highway with multiple lanes, bridges, and train tracks. **Improved Connectivity**: Enhanced transportation links between coastal states. **Reduced Travel Time**: Shorter distances between cities along the route.	**Economic Growth**: Increased trade, investment, and industrial development due to improved connectivity. **Job Creation**: Employment opportunities during construction and maintenance. **Environmental Impact**: Reduced congestion and pollution as traffic flows more efficiently.	**Regional Development**: Boosted economic activity, tourism, and urbanization. **Social Well-Being**: Better access to healthcare, education, and services. **National Progress**: A landmark infrastructure project contributing to Nigeria's growth and global recognition.

Lagos-Calabar Coastal Highway Project Theory of Change Model

The Chosen Engineering Option: Rigid Pavement

Rigid pavement with cement has been chosen to ensure a durable, sustainable, and high-quality road infrastructure. Chapters 2 and 3 of the Report outline that the proposed project necessitates road engineering, a complex field encompassing careful planning, design, and construction. This involves a range of disciplines, from material selection to pavement design. By meticulously considering alternatives and optimizing construction methods, we aim to create durable, cost-effective, and sustainable road networks.

The decision to opt for rigid pavement (Cement) over flexible pavement (asphalt) is grounded in a commitment to building a robust, enduring highway that will serve future generations. This is not merely a technical detail but a strategic choice crucial to achieving the project's durability, safety, and long-term performance goals. The choice aligns with the shared objectives of sustainability and long-term value. Unlike flexible pavement, Rigid pavement is a road surface constructed using rigid materials like concrete. It offers superior durability, load-bearing capacity, and resistance to deformation. While flexible pavement distributes loads throughout its structure, rigid pavement relies on the inherent strength of the concrete slab itself, ensuring exceptional performance. This superiority instils confidence in the quality of our chosen engineering option.

Furthermore, cement and asphalt are commonly used for paving surfaces but have distinct climate impacts. Darker surfaces tend to absorb more heat from sunlight than lighter ones. Climate scientists use a metric called 'albedo' to quantify this phenomenon.
The proposed project utilizes cement for the rigid pavement, considered superior to asphalt. This choice ensures a durable road and contributes to a more sustainable environment. By selecting cement, we make an informed decision that benefits both the project and the community, keeping you well-informed and engaged in the project's positive climate impact.

Value of the Project

Economic analysts predict that completing the first phase could increase Lagos State's economy by **50%**, especially with the connections to the Lekki Deep Seaport and the Lekki Industrial hub, which harbours the Dangote Refinery and Petrochemical Complex, Marine Industries, Food Industries and logistics in the Free Trade Zone. The proposed project is estimated at N1,067,887,381,148.61 (VAT inclusive) in terms of monetary cost. The project is estimated at N4.33bn per kilometre using reinforced concrete technology for a carriage width of 59.7 meters, to include ten lanes, shoulders and rail with additional designs of service ducts, streetlights, drainages and shore protection. The 10-lane Coastal Road is designed to connect Lagos to Cross River, passing through Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom states before culminating in Calabar, the Cross River State Capital.

The estimated costs and benefits for Section 1 of the Lagos-Calabar Coastal Road, which spans approximately 47.47 kilometres, are estimated to be N189.88 billion. Some of the Potential Benefits are:

- Improved Connectivity: The road will link major urban centres, industrial hubs, and seaports along the southern coast, enhancing regional integration.
- Economic Growth: Reduced travel times and improved transportation infrastructure stimulate economic activity and attract investments.
- Employment Opportunities: Construction and subsequent maintenance create jobs.
- Market Access: Businesses of all sizes benefit from better access to markets.
- Inclusive Development: Bridging rural-urban gaps fosters inclusive growth and reduces income disparities.

While the costs are substantial, the long-term benefits of the Lagos-Calabar Coastal Road are expected to impact the region's economic development and living standards.

The proposed project is an investment with net positive benefits, promoting sustainable development and improved livelihoods.

Project Description

The proposed road project starts in Lagos and runs through several states: Lagos, Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom, and it terminates in Cross River State. The project will be implemented in stages, allowing for incremental opening of completed segments for public use. Thus, the project will start with Section 1, which is the focus of this report.

The Section 1 alignment begins at **Eko Atlantic's Ahmadu Bello Road (0.0km)** and terminates at Eleko (47.5km) for Section 1, all within Lagos State, Nigeria.
The initial phase spans **47.5 kilometres**. It commences from **Victoria Island** and extends to **Eleko**: **Victoria Island**, a bustling commercial hub in Lagos. The highway then winds through the coastal landscape, connecting various regions. **Eleko** is a strategic location known for its economic potential and development prospects. This Section integrates rail systems, which will enhance connectivity and has been considered in this ESIA process and report.

A. *The Key Details of the Project Information*

S/No	Aspect*	Details
1.	Project Length	• Approximately 700 kilometres
2.	Rail Integration	• Rail lines within median strips of highways
3.	Number of Sections of the Road	• 9
4.	Start and End of Section 1	• The first phase of the highway covers a 47.5-kilometre section starting from Victoria Island in Lagos.
5.	Economic Impact of the Coastal Road	• Boosting trade, industry, and livelihoods
6.	National Importance	• Enhancing Nigeria's Coastal Connectivity
7.	Construction and Features:	• It features five lanes on each side of the dual carriageway, with a train track running through the middle.
8.	Alignment Considerations:	• Eko Atlantic's Ahmadu Bello Road: The alignment starts here, running parallel to the coastline • Cross-State Connection: Extends across Ogun, Ondo, Edo, Delta, Bayelsa, Rivers, and Akwa Ibom States, terminating in Calabar, Cross River State.

S/No	Aspect*	Details
		• Trans West African Highway Connection: Links with the Lagos-Benin-Enugu-Abakailiki-Ikom-Cameroon-Mombasa route.
9.	Ecological Considerations:	• Deflection to Avoid Sensitive Areas: The alignment avoids ecologically sensitive zones, such as mangrove swamps and turtle nesting areas.
10.	Existing Infrastructure/Utilities Considerations	• Avoid infrastructures/utilities like the Telecommunication corridor (marine cables) existing along the proposed corridor. • Oil Pipelines: Existing pipelines influence the alignment in certain segments.

Summary of Activities in Project Phases

Pre-construction Phase:

- Planning: Detailed project planning takes place.
- Feasibility Study & Engineering Design: Assessing technical feasibility and designing the road.
- Procurement of Works: Acquiring necessary materials and services.
- Securing Bonds & Insurances: Ensuring financial security.
- Land Acquisition & Clearing: Obtaining land rights and clearing the construction site.
- Worksite Organization: Setting up camps, workshops, and schedules.
- Resource Allocation: Identifying and organizing essential resources.
- Land Dispossession & Property Evaluation: Addressing land ownership changes.
- Relocation & Compensation Arrangements: Managing affected communities.

Construction Phase:

- Establish temporary access to work areas and create clearance zones while controlling access.
- Construct temporary diversions for roads that need upgrading to manage existing traffic.
- Clear and level the corridor and perform major earthworks (cuttings, embankments).
- Locate and develop borrow pits and quarries to import materials (gravel, clay, bitumen).
- Source and establish a water supply from surface and groundwater.
- Improve existing drainage and introduce new road drainage (including culverts if necessary).
- Surface and seal the carriageway (using bitumen mixing plants where applicable).
- Build water crossings such as bridges and culverts, including concrete batching for structures.
- Establish or improve safety arrangements (modify camber, barriers, sight lines).
- Perform landscaping as needed.

Operation Phase:

- The road becomes operational, serving transportation needs.
- Regular maintenance, monitoring, and safety checks are essential.

Demobilization Phase:

- Decommission temporary facilities (workshops, laydown areas, etc.).
- Restore any disturbed areas to their natural state.
- Evaluate the project's success and lessons learned.

Construction Method and Materials (new placement)

- **Design Considerations**:

The project aims to utilize all available technology and resources.

Key factors include simple techniques, readily available construction materials, and efficient labour input.

- **Structural Materials**:
    - **Reinforced Concrete (RC)**:

All superstructural and substructural elements will be constructed using reinforced concrete.

- - **Reinforcement Steel**:

Grade 60 reinforcement steel for bars with a diameter equal to or greater than 20mm.

Grade 40 steel for bars with a diameter of less than 20mm.

Minimum yield strength: 420MPa for grade 60 and 300MPa for grade 40.

The minimum clear cover for reinforcing bars will be as recommended and shown on the drawings.

- **Concrete**:
  - **Superstructure**:

Design parameters for C-30 concrete will be used in structural computations.

Compressive strength: 30MPa for 150mm cube samples and 25MPa for 150mm cylindrical samples.

  - **Substructure (Plain Concrete Leveling)**:

C-15 class of concrete will be used.

Compressive strength: 15MPa for 200mm cube samples and 10MPa for 150mm cylindrical samples.

These parameters are specified in design drawings and technical specifications for attainment during the construction stage.

- **Resistance Factors**:

Resistance factors are recommended to account for imperfections in production.

Appropriate factors for structural components' shear and bending moment were considered during the design phase.

Raw Materials and Hazardous Materials

These include fine-grained soil, which is used for roadbed preparation and stabilization. Gravel: Essential for road base layers and drainage. Blocks: Used in structures like retaining walls and bridges. Laterite: A locally available material used for road construction.

These raw materials form the **building blocks** of the road. The sand for filling shall be **sourced from the Atlantic Ocean/sea**. Proper sourcing and utilization of these materials contribute to efficient and sustainable construction.

Estimated Quantities of Materials

ITEM	Unit	Quantity	NOTES
Cut	m3	4,002,058	
Fill	m3	Up to 17 million	
CRCP Service Lanes (Phase 1)	m3	290,400	2 lanes for each direction for main road (Shoulders are not paved)
Base &Subbase (Phase 1)	m3	441,600	icluding shoulders
CRCP Main Carriageways (Phase 2)	m3	390,000	3 lanes for each direction for main road + 2 lanes for service road (Shoulders are not paved)
Base &Subbase (Phase 2)	m3	656,640	including shoulders
Number of Streetlight	Number	2,377	
Interchanges	Number	4	

Energy: The project will make use of the national grid as power supply; however, due to the situation of the grid power supply in Lagos, having backup diesel generators for the Ancillary Sites is crucial to ensure uninterrupted operations, especially during construction activities where consistent power supply is essential. The generators' capacity is 800 KVa, 100KVa at the Laydown Area and 200 KVa at the construction site.

Workforce: The contractor will require both a skilled and unskilled workforce. Priority will be given to employing unskilled staff in local communities near the yard sites. The project aims to employ **1000 people** for direct labour, and indirect labour involves **400 people**, including subcontractors, suppliers, and transporters. The project will have **50 expatriate personnel** who bring specialized knowledge and experience.

*Environmental releases of emissions, discharges, and wastes, such as dust, greenhouse gas (GHG) emissions****, and noise, would occur during construction. Other include wastewater and solid waste management.***

Construction Equipment greenhouse gas (GHG) emissions: The proposed construction project is expected to produce an estimated 85,897.3 tonnes of carbon equivalent (tCOe) in greenhouse gas (GHG) emissions during the construction phase, mainly due to the use of construction equipment. The seven primary greenhouse gases considered are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

To minimize the environmental impact of this project, it is essential to implement sustainable practices throughout both the construction and operational phases. This involves managing GHG emissions and adopting strategies that promote long-term sustainability. Also to ensure a sustainable approach, the project has adopted the following strategies:

- Use of Eco-Friendly Materials: Prioritize materials with low environmental impact throughout the construction process.
- Emission Reduction During Construction: Employ techniques and technologies that minimize emissions from construction equipment and activities.
- Promotion of Public Transportation: Encourage the use of public transport to reduce individual vehicle emissions during the operational phase.
- Regular Emission Monitoring: Implement a system for regular monitoring of GHG emissions to identify and address potential issues.
- Adherence to Environmental Regulations: Comply with all relevant environmental regulations and standards.

Water/Wastewater. Effective wastewater treatment and responsible construction practices shall be ensured to safeguard both surface water and underground water quality during the project.

Estimated Solid Waste Generation and Contractor's Waste Management Plan

- **Construction Materials:**
  - Steel Reinforcement Waste: Approximately 230 cubic meters.
  - Concrete Waste: Approximately 195,000 cubic meters.

- **Workforce Waste:**
  - Sewage Generation: Estimated at 28,320 litres.
  - Waste Generation: An average of 0.15 kilograms per person daily, totalling 87.3 kilograms.
- **Waste Management Strategies:**
  - Recycling and Reuse: Explore opportunities to recycle or reuse construction materials, such as steel reinforcement and concrete waste, whenever possible.
  - Proper Disposal: Ensure all waste is disposed of responsibly by local regulations and environmental guidelines.
  - On-Site Storage: Implement temporary storage solutions for excavated spoils and construction waste until they can be transported for proper disposal.
  - Waste Minimization: Encourage waste reduction practices among contractors and workers, such as minimizing material waste and using efficient construction methods.
  - Collaboration with Local Authorities: Work closely with local waste management authorities to coordinate disposal and ensure compliance with regulations.

A **Waste Management Plan** outlining waste handling, segregation, recycling, and disposal procedures has been developed to ensure proper waste management compliance with environmental regulations and minimize negative impacts.

Dredging for Reclamation
Responsible management that balances economic progress through dredging with environmental conservation shall be adopted. The strategies include **beneficial** reuse, which involves upcycling dredged sediments for beach restoration and other purposes**; monitoring and** planning, which involves regularly monitoring water quality, ecological impacts, and **eco-friendly technologies**; and integrating sustainable practices and technologies.

Environmental, health, and safety management (EHS)
The construction phase would adopt the following to manage the following issues:

1. Sediment and Erosion:
2. Runoff Control:
3. Neighbourhood Effects: Noise and Dust:
4. Landscaping and Green Cover:
5. Solid Waste:

The proposed project is expected to be completed in 36 months,

ENVIRONMENTAL AND SOCIAL BASELINE

An investigation was conducted within a 50-meter buffer along both sides of the route to identify the presence of sensitivities or sensitive receptors in this area. The Area of Influence (AOI) primarily encompasses industrial and commercial zones, including residential areas, commercial/industrial areas, hospitals, roads, churches, schools and farmlands. The baseline study involved primary monitoring and surveys and the collection of relevant secondary data from various sources.

Study Area: Section 1 of the Lagos- Calabar project spans 47.5 kilometres starting from (CH 0 + 000m) the intersection of Ahmadu Bello Way and Adetokunbo Ademola Street in Victoria Island Annex) up to (CH 47 + 474m) Eleko village area in Ibeju-Lekki).

Physical Environment

Climatic Condition of the Study Region: The project area in South-Western Nigeria experiences a tropical climate with longer wet seasons from April to October and shorter dry seasons from November to March, including the Harmattan wind from December to early February. Rainfall, expected for 274 out of 547 construction days, poses a risk of delays, reduced soil stability, and landslides. Temperature extremes below 29°C and above 33°C can impact construction, particularly for bitumen, asphalt, and concrete work. High humidity, averaging 80%, especially from June to September, affects material performance and worker health—prevailing winds in Lagos State average 6.5 knots, with a peak of 8.2 knots.

In terms of Climate Risk Assessment, while the project location is generally vulnerable to the impacts of climate change, the estimated total CO2 emissions (**Green House Gas Emission**) per hour from diesel-powered trucks and the coastal road due to truck movements are approximately 107,200 kg of CO2.

Air Quality: Air quality measurements were undertaken at 18 strategic locations within the project area. Measurements were conducted at strategic locations that considered project sites and sensitive receptors. Measurements were undertaken between 6th and 21st May 2024. Parameters measured included Pm 2.5, Pm10, CO_2, NO, NO_2, SO_2, NH_3 and O_3. All parameters were within regulatory limits except NO_2 (Debojo and Okun Aja) and SO_2 (Mokpo Ijebu), with concentrations above the WHO and FMEnv regulatory limits. The project must incorporate appropriate measures to avoid exacerbation during project implementation.

Noise Quality: Noise quality measurements, including air quality, were conducted at 18 points. Results of the noise measurements indicated an elevated noise level above the daytime threshold stipulated for the various environments (school, hospital, residential and farmlands) across all sampled points. The project must incorporate appropriate measures to prevent further increases during project implementation.

Soil Quality: A comprehensive soil baseline survey was conducted at strategic locations within the area to analyze soil conditions for the proposed project. The survey encompassed 12 locations, including the surrounding communities and residential places. Sand, clay, silt content, temperature, conductivity, and various chemical and biological properties were measured to assess soil quality. The results indicated that the topsoils are predominantly sandy texturally, and the sub-soils loamy sand. The PSD analysis revealed a more compacted subsoil than the top. All soil physicochemical parameters were within NIS threshold values except for Ph, Ammoniacal Nitrogen, Nitrate, and Arsenic values, which may be attributable to the use of pesticides, wastewater discharge and inorganic fertiliser usage over time. This contamination could impact soil health and fertility if not properly monitored and managed.

Groundwater quality: Groundwater samples were collected from fourteen (14) (Oniru, Marwa, Elegushi, Jakande, Lafiaji, Okun Aja, Mopo Ijebu, Sangotedo, Igando, Badore, Eleko, Oguntimehin, Solu Alade Solu Orunmija and Debojo communities) sampling points. The results showed that most physicochemical parameters were within regulatory limits, except for electrical conductivity, TDS, total hardness, chloride, calcium, iron, magnesium, and dissolved oxygen, which were elevated. These increases are likely due to natural processes, such as the weathering of mineral-rich rocks, and human activities, including

agricultural runoff, industrial discharges, and wastewater infiltration. High TDS levels were linked to natural minerals, industrial waste, and saline intrusion. Elevated iron and chloride levels were attributed to industrial pollution and agricultural practices. The microbiological analysis found negligible microbial traces, but coliform bacteria (E. coli) were present, likely from domestic wastewater leaching.
In terms of depth and flow direction in the area, groundwater flows from north to south with depths ranging from 10 to 270 meters, elevations between 1 and 20 meters, static water levels of 0.35 to 20.15 meters, yields of 432 to 1896 m^3/day, drawdowns of 0.47 to 65.35 meters, and aquifer thicknesses of 6 to 25 meters.

Surface Water: A survey was conducted to assess the physico-chemical and biological parameters of surface water in the area. Sampling included in-situ measurements and collection of surface and groundwater samples at strategic locations. The results showed that all physicochemical parameters analysed in the water samples were within FMEnv threshold values, except for dissolved oxygen (DO). These high values indicate an elevated pollution level as the water body is used for multi-domestic purposes, surface runoffs and industrial 0ily waste deposition. Water with high DO implies an elevated organic waste load. This condition is expected to be exacerbated during the project's construction phase.

Sediment Quality: Sediment samples were obtained alongside the surface water sample. Results of sediment studies showed that the physicochemical parameters analysed in the sediment sample, except Cadmium and Chromium, were within ISQG threshold values. Compared to the water samples, the high Cadmium and Chromium content recorded in the sediment samples could be attributed to industrial and artisanal waste streams. The presence of factories in the area and the various industrial activities further corroborate the assertion.

Erosion and Accretion Pattern
The Lagos coast is characterized by west-east trending barrier islands fortified by Badagry Creek, and the study of shoreline changes is crucial for understanding coastal erosion and accretion. The construction of breakwaters between 1908 and 1912 at the entrance to Lagos Harbour disrupted the natural flow of the longshore drift, leading to accelerated erosion in the Victoria Island area and accretion on the western side. Despite interventions like the Eko Atlantic City project and coastal defences, recent satellite imagery and shoreline change analysis show that these measures have only shifted erosive actions to areas downstream of the coastal defences. Furthermore, the Lagos shoreline undergoes continuous changes due to natural processes and human development. Google Earth images (2001 and 2020) showed an average shoreline change rate of +0.93 m/year, erosion rate of -1.94 m/year, and accretion rate of +4.84 m/year. Victoria Island experienced the highest shoreline change rate, with an average of +6.24 m/year due to accretion activities. Land reclamation activities contributed to the high accretion rate. However, significant erosion is observed eastward of Victoria Island. Effective land use and cover management plans are needed, especially for Victoria Island.

Biological Environment
The biological surveys conducted in the project area focused on biodiversity and hydrobiology. Biodiversity surveys were carried out, revealing three habitats (Mangrove Forest (MF) accounts for about 50%, Secondary Forest (SF) accounts for 33%, and Freshwater swamp (FS) constitutes the remaining 17%). Twenty-three (23) flora species were inventoried in the area, comprising one alien/invasive species

(*Chromolaena odorata*). No flora species were of conservation interest. On the other hand, a survey of the fauna resources of the area revealed five (5) mammalian species, four (4) amphibian and reptile species, respectively and eleven (11) avian species. Six (6) fauna species were of conservation interest (three (3) each of reptile and mammalian species). The habitat assessment showed no critical habitats or protected areas within the area of interest (AOI). Human activities, however, have negatively impacted ecosystems and fish abundance in the Lagos Lagoon system.

Hydrobiology: The hydrobiology assessment included desktop studies, stakeholder consultations, field sample collection, and laboratory analyses, revealing diverse aquatic communities. The project area's water bodies support a variety of marine resources, and thirty-five (35) fish species were inventoried in the area. On the other hand, twenty (20) phytoplankton species, sixteen (16) species each for zooplankton and macrobenthos, respectively, were inventoried in the project area.

Forest Carbon: Forests play a crucial role in mitigating climate change by sequestering and storing carbon dioxide, thus helping to offset greenhouse gas emissions. In this project, the total amount of sequestered CO2eq. (t ha-1) in the above-ground biomass was 6.7340 t CO2eq. ha-1 for the entire sample plots while the standard error and standard deviation had values of 0.0005 and 0.0106 with an uncertainty value of 35%.

Socioeconomic Environment

The project is in Ibeju Lekki and Eti-Osa Local Government Areas in Lagos, Nigeria. The proposed road project transverses 26 communities namely; Eko Atlantic, Oniru, Marwa, Elegushi, Ilasan Iroko Awe, Aro/Ologolo, Jakande, Lafiaji, Okun Aja, Mopo Ijebu, Sangotedo, Igando, Badore, Eleko, Oguntimehin, Solu Alade, Solu Orunmija, Debojo, Eko Akete, Idado, Lakowe, Iwesolu, Okunsolu, Moser Ikoga, Iwereku, Akinlade. These communities originated from various parts of Nigeria, including Ile-Ife, Osun State, Ijebu Ode, Oyo State, and Awori Yoruba, and migrated to their current locations through multiple routes. Each community has a traditional governance system headed by Kings (Kabiyesi) and Chiefs/Community Heads (Baale), with 8-32 families controlling community resources. Annual festivals like Ileya, Imale, and Osun promote peace and harmony, while sacred shrines like Ogun and Efun-Ilese are revered. Land ownership is through inheritance, purchase, and lease, with taboos including adultery, stealing, and cultism. The major occupations are fishery, farming, trading, and public service, with potential conflicts arising from borderland disputes, land ownership, and desecration.

Socioeconomic survey

The age distribution of respondents along the project corridor indicates a predominantly young and active population, with 38.46% aged 31-40 years and 25.64% aged 18-30 years. The majority of respondents (69.23%) are male. Most are married (78%) with 3-4 or 5-6 children, and household sizes average 6 to 10 people. The Yoruba ethnic group is predominant, making up 53.2% to 61.5% of respondents across different communities, followed by the Ibo. Religious practices are mainly Christian (66%), with Muslims comprising 28%. Educational attainment is high, with 43.59% having tertiary education. Access to potable water relies mainly on private wells and boreholes, while energy sources include gas, kerosene, firewood, and electricity, varying across communities. The presence of educational institutions and challenges like limited potable water access and reliance on traditional fuels underscore the socio-economic diversity and infrastructural needs within the project area.

Household waste is mainly managed through open dumping (50%) and incineration (25%), leading to potential environmental and health issues. Sewage disposal practices include water closets, pit latrines, and open defecation, with two-thirds using water closets correlating with housing, social status, and education. About 75% use pit latrines or open defecation, contributing to E. coli in the soil. Common household facilities include power generators, televisions, and radios, indicating reliance on these for electricity and information. Ilasan Iroko Awe and Sangotedo have the highest number of generators, showing unreliable power supply, while Oniru has the most televisions and radios, indicating a strong desire for connectivity. Economic activities are diverse, with fishing and aquaculture prevalent, especially in Sangotedo and Lakowe, though challenges such as lack of capital and poor infrastructure hinder development. Communication primarily occurs through mobile networks from providers like MTN, GLO, AIRTEL, and 9MOBILE, with news accessed via radio, television, and digital devices.

Transportation and infrastructure patterns show disparities in commute distances, spending, infrastructure effectiveness, and public transport satisfaction. Communities like Eko Atlantic and Oniru have high short-distance commutes, greater transport spending, and higher car usage, reflecting better service access and income levels. In contrast, areas like Badore and Akinlade, which spend minimally on transport and rely heavily on public options, face infrastructure challenges, leading to longer travel times and lower satisfaction. Infrastructure effectiveness is higher in Eko Atlantic and Oniru but decreases in more remote areas, where residents report inadequacies. Public transport satisfaction varies, with higher satisfaction in developed regions and dissatisfaction in less-served communities, highlighting the need for improvements.

Health facilities include fifteen Primary Health Centres (PHCs) and one hospital, such as Awoyaya Public Health Centre and Ibeju Lekki General Hospital. A shortage of facilities raises health concerns, with prevalent diseases like malaria, typhoid, and respiratory infections. This has led to the use of herbal treatments and traditional healers, with malaria affecting 42.1% of the population. Poor hygiene, such as indiscriminate refuse disposal, exacerbates disease spread. Traditional medical practices are common, with 82% seeking these remedies due to insufficient facilities. Sexual health issues, including HIV/AIDS and STIs, are prevalent, though data is lacking. Condom use is low, with less than 30% of males and 35% of females having used them and only 12% of males and 7% of females using them consistently. Deficiencies remain despite an 80% immunization rate for children under five, which exceeds the national target. Land ownership is mainly by the community or families, with the state able to acquire land for public use. Vulnerable groups, including children, women, non-indigenes, the elderly, and the physically challenged, form significant population segments. Cultural heritage sites are absent, and gender disparities are evident, with men dominating land ownership, credit access, and decision-making. Male circumcision is nearly universal but rare among females, reflecting gender imbalances in the project area.

Traffic: The survey results highlighted consistent vehicle flow throughout the day, with noticeable peak traffic during 9-10 am and 1-2 pm, likely corresponding to work commutes and lunch breaks. Off-peak periods were identified early in the morning (6-7 am) and late in the afternoon (5-6 pm), with relatively lower traffic volumes. This variation in traffic flow suggests that the proposed road must be designed to handle fluctuations in traffic, ensuring capacity during peak hours while maintaining efficiency during off-peak periods. The traffic survey revealed that cars and SUVs dominate the road, indicating a reliance on personal vehicles, while lorries represent ongoing commercial activities. Traffic direction varies by time of day, with outgoing traffic peaking in the morning and incoming traffic peaking at midday.

Stakeholder Engagement

A comprehensive stakeholder consultation was conducted for the proposed road project, involving five planned rounds, with the first three rounds completed. The consultations aimed to engage stakeholders, discuss environmental and social impacts, address concerns, and gather data to inform the project's planning and implementation.

Key Outcomes:

- **Environmental Impact Assessment (EIA) Scope:** Agreement on the EIA scope, identification of key environmental issues, and a plan for further stakeholder engagement.
- **Fair Compensation and Transparency:** Commitment to fair compensation, transparent communication, and careful enumeration, compensation, and property realignment.
- **Data Collection Framework:** Establishment of a comprehensive data collection framework to ensure all environmental and cultural factors are considered.
- **Mitigation Strategies:** Agreements on mitigation strategies to protect water resources, minimize impact on farmlands, and implement noise-reduction measures.
- **Cultural Heritage Preservation:** Emphasis on preserving cultural heritage, including sacred sites, shrines, and traditional festivals.
- **Infrastructure Needs:** Identification of urgent infrastructure needs in host communities, including access to clean water, healthcare, well-maintained roads, and job opportunities.

Stakeholder Concerns:

- **Environmental Pollution:** Concerns about environmental pollution, displacement of animals, and impact on fishing livelihoods.
- **Displacement and Compensation:** Concerns about discrepancies in compensation, property realignment, and fate of properties on the right-hand side of the corridor.
- **Community Health and Well-being:** Concerns about emissions, noise, and vibrations affecting community members, especially around Eleko.

Summary of Potential Impacts

The 47.5-kilometre Section 1 Alignment of the Lagos-Calabar Coastal Highway holds immense promise; responsible planning, environmental assessment, and mitigation strategies are essential to balance development with preserving natural ecosystems. However, the project also has its negative impacts. Both negative and positive effects are summarised below:

Significant Positive Impacts

The Lagos-Calabar Coastal Highway spans approximately 650 to 700 kilometers. The project is expected to take eight years to complete. This extensive highway will herald a new era of efficient travel and trade along Nigeria's coastal corridor. The project's estimated cost is $2 billion (approximately N4 billion per kilometre), with a tentative cost based on other projects within the same budget. The government aims to recoup its investment by tolling the highway 15 years after completion. However, the estimated costs for Section 1, which spans approximately 47.47 kilometres, are estimated to be N189.88 billion to completion.

The proposed project holds immense promise for Nigeria's economic landscape, which will have highly positive socio-economic impacts. The highway connects major financial hubs, potentially boosting trade and commerce. However, this must be balanced with environmental considerations. Proper planning can ensure that the highway minimizes environmental impact while enhancing connectivity.

1. Distance Compression:
The coastal road will remarkably compress the distance between Lagos and Ondo State.
For instance, the distance from Ibeju-Lekki in Lagos to Araromi in Ondo State is approximately 50 kilometres along the coast. This translates to about an hour's journey, significantly reducing travel time compared to existing routes.

2. **Economic Impact**:
The completion of the first phase of the project alone could increase the size of Lagos State's economy by 50%. The connection to the Lekki Deep Seaport and the Lekki economic corridor, where the Refinery and Petrochemical Complex, Marine Based Industries, and Logistic are located alongside other multinational industries, will drive economic growth. The highway is expected to significantly improve Nigeria's Logistics Performance Index (LPI) for trade and transport infrastructure. It could contribute at least 0.5 to 1.0 points to the LPI.

3. Transformational Potential:
The coastal highway will usher in Nigeria's new era of ambitious road infrastructural development projects. Like the iconic Third Mainland Bridge, which spans 11 kilometres across the lagoon, the Lagos-Calabar Coastal Road aims to be monumental. When completed, it will enter the world record books alongside iconic coastal routes like the Wild Atlantic Highway in Ireland and the Pacific Coastal Highway in the United States.

4. Integration and Connectivity:
The highway will have two spurs linking up with Northern Nigeria, further integrating the north and south regarding the movement of people, goods, and services. It promises to enhance regional connectivity and foster economic exchange.

5. Blue Economy:
The coastal highway connects major economic hubs, including the Lekki Deep Seaport. It facilitates the efficient movement of goods, boosting trade and economic growth. Proper waste management along the highway is essential to prevent pollution of coastal waters.

6. Ecotourism:
The scenic coastal route can promote ecotourism. Sustainable development, preservation of natural habitats, and wildlife conservation are vital. Interpretive centres, eco-friendly rest stops, and guided tours can enhance the ecotourism experience.

7. Provision of employment opportunities:
The highway will contribute to the overall socio-economic well-being of the benefiting communities through the provision of employment opportunities (locals are expected to be engaged directly, especially as semi-skilled (e.g. masons, carpenters, electrical technicians, welders, etc.) and unskilled labour (e.g. for site clearance, loading and offloading of materials, security services e.t.c).

There will also be indirect opportunities for local contractors, businesses and food sellers. This will have a significant impact since the unemployment rate is generally high in Nigeria and in project communities.

8. National Impact:
- **Improved Transport Conditions:** The Highway enhances connectivity, allowing smoother movement of goods, services, and people.
- **Sustained Access**: By maintaining the proposed infrastructure, Nigeria ensures long-term accessibility for its citizens.
- **Economic Growth**: The Highway contributes to Nigeria's economy on a global scale. Efficient transportation fosters trade, investment, and economic expansion.
- **GDP Contribution:** The coastal Highway facilitates the transit of goods to states along its route, bolstering GDP.
- **Strategic Importance**: As a major corridor, it supports regional integration and development.

9. Host Communities:
- **Increased Travel Efficiency and Productivity:** Reduced travel time and smoother journeys benefit commuters, businesses, and tourists.
- **Environmental Improvement:** Proper road construction minimises ecological impact. Sustainable practices enhance the quality of the surroundings. Integrated coastal management deals with coastal erosion and ensures biodiversity enhancement.
- **Enhanced Quality of Life and Social Standards:** Access to better infrastructure positively affects residents' well-being. Improved roads lead to safer, more comfortable travel.
- **Economic Activity Spread:** The Highway connects villages and towns, promoting economic growth. Local businesses thrive due to increased accessibility.
- **Safety and Security Enhancement:** Addressing poor safety records ensures safer travel for all. Reduced accidents and incidents benefit both travellers and communities.
- **Stress Reduction:** Smooth roads alleviate stress for commuters and long-distance travellers.
- **Comfortable Rides:** Adequate facilities, including sidewalks, enhance the overall travel experience.
- **Environmental Aesthetics and Carbon Reduction:** Proper maintenance and greenery along the corridor reduce the carbon footprint. Aesthetically pleasing surroundings contribute to a better quality of life.

Significant Negative Impacts
Unfortunately, the proposed development is also likely to negatively impact the social and physical environment within which it is executed. This is because, for instance, the construction phase is often a

rapid and disorderly process when a strong emphasis on completing the project is paramount, not protecting the environment.

Construction activities occur only once but can have lasting effects due to site preparation, earthworks, waste generation, traffic and safety, which are localized and reversible. During construction, the impacts are rated as significant. However, they are considered minor in duration since construction activities are temporary. Proper construction management practices are crucial to minimize negative impacts. Adherence to safety protocols and environmental safeguards is essential. Proactive measures, responsible construction practices, and continuous monitoring will help mitigate any adverse effects during the construction phase.

Based on the design of the project, these impacts can be divided into two, namely:

a. Short-term construction-related impacts typical of building construction activities such as:

1. **Community Engagement and Land Acquisition:**

- Community Resistance: Some communities may resist land acquisition for the highway, leading to delays and disputes.
- Compensation: Ensuring fair compensation for affected landowners and communities is critical for maintaining goodwill.
- Relocation Challenges: Resettling communities while minimizing disruption requires thoughtful planning and sensitivity.

2. **Geological and Environmental Factors:**

- Habitat Destruction: The construction of the coastal highway could lead to habitat destruction, disrupting ecosystems along the route.
- Vulnerability to Erosion and Flooding: Altering the coastal landscape may increase vulnerability to erosion and flooding. The coastal region's susceptibility to erosion poses a risk to soil stability and overall highway integrity.
- Swamps, Mangroves, and Wetlands: These natural features complicate foundation work and roadbed construction along the route.
- Ecological Impact: Striking a balance between development and environmental conservation is crucial. Efforts to minimize harm to local ecosystems and wildlife habitats are essential.

3. **Infrastructure and Logistics:**

- Materials Supply: Transporting construction materials long distances can be costly and time-consuming.
- Access Roads: Developing access roads to remote construction sites is challenging.
- Bridge Construction: Building durable bridges across rivers and estuaries demands specialized engineering expertise.

4. **Security and Safety:**

- Security Threats: The highway passes through regions with security challenges (e.g., militancy, banditry). Ensuring safety for workers and equipment is paramount.
- Traffic Management: Coordinating traffic during construction, especially in densely populated areas, requires careful planning.

5. **Funding and Budget Constraints:**

- Cost Overruns: Unexpected expenses can strain the project budget. Vigilant cost management is essential.

- Government Funding: Consistent funding throughout the eight-year construction period is critical for project continuity.

6. **Technical Engineering Challenges:**

- Soft Soil Stabilization: Techniques like soil compaction, geotextiles, and deep foundations are necessary for stability.
- Drainage Design: Proper drainage prevents waterlogging and erosion.
- Bridge Durability: Constructing bridges that withstand environmental forces and heavy traffic is a significant task.

7. **Noise and Dust Nuisance:**

- The preparation of the site and material transportation can lead to increased noise and dust levels.

8. **Waste Generation and Disposal:**

- Proper waste management from the site and camp is essential to prevent environmental harm.

9. **Soil Contamination:**

- Stored fuel, lubricants, and paints can contaminate the soil.

10. **Health and Safety Issues:**

- Occupational Health: Workers involved in construction (including non-skilled workers, operators, drivers, surveyors, and supervisors) face health risks.
- Workers' Camp: Proper facilities and safety measures must be in place at the workers' camp.
- Public Safety: Ensuring the public's safety near construction zones is critical.

11. **Resource Utilization:**

- Efficient use of resources is necessary.

12. **Potential Social Issues:**

- Increased social vices and other community-related challenges may arise.

Environmental and Social Management and Monitoring Plan (ESMMP)

The ESMMP has been tailored to the specific project and its environmental and social context with the full Table in Chapter 7. Belw is a general overview in relation to the phases of project:

Pre-Construction Phase:

- **Key Impacts:** Fugitive dust, soil compaction, oil spills, noise pollution, occupational accidents, biodiversity loss, social impacts (STDs, GBV) with involuntary displacement of assets.
- **Mitigation Measures:** Dust control, vehicle maintenance, soil protection, noise reduction, safety training, community engagement, biodiversity conservation (habitat restoration, minimizing disturbance, pollution control, invasive species management).
- **Responsibility:** Contractor, FMEnv, FMW, LASEPA, LSMEnv, LGC.
- **Costs:** USD 50,100.00.

Construction Phase:

- **Key Impacts:** Air pollution, soil contamination, waste generation, noise pollution, OHS risks, biodiversity loss (habitat destruction, fragmentation, pollution, invasive species), social impacts.
- **Mitigation Measures:** Pollution control, waste management, safety measures, community engagement, biodiversity conservation (habitat restoration, minimizing disturbance, pollution control, invasive species management), social impacts (STDs, GBV).
- **Responsibility:** Contractor, FMEnv, FMW, LASEPA, LSMEnv.

- **Costs:** USD 150,900.

Operation Phase:

- **Key Impacts:** Air pollution, drainage issues, accidents, social impacts.
- **Mitigation Measures:** Pollution control, infrastructure maintenance, community engagement.
- **Responsibility:** Contractor, FMEnv, FMW, LASEPA, LSMEnv.
- **Costs:** USD 101,800.

Total Costs:

- **Environmental and Social Mitigation:** USD 302,800 (@N1,500.00 = US$1).
- **Monitoring:** USD 202, 100.00(@N1,500.00 = US$1).

Key Performance Indicators:

- **Environmental:** Air quality, soil quality, water quality, waste management, noise levels, biodiversity.
- **Social:** Community engagement, grievance resolution, health and safety, gender equality.

Monitoring Frequency: Varies based on activity and impact.
Institutional Responsibility: FMEnv, FMW, LASEPA, LSMEnv, contractor, community groups.

Relevant Management Plans

As part of the proposed mitigation measures and monitoring and implementation activities included in the ESMP, additional Management Plans should be developed. These management plans include the detailed activities to be done by each E&S aspect of the project to ensure full implementation with both international and local regulations as indicated.

Below is a summary of the various Management plans prepared for the project:

Management Plan	Description	Mitigation Measures, Protocols and Procedures
1. Biodiversity Management Plan	An implementation plan for conserving, restoration and enhancement of biodiversity value of a farm. The BMP sets the objectives and describes the management actions necessary to deliver the desired outcomes. The actions should be specific, measurable, achievable, and time-bound.	Develop a Biodiversity Action Plan which identifies threats and sets out steps to be taken to protect and improve the area to preserve and enhance its biodiversity for the future. Work with Conservation Centres & Nature Park within the corridor area for rescued animals.
2. Heritage/Cultural Management Plan	An overarching plan that stipulates how affected cultural heritage will be managed throughout an asset's lifecycle.	Features of the design or other measures of the proposed development that can be adopted to avoid, prevent, reduce or offset negative effects.
3. Shoreline and Coastal Erosion Management Plan	Support localized, effective and sustainable responses to shoreline erosion issues within specific communities.	Barriers, such as rocks, sediment control logs, perimeter control fencing, and vegetation, can slow the flow of water and wind and prevent erosion.

Management Plan	Description	Mitigation Measures, Protocols and Procedures
4. Gender Management Plan	A progressive and efficient mainstreaming of gender dimensions throughout the project phase.	Tackle stereotypes about gender roles in families and society. ... Take paternity leave to build stronger families. ... Call for family-friendly workplaces. ... Share the care. ... Empower women and girls. ... Respect reproductive rights and bodily autonomy.
5. Dust Management Plan	This plan identifies sources of dust, outlines measures to control emissions, and includes monitoring strategies to protect air quality and public health.	Automatic dust suppression systems, such as misting cannons and water sprays, are highly effective in reducing dust pollution. These systems work by spraying a fine mist of water over the construction site, which helps to bind dust particles and prevent them from becoming airborne.
6. Environmental Construction Method Statement	This statement describes environmentally friendly construction methods and practices to minimize environmental impacts during project implementation.	Grade fine materials from un-surfaced haul roads Please keep it in compact condition using static sprinklers, bowsers, commercially available additives, and binders.
7. Emergency Management Plan	This plan outlines procedures for responding to emergencies, including natural disasters and accidents, to minimize harm to people, property, and the environment.	Mitigation involves structural and non-structural measures to limit the impact of disasters and emergencies. Structural mitigation actions change the characteristics of buildings or the environment; examples include flood control projects, raising building elevations, and clearing areas around structures.
8. Human Resources Management Plan	This plan outlines strategies for managing human resources, including recruitment, training, and welfare, to ensure a safe and healthy work environment.	It is a process to ensure that businesses have employees with the right skills, time, and the appropriate capacity to meet strategic goals.
9. Waste Management Plan	This procedure outlines proper construction and hazardous waste management, including storage, handling, transportation, and disposal, to minimize environmental impacts.	The long-recognized hierarchy of management of wastes, in order of preference, consists of prevention, minimization, recycling and reuse, biological treatment, incineration, and landfill disposal.

Management Plan	Description	Mitigation Measures, Protocols and Procedures
10. Wastewater Management Plan	This plan outlines procedures for managing wastewater generated during construction activities, including treatment and disposal methods to protect water quality.	Mitigation involves physical, biological, chemical, and sludge water treatment.
11. Construction Contaminated Land Management Plan	This plan outlines procedures for managing contaminated land during construction activities, including remediation measures to protect human health and the environment.	The remediation methods are broadly classified as physico-chemical, biological, electrical, thermal and a combination of these methods. One of the simplest physical remediation methods is removing and replacing the contaminated soil with clean soil. Essentially, it is a dig, dump and replace procedure.
12. Soil and Water Management Plan	This plan outlines measures to protect soil and water resources during construction activities, including erosion and sediment control measures.	Agronomic measures include mulching, crop management and agroforestry. These measures use the effect of surface covers to reduce erosion by water and wind.
13. Occupational Health and Safety Management Plan	This plan outlines measures to ensure the health and safety of workers, including training, protective equipment, and monitoring, by international standards. .	Communicate your health and safety policy. ... Deal with hazards quickly. ... Make health and safety part of your culture. Equip employees for health and safety.
14. Community Health and Safety Management Plan	This plan addresses local communities' health and safety concerns near the project site, focusing on mitigating risks from construction activities and promoting community well-being.	It gives due consideration to health outcomes and related health determinants in considering potential changes in the health status of communities or groups within the potentially affected stakeholders.
15. Contractor and Supplier Management Plan	This plan outlines procedures for selecting, contracting, and managing contractors and suppliers to ensure compliance with environmental, social, and health and safety requirements.	To mitigate these risks, businesses can employ strategies such as supply chain mapping, weighted ranking, Value at Risk (VaR) assessment, supplier segmentation, diversification, inventory management adjustments, scenario planning, and building strong supplier relationships.
16. Resettlement Action Plan (RAP)	The RAP addresses the impact of the project on Project Affected Persons (PAPs). It outlines	Detailed entitlements for PAPs are specified. Protocols for land acquisition, involuntary resettlement, and loss of assets

Management Plan	Description	Mitigation Measures, Protocols and Procedures
	compensation and assistance measures.	are established. Procedures for compensation and relocation are defined. Detailed mitigation measures and entitlements for these PAPs are outlined in the standalone Resettlement Action Plan (RAP), which complements ESIA report. The RAP ensures that affected individuals and entities receive compensation and support during the project implementation. The compensation process for the PAPs has been initiated by the Honourable Minister of Works on May 5, 2024.
17. Stakeholder Engagement Plan	This plan outlines strategies for engaging with stakeholders, including local communities, to address their concerns and ensure their participation in decision-making processes. It makes provisions for a Smart Emergency Response System (SERS), which integrates cutting-edge technology, real-time data, and efficient resource allocation to ensure rapid and effective emergency response along the Lagos Coastal Road.	Define the stakeholders and their roles in the project. Analyze the stakeholders' interests, expectations, and influence. Plan how to engage with the stakeholders and communicate with them effectively. Implement the engagement plan and measure its effectiveness Incorporate Smart Emergency Response System for Lagos Coastal Road

Decommissioning and Restoration Plan

Decommissioning covers the project cessation of operations and the removal of inventory to obtain a state of passive safety. Though this phase is unlikely for a Project like the Lagos-Calabar Highway Road, the restoration programme at the end of the Lagos-Calabar Coastal Highway project's economic life is crucial for environmental sustainability. The statutory regulations emphasize the importance of rehabilitating areas to be relinquished after a project, a responsibility we all share in ensuring a sustainable future. In this context, the biological objective of rehabilitation programs establishes an ecologically functional system that supports satisfactory flora growth, such as the following:

- When a project concludes, the site must be restored to its original or improved state.
- Rehabilitation ensures that disturbed ecosystems recover and regain functionality.
- Our goal is to create an ecosystem that functions naturally and supports life, underscoring the importance of your role in achieving this goal.
- This involves restoring soil health, water cycles, and nutrient cycling.
- Flora (plants) play a crucial role in ecosystem stability.

Conclusion and Recommendations

The Lagos-Calabar Coastal Highway Project Section 1 Environmental and Social Impact Assessment (ESIA) has been prepared *with a strong commitment to comply with the Environmental Impact Assessment (EIA) Act CAP E12, LFN 2004.* The report results from a rigorous scoping of the proposed alignment, areas of influence, and the existing baseline environmental and social impact based on previous studies. The report presents compelling and inspiring findings demonstrating the importance of responsible and sustainable development practices.

The ultimate objective of the ESIA process was to ensure that the Project has no major residual impacts on the environment, be it in the long term or over a vast area. Consequently, after implementing the delineated mitigation measures, the residual effects of the Project were significantly reduced to mostly short-term, localized, and reversible. Alongside this, we provided recommendations to optimize the beneficial effects of the Project and sustain them for the long term.

An Environmental and Social Management Plan (ESMP) was developed to ensure that the Project meets its operational requirements and delivers its stated business objective in an environmentally responsible manner. The ESMP outlines the mitigation/enhancement measures to action points and recommends performance indicators monitoring and audit programmes. This helps maintain all impact indicators for the various environmental components within statutory limits throughout the Project's life.

Overall, beyond being just a road, the Lagos-Calabar Coastal Highway is a testament to collaboration, foresight, and commitment. The Lagos-Calabar Coastal Highway project (Section 1) stands on solid ground, supported by multiple pillars of assurance as outlined below:

- Social and Cultural Acceptance:
  - The project aligns with societal norms and cultural values.
  - Communities find it appropriate and acceptable.
- Technical Soundness:
  - Rigorous engineering design ensures technical feasibility.
  - The highway's construction and operation are sustainable.
- Environmental Considerations:
  - Environmental impact assessments have been thorough.
  - Mitigation measures are in place to minimize harm.
- Economic Viability:
  - Leveraging private sector resources and funding.
  - The project's financial sustainability is assured.
- Government Commitment:
  - Key ministries (Federal Ministry of Works, Federal Ministry of Environment, and Federal Ministry of Finance) champion the project.
  - Regulatory frameworks and flexible financing instruments are actively implemented.

In conclusion, the ESIA prioritises balancing economic development with environmental and social sustainability. By implementing the proposed mitigation measures and engaging with stakeholders, the project can achieve its objectives while protecting the environment and enhancing the well-being of local communities.

CHAPTER ONE
INTRODUCTION

1.0 Project Background

Nigeria is Africa's most populous nation, home to an estimated 229 million people with a rapid growth rate projected to reach 400 million by 2050. Fig 1.1 shows the Map of Nigeria in the World.

Figure 1.1: Nigeria in the World

Despite abundant natural resources and burgeoning commercial activities, the country faces significant challenges in maximizing its potential. A critical bottleneck hindering development is the underdeveloped inland transportation infrastructure. This hampers the exploitation of natural resources, leading to substantial waste, and negatively impacts the agricultural sector, a key economic driver. Post-harvest losses due to inadequate transportation networks remain a significant challenge.

Nigeria's transportation infrastructure is composed of roads, railways, ports, airports, and inland waterways. Although recent investments, such as the modernized Abuja-Kaduna railway, have shown progress, the sector faces significant hurdles. Challenges include inadequate maintenance, severe congestion, and overall inefficiency. To meet the burgeoning demands of its growing population and economy, Nigeria necessitates substantial investments and strategic planning in its transportation system.

The federal road network, spanning approximately 36,000 kilometers, is the backbone of transportation. However, inadequate maintenance, coupled with increasing traffic volumes, has led to deteriorating road conditions.

Recognizing these challenges, the government has initiated the proposed Lagos-Calabar Coastal Highway designed to improve connectivity and facilitate economic growth. A visual representation that highlights the Nigerian coastal states (Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom states) traversed by the proposed Lagos-Calabar Coastal Highway is given in Figure 1.2.

Figure 1.2: Nigerian Coastal States Traversed by the Proposed Lagos-Calabar Coastal Highway

1.1 The Proposed Lagos-Calabar Highway

The Lagos-Calabar Coastal Highway is an ambitious 700-kilometer project that will stretch from Victoria Island in Lagos to Calabar in Cross River State. This transformative project promises improved transportation, economic growth, and enhanced connectivity for Nigeria. This highway aims to connect the western and southeastern regions of Nigeria, enhancing cross-country connectivity and trade relations.

Some key details include:

1. **Route and States Covered:**
    - The highway will traverse through several states, including Lagos, Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom, before reaching its final destination in Calabar.
    - It's designed to link major urban centers, industrial hubs, and seaports along the southern coast.
2. **Alignment Considerations:**
    - To avoid ecologically sensitive areas, the alignment takes a significant detour between the River Dodo and the River St. Nicholas. This deflection bypasses mangrove swamps and turtle nesting/breeding grounds.
    - Additionally, it avoids built-up areas like Brass Town and existing facilities such as the Agip Terminal and the Brass LNG Plant.
    - As it approaches the New Calabar River, the alignment courageously hugs the coastline, passing through barrier island forests. Interestingly, the presence of oil pipelines in this segment eliminates the need for further ecological precautions.
3. **Interconnected Routes:**
    - The Lagos-Calabar Coastal Highway will serve as a vital link, connecting Lagos to the coastal regions of Ogun, Ondo, Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross River States.
    - Additionally, it will intersect with several north-south vertical routes:
        - A1: Lagos to Sokoto
        - A2: Warri to Kaduna, Zaria, Kano, and Daura
        - A3: Port Harcourt to Makurdi, Bauchi, and the Kano/Maiduguri Road
        - A4: Calabar to lkom, Ogoja, Jalingo, Numan, and Maiduguri

Figure 1.3 shows the proposed Lagos - Calabar Coastal Highway and Connection with Nigeria's North-South Vertical Routes**.**

Figure 1.3: Proposed Lagos - Calabar Coastal Highway and Connection with Nigeria's North-South Vertical Routes

1.2 The Proposed Project Objectives

The Lagos-Calabar Coastal Highway is a strategic investment designed to drive economic growth, improve transportation infrastructure, and enhance the overall quality of life for Nigerians. The Highway is a massive infrastructure project aimed at transforming transportation and economic development along Nigeria's coastline.

The key objectives are outlined below:

- **Enhanced Connectivity:** Improve transportation links between major coastal cities and towns, integrating with existing federal roads.
- **Economic Growth:** Boost trade, tourism, and overall economic development in the region.
- **Reduced Travel Time:** Significantly shorten travel distances between coastal cities, leading to increased efficiency and productivity.
- **Infrastructure Development:** Utilize concrete technology to stimulate local industries and create employment opportunities.

1.3 Project Facilitation Entities

The Lagos-Calabar Coastal Highway project is structured under an Engineering, Procurement, Construction, and Financing (EPC+F) model with the following key entities:

1. Federal Ministry of Works (FMW)

- **Role:** Project Proponent responsible for overall project management and development.
- **Responsibilities:** Construction, rehabilitation, planning, design, and monitoring of federal highways.

2. Hitech Construction Africa Ltd

- **Role:** EPC+F Contractor responsible for project execution.
- **Responsibilities:** Engineering, procurement, construction, and financing of the highway.
- **Expertise:** Specializes in coastal erosion solutions and marine engineering.

3. Natural Eco Capital Limited

- **Role:** Environmental and Social Consultant.
- **Responsibilities:** Preparation of Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP).
- **Expertise:** Sustainability consulting, with a focus on environmental impact assessment and sustainable development.

Thus the project is a Public-Private Partnership (PPP) between the government and the private sector. The EPC+F model ensures efficient project delivery and risk allocation. Environmental and social considerations are integrated into the project through the involvement of a dedicated consultant.

1.4 Objectives of the ESIA

The ESIA aims to ensure that the project is developed and implemented in a sustainable manner that protects the environment and benefits the local community. The primary goal of the Environmental and Social Impact Assessment (ESIA) for the Lagos-Calabar Coastal Highway is to **identify, assess, and mitigate potential negative impacts** on the environment and society.

Specific Objectives include:

- **Baseline assessment:** Understand the existing environmental and social conditions.
- **Impact identification:** Determine the potential impacts of the project on both the natural and human environment.
- **Risk assessment:** Evaluate the potential risks associated with the project.
- **Mitigation planning:** Develop strategies to avoid, minimize, or compensate for negative impacts.
- **Environmental management:** Create an Environmental and Social Management Plan (ESMP) to implement mitigation measures.
- **Reporting:** Document findings and recommendations in a comprehensive ESIA report.

In essence, the ESIA is a crucial tool for identifying, assessing, and mitigating the potential negative impacts of the Lagos-Calabar Coastal Highway project while maximizing its benefits.

Alongside the ESIA is the preparation of a Resettlement Action Plan (RAP) for the Highway.
A Resettlement Action Plan (RAP) is essential for a highway due to the potential for involuntary resettlement. The following are the key reasons:

- Construction of the highway requires acquiring land, which may displace people, businesses, or communities.
- Building the highway may necessitate removing or relocating existing infrastructure, such as homes, shops, or public facilities.
- People dependent on land for agriculture, fishing, or other livelihoods may be affected by the project.
- Resettlement can lead to social disruptions, loss of community cohesion, and psychological distress.

Thus by preparing a RAP, the project ensures that people affected by the highway construction are treated fairly and justly, and that their livelihoods and well-being are protected. The RAP addresses these challenges by outlining:

- How affected people will be identified and classified.
- The process for determining compensation for lost assets.
- Plans for resettlement, including housing, infrastructure, and livelihood restoration.
- Measures to minimize disruptions and support affected communities.

1.6 Scope of the ESIA

- Comprehensive literature review to generate background information on the environmental characteristics of the study area.
- Review of national and international regulations relevant to the proposed project.
- Identification of communities within the project locations for effective consultation.
- A one season detailed site investigation of existing baseline data and laboratory analysis.
- Identification of potential impacts and associated impacts.
- Identification of effective mitigation/enhancement measures and monitoring programs using best up to date technology for the project activities.
- Development of a comprehensive Environmental and Social Management Plan, including monitoring, decommissioning/abandonment and remediation plans.
- Writing of ESIA reports (draft and final) that conform to standards and guidelines set by the regulators and international bodies.

The Lagos-Calabar Coastal Highway project is a significant infrastructure development spanning over 700 kilometers and divided into nine sections.

Figure 1.4: The Proposed Coastal Highway showing the proposed Alignment

Work will begin with Section 1, which spans from 0km to 47.5km and is in Lagos (Figures 1.5 and 1.5). Notably, Section 1 includes development activities related to transportation, coastal resort facilities, hotels, and recreational facilities in national parks and marine parks

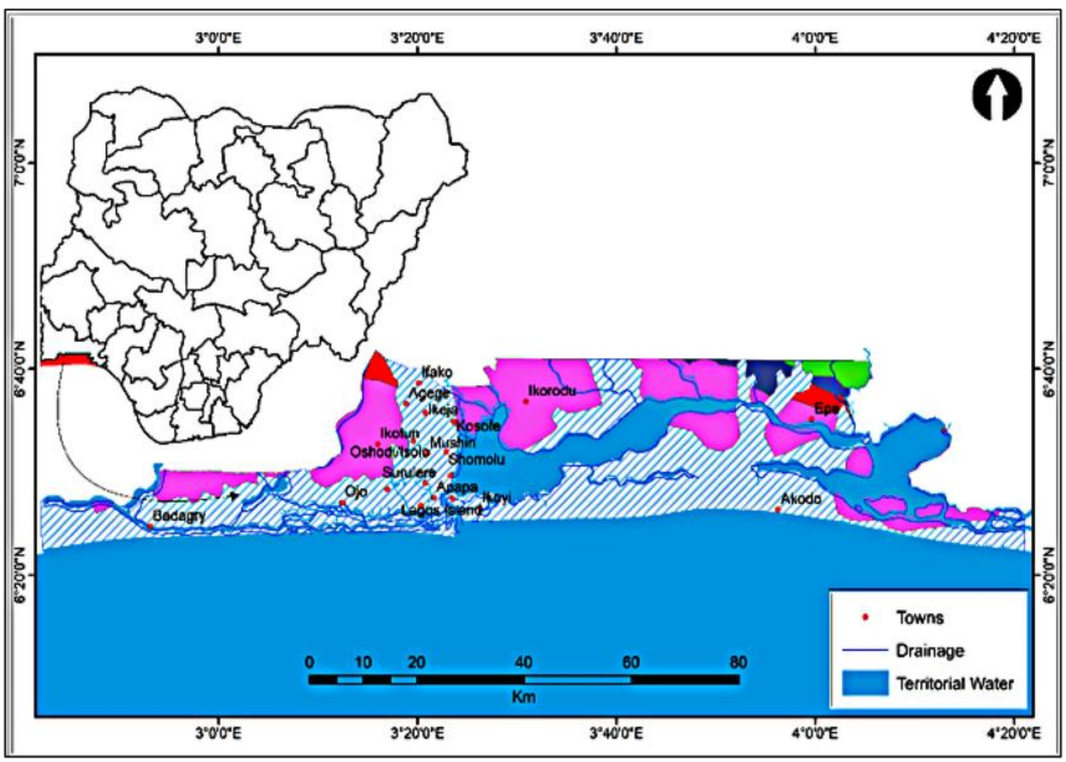


Figure 1.5: State of Coastal Highway Project Kick-off – Lagos State in Nigeria

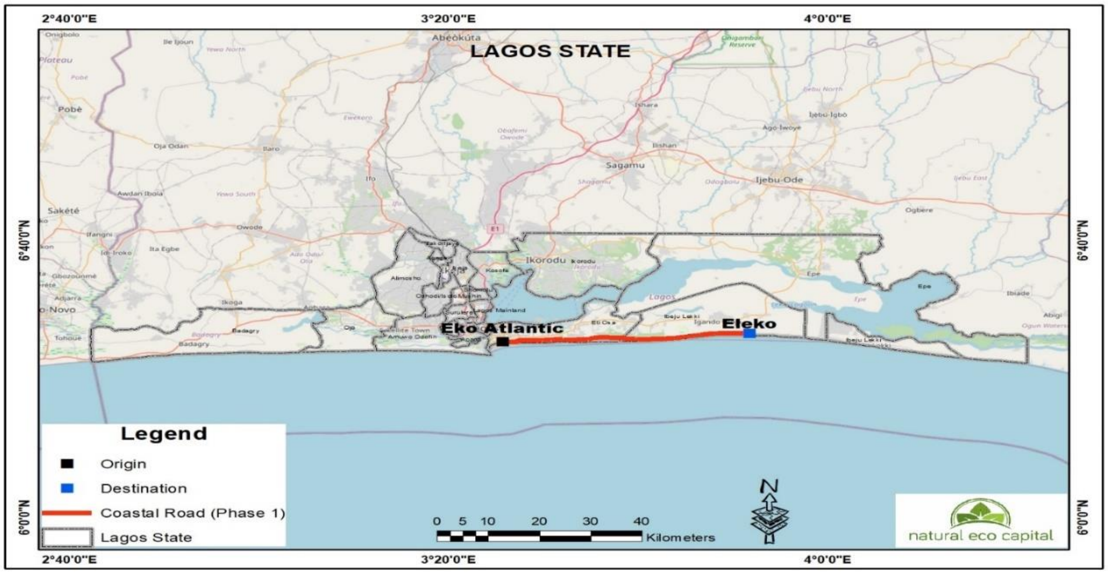


Figure 1.6: Length of the Proposed Section 1 of the Lagos-Calabar Coastal Highway

The project's impact assessment has a phased approach to demonstrate a commitment to environmental and social considerations. The expected impact include:

- **Economic Expansion:** The project is expected to increase Lagos State's economy by 50% in the first phase alone due to its connection to the Lekki Deep Seaport and other industrial zones.
- **Regional Integration:** Foster collaboration and development among coastal states.

This ESIA report specifically focuses on Section 1, providing a foundation for subsequent sections. The ESIA evaluates the environmental and social impact of a plan, policy, program, or project before deciding to proceed with the proposed action. It covers various aspects, including physical, biological, and socio-economic elements. The ESIA will describe project activities and identify potential impacts on air, water, soil, vegetation, wildlife, land use, and affected individuals and assets.

1.7 Approach and Methodology for the ESIA

1. **Strategic Approach**:

The ESIA process adheres to relevant local, national, and international policies, regulations, and standards. The key guiding parameters include:

- Considering policy, legal, and administrative frameworks.
- Focusing on main issues.
- Involving appropriate professionals and groups.
- Consulting the public.
- Linking information to decision-making.

- Presenting clear options for mitigating adverse environmental and social impacts.
- Providing helpful information to road agencies, donor agencies, planners, engineers, and decision-makers.

2. **ESIA Methodology**:

- The methodology ensures sustainable development, considering environmental and societal needs.
- It identifies potential risks and impacts associated with the project.
- A framework for mitigation measures is developed.
- Critical steps outlined in Figure 1.3 guide the preparation of the ESIA Report.

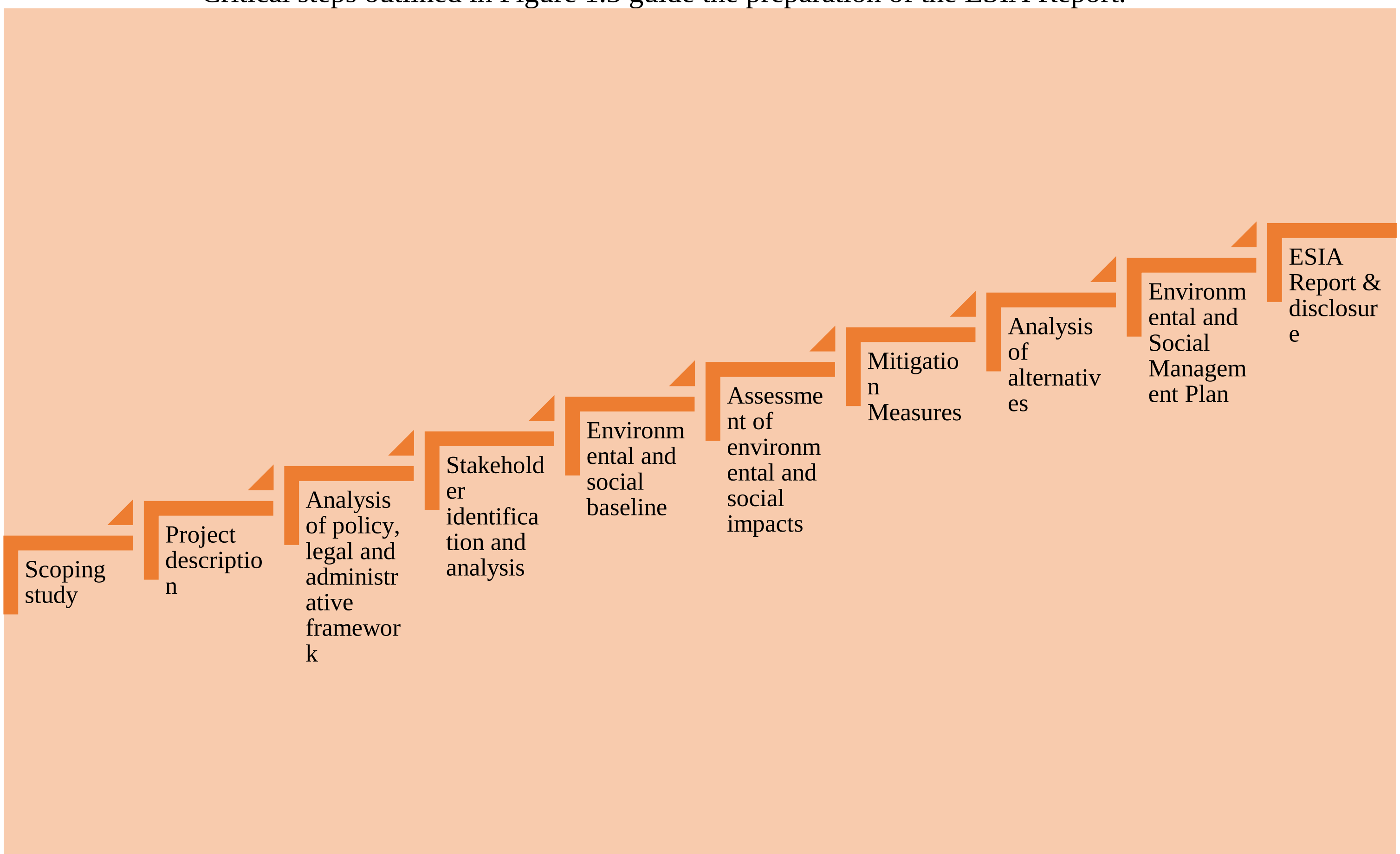


Figure 1.7: Key Elements of the ESIA Process

1.8.3 Administrative and Legal Framework

In carrying out EIA studies, local and international environmental laws, guidelines and regulations are handy guides and references. In Nigeria, the Federal Ministry of Environment (FMEnv) is the nation's regulatory authority for the environment. Act No. 58 of 1988 established the Federal Environmental Protection Agency (FEPA) -now defunct- as the chief regulatory body for environmental protection in Nigeria. The FMEnv, created in June 1999, now oversees the functions of defunct FEPA. The Act establishing the Ministry places on it the responsibility of ensuring that all development and industry activity, operations and emissions are within the limits prescribed in the National Guidelines and Standards, and comply with relevant regulations for environmental pollution management in Nigeria as may be released by the Ministry.

In general, the Nigerian laws, regulations, and policies applicable to this project are described as follows:

1.8.4 National Legislations/Regulations/Policies

A. Federal Ministry of Environment (FMEnv)

❖ **National Policy on Environment**

Environmental management in Nigeria is based on the National Policy on the Environment (1989), as revised in 1999 and 2016. The goal of this policy is to achieve sustainable development, in particular to:

- Secure for all Nigerians a quality of environment which is adequate for their health and wellbeing;
- Conserve and use the environment and natural resources for the benefit of present and future generations;
- Restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity and the principle of optimum sustainable yield in the use of these natural resources and ecosystems;
- Raise public awareness and promote understanding of essential linkages between environment and development and to encourage individual and community participation in environmental improvement efforts; and
- Co-operate in good faith, with other countries, international organizations/agencies to achieve optimal use of trans-boundary natural resources and effective prevention or a statement of trans-boundary environmental pollution.

❖ **Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004**

The EIA Act No 86 of 1992 stipulates that the public or private sector of the economy shall not embark on or undertake or authorize projects or activities without prior consideration, at an early stage of their environmental effects. The Act makes EIA mandatory for any major development project, prescribes the procedure for conducting and reporting EIAs. The Act also clearly stipulates among other things the objectives of an EIA, list of project activities for which an EIA is mandatory; minimum content of an EIA, regulatory authority of FMEnv; offences and penalties.

❖ **National Environmental Impact Assessment Procedural Guidelines, 1995.**

In response to the promulgation of the EIA Act of 1992, the FMEnv developed a National EIA Procedure in 1995. The procedure provides steps to be followed from the stage of project conception to commissioning in order to ensure that the project is implemented with maximum consideration for the environment. Figure 4 presents the EIA Process Flowchart showing the onset of EIA Registration with the Federal Ministry of Environment to Audit stage when a project becomes operational.

❖ **S.I.9 National Environmental Protection (Pollution Abatement in Industries Generating Wastes) Regulations 1991**

The National Environmental Protection (Pollution Abatement in Industries Generating Wastes) Regulations, S.1.9 of 1991 (No. 42, Vol. 78, August, 1991) impose restrictions on the release of toxic substances and stipulate requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries; submission of lists and details of chemicals used by industries to FMEnv; requirement of permit by industries for the storage and transportation of harmful or toxic waste; the generator’s liability; strategies for waste reduction; permissible limits of discharge into public drains; protection of workers and safety requirements; environmental audit (or EIA for new industries) and penalty for contravention.

❖ **Harmful Waste (Special Criminal Provisions etc) Act CAP HI LFN 2004.**

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria. The following sections are notable:

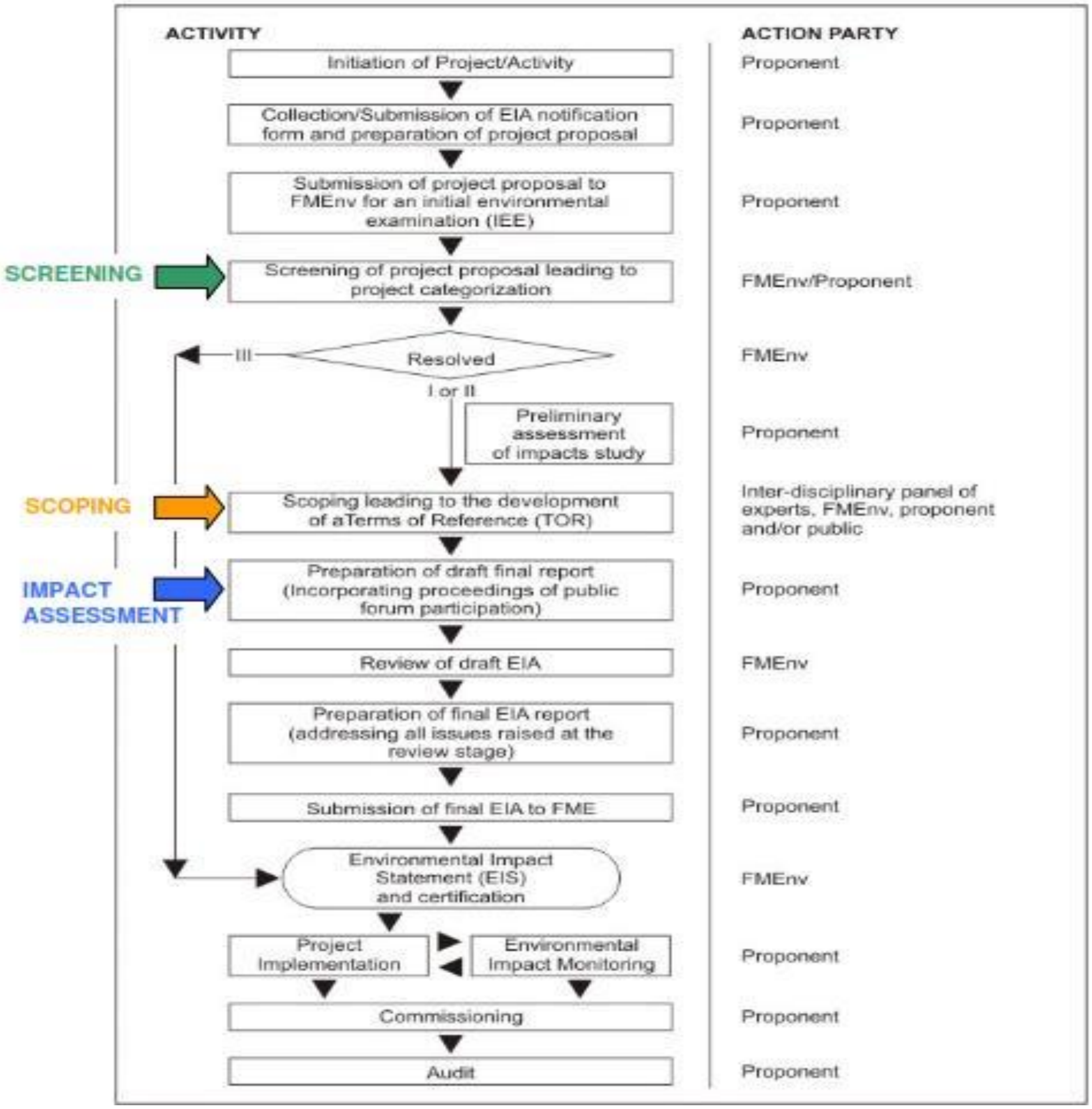
1. Section 6 provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.
2. Section 7 makes provision for the punishment accordingly, of any conniving, consenting or negligent officer where a company commits the offence.
3. Section 12 defines the civil liability of any offender. He would be liable to persons who have suffered injury as a result of his offending act.

This Act is essentially penal legislation. The offences are committed doing any of the act or omission stated in section 12 of the act. The jurisdiction of the Act is far reaching as it sought to remove any immunity conferred by the diplomatic immunities and privileges Act on any person for the purpose of criminal prosecution.

❖ **S.1.15 National Environment Protection (Management of Solid and Hazardous Wastes) Regulations 1991.**

The National Environment Protection (Management of Hazardous and Solid Wastes) Regulations, S.1.15 of 1991 (No. 102, Vol. 78, August, 1991) define the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, and incinerators. The Regulations describe the hazardous substances tracking programme with a comprehensive list of acutely hazardous chemical products and dangerous waste constituent. The requirements and procedure for inspection, enforcement and penalty are also described.

Further, the defined guidelines and strategies provide for the effective management of the environment in the following 14 major areas: Human population; Land use and soil conservation; Water resources management; Forestry, wildlife and protected areas; Marine and coastal area resources; Toxic and hazardous substances; Energy production and use; Air pollution; Noise pollution; Working environment (occupational health and safety); and Settlements, recreational space, greenbelts monuments and cultural property.



Source: Adopted from FMEnv, 2014

Figure 1.5: Overview of the Nigeria EIA Process

❖ **Nigeria Climate Act, 2021**

In 2021, Nigeria got a new Climate Change Act. This is the first legislation in the country's history dedicated to tackling climate change, and one of the first in Africa. The new Act establishes a powerful National Council on Climate Change, which will be a corporate entity, and make policies, regulations, guidelines, institute penalties (including fines).

The new Council, which will be chaired by the President, with the Vice President as Vice Chair, will also administer the new Climate Change Fund as well as oversee, working with relevant partners, the implementation of Carbon Emission Trading and a Carbon Tax in Nigeria.

It will also produce and revise Nigeria's National Climate Change Action Plan, every five years.

Under the Act, the Federal Ministry of Environment, working with the Federal Ministry of Budget and National Planning, is mandated to set a 'Carbon Budget' for Nigeria, which is the allowable/acceptable quantity of greenhouse gases in the country, per time. In addition, it will have a responsibility to conduct public communications and engagement on Climate Change and related matters in Nigeria.

The new Climate Change Act, 2021 requires private entity with at least 50employees to put in place a plan that will support in carbon reduction annually (Part VI, Section 24).

❖ **Nigeria Long-Term Low Emission Development Strategy (LT-LEDS)**

Nigeria's **Long-Term Low Emission Development Strategy (LT-LEDS)** is a comprehensive plan that outlines the country's vision for achieving low-carbon, climate-resilient, and sustainable development. It represents a transformative pathway toward sustainable development, resilience, and a low-carbon future.

The key features of Nigeria's LT-LEDS:

1. **Global Commitments**:
    - Nigeria submitted its Long-Term Vision 2050 during COP26 in Glasgow, demonstrating its commitment to the Paris Agreement. FINAL NIGERIA LT VISION_2050_Nov2021.pdf (unfccc.int)*)*.
    - The LT-LEDS aligns with global efforts to address climate change and achieve net-zero emissions.
2. **Implementation Pathway**:
    - The LT-LEDS translates this vision into quantified emission reduction targets.
    - It explores technological options and cost implications.
    - The LT-LEDS integrates gender considerations throughout its implementation.
3. **Existing Policies and Commitments**:
    - Nigeria's existing policies, such as the Climate Change Act, National Climate Change Policy, and Economic Sustainability Plan, contribute to LT-LEDS goals.
    - The LT-LEDS builds upon these efforts to accelerate decarbonization.
4. **Stakeholder Engagement**:
    - The LT-LEDS involves stakeholders, including government agencies, communities, and civil society.
    - Regular consultations ensure transparency and inclusivity.

❖ **Nigeria's Nationally Determined Contributions (NDCs)**

The development of the Nationally Determined Contribution (NDC) by the Government embodies the country's efforts to reduce national emissions and adapt to the impacts of climate change. If all the laws mentioned and discussed above are critically followed and implemented, Nigeria would reduce Greenhouse Gas Emission by 20% unconditionally and 45% with international support. At the same time, the economy will grow at an average annual rate of 5% by 2030. This represents an important milestone in tackling the challenges of climate change in the country.

- **Abandonment Guidelines 1995**

The guidelines help to ensure the environment is returned to, as much as reasonably practicable, its original/baseline conditions.

B. National Environmental Standards and Regulations Enforcement Agency (NESREA), Act 2007.

The Federal Government in line with Section 20 of the 1999 constitution of the Federal Republic of Nigeria established the National Environmental Standards and Regulations Enforcement Agency {NESREA} as a parastatal of the Federal Ministry of Environment.

The bill for an act establishing the agency was signed and published in the Federal Republic of Nigeria Official Gazette No.92, Vol. 94 of 31st July 2007, By the NESREA Act; the Federal Environmental Protection Agency Act Cap F 10 LFN 2004 was repealed. NESREA has responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws policies and guidelines.

NESREA has the mandate to enforce compliance with laws, guidelines, policies and standards on environmental matters.

- Section 7 provides the Agency authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitory and regulatory measures.
- Section 8 (1)(K) empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution and sanitation.
- Section 27 prohibits, without lawful authority, the discharge of hazardous substances into the environment.

The Act also enables the Agency also:

- Prohibit process and use of equipment or technology that undermine environmental quality.
- Conduct field follow-up of compliance with set standards and take procedures prescribed by law against any violator.

NESREA has, over the past years, provided at least 24 regulations gazette as supplementary in its Act. Some of these include:

- National Environmental (**Surface and Groundwater Quality Control)** Regulations, S. I. No. 22 of 2011

- National Environmental (**Sanitation and Wastes Control)** Regulations, S. I. No. 28 of 2009
- National Environmental **(Ozone Layer Protection)** Regulations, S. I. No. 32 of 2009
- National Environnemental **(Noise Standards and Control)** Régulations, S. I. No. 35 of 2009.
- National Environmental (Electrical and Electronic Equipment) Regulations, 2011 (S.I 23)
- National Environmental (Soil Erosion and Flood Control) Regulations, 2010 (S.I.12)
- National Environmental (Surface and Groundwater Quality Control) Regulations, 2010 (S.I.22)
- National Environmental (Ozone Layer Protection) Regulations, 2009 (S.I.32)

C. Criminal Code Act Cap C38 LFN, 2004

The Criminal Code contains provisions for the prevention of public health hazards and for environmental protection. Sections 245-248 deal with offences ranging from water fouling to the use of noxious substances.

The Nigerian Criminal Code makes it an offence punishable with up to 6-month imprisonment for any person who:

- Violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carry on business in the neighbourhood, or passing along a public way or
- Does any act which is, and which he knows or has reason to believe to be likely to spread the infection of any disease dangerous to life, whether humans or animals.

D. Land Use Act of 1978, **CAP 202, LFN 2004**

The Land Use Act places the ownership, management and control of land in each state of the federation in the Governor. Land is therefore allocated with his authority for commercial, agricultural and other purposes. The Land Use Act of 1978 states that'… It is also in the public interest that the rights of all Nigerians to use and enjoy land in Nigeria and the Natural fruits thereof in sufficient quality to enable them to provide for the sustenance of themselves and their families should be assured, protected and preserved'. This implies that acts that could result in the pollution of the land, air, and waters of Nigeria negates this decree, and is therefore unacceptable.

E. Nigerian Urban and Regional Planning Act, *CAP N138, LFN 2004*

Aimed at overseeing a realistic, purposeful planning of the country to avoid overcrowding and poor environmental conditions.

- Section 30 (3) requires a building plan to be drawn by a registered architect or town planner.
- Section 39 (7) establishes that an application for land development would be rejected if such development would harm the environment or constitute a nuisance to the community.
- Section 72 provides for the preservation and planting of trees for environmental conservation.

F. Forestry Act CAP 51 LFN 1994

This Act provides for the preservation of forests and the setting up of forest reserves. It is an offence, punishable with up to 6 month imprisonment, to cut down trees over 2ft in height or to set fire to the forest except under special circumstances.

G. Endangered Species Act 11, 1985

In pursuance of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, (CITES), the Federal Government of Nigeria enacted Endangered Species (Control of International Trade and Traffic) Act 11, 1985. The Law makes, among others, provisions for the conservation, management and protection of some of the country's endangered species. Section 1 absolutely prohibits the hunting or capture or trading in threatened animal species. The list of endangered species includes reptiles, birds (Aves) and mammals (insectivores, primates, rodents, carnivores).

H. Wild Animals Preservation Act CAP132 LFN 1990

The act was designed to protect the rare and more valuable kinds of game by giving complete protection to certain species. The use of traps and weapons was limited, and the slaughter of female game prohibited. The act sets out in the attached schedule those animals, which are protected, the hunting, killing or capturing of which require special permission from the Administrative Officer or magistrate.

I. National Resource Conservation Action Plan, 1992

The plan was established to set out objectives for living resources conservation through:

- Maintaining genetic diversity in order to ensure permanence in the supply of materials to satisfy basic human needs and thus improve the well-being of society.
- Promoting the scientific value of natural ecosystems, the study of which is required to enhance conservation itself, to improve the management of man-made systems, and to provide clues to technical innovations in agriculture, medicine and industry.
- Regulating environmental balance in such factors as carbon dioxide and radiation levels and the bio- geo chemical cycles.
- Maintaining ecological services through the protection of catchment's areas in order to enhance water resources and check soil erosion and flooding, protection of grazing lands against desert encroachment and the stabilization of coastal zones and.
- Enhancing the amenities values of natural resources, including aesthetic, heritage, religious, sentimental, ethical and recreational values on which tourism may be built.

J. FRSC Act CAP 141 (LFN), 2007.

In February 1988, the Federal Government created the Federal Road Safety Commission through Decree No. 45 of the 1988 as amended by Decree 35 of 1992 referred to in the statute books as the FRSC Act cap 141 Laws of the Federation of Nigeria (LFN) Passed by the National Assembly as Federal Road Safety Commission (establishment) Act 2007.

K. Water Resources Act, CAP W2, LFN 2004

This is an Act to promote the optimum planning, development and use of Nigeria's water resources and other matters connected therewith. It describes the right to the use and control of all surface water and ground water and any watercourse affecting more than one states together with the bed and banks thereof.

L. National Guidelines on Environmental Management System 1999

Recognizing the value of EMS to EIA, this document sets out objectives and provides a guide on the general scope and content of an EMS.

M. **Road sector-related policies and laws in Nigeria**

Oversight of all transport related policy and development falls under the Federal Ministry of Transport with the equivalent at the State level. Some of the relevant instruments for roads development in Nigeria include, Nigeria Integrated Infrastructure Master Plan (2014-2043), 2021 updated Nigeria Nationally Determined Contributions, Federal Roads Safety Commission (FRSC) Act CAP 141 Laws of the Federation of Nigeria (LFN) 2004 and Federal Highways Act, CAP 135.

N. Health and Safety National Instruments

Integrating Health and Safety standards into ESIA ensures that projects prioritize worker safety, prevent harm, and contribute to sustainable development.

The relevant instruments include National Policy on Occupational Safety and Health, revised 2020, which has the chief goal to facilitate improvement of occupational health and safety performance of all workers in all sectors of economic activity, the National Health Policy 2016 which, *inter alia*, has the goal to significantly reduce the burden of non-communicable diseases in Nigeria in line with the targets of the 3rd Sustainable Development Goal.

Some of the relevant international instruments on good international industry practice in health, and safety which will be of benefit to the proposed project include the International Labour Standards on Occupational Safety and Health such as **Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)**, Occupational Safety and Health Convention, 1981 (No. 155) and its Protocol of 2002 , Occupational Health Services Convention, 1985 (No. 161), and **Working Environment (Air Pollution, Noise and Vibration) Convention, 1977 (No. 148)**.

Some of the Key instruments on occupational safety and health include the following:

i. Factories Act CAP 126 LFN 1990

The Act makes provision for health and safety of persons employed in places statutorily defined as factories and for which a certificate of registration is required by law. It requires that workers should be adequately protected from occupational health and safety hazards.

ii. Workmen Compensation Act, 1987

This is an Act to provide compensation for injuries and death suffered by workmen in the course of their employment. (1) An employer shall pay compensation to any of his employees who suffer injury from any accident arising out of and in the course of his employment. (2) An employer shall pay compensation to the person or persons entitled to the estate of any of his employees who dies as a result of an accident arising out of and in the course of his employment.

iii. Public Health Law Cap 103 LFN 1990

Public Health Law examines the authority of the government at various jurisdictional levels to improve the health of the general population within societal limits and norms. The state is empowered to protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria. The law prohibits the public or private sector of the economy not to undertake or embark on or authorize projects or activities without prior consideration of the effect on the environment.

iv. National Policy on Occupational Safety and Health, 2016

The policy is aimed at ensuring that all workers are safe at their workplaces across the country. This policy was derived from provisions of the Nigerian constitution and the International Labour Organisation's (ILO) convention.

v. The Fire Service Act CAP F29, LFN 2004

An Act to make provision for the organisation, discipline, powers and duties of the Federal Fire Service, and for matters incidental thereto or connected therewith.

vi. The National Emergency Management Agency (NEMA)

The National Emergency Management Agency of Nigeria was established via Act 12 as amended by Act 50 of 1999, to manage disasters in Nigeria. Therefore, from its inception, NEMA has been tackling disaster-related issues through the establishment of concrete structures and measures. Such measures as the education of the public in order to raise their level of awareness and reduce the effects of disasters in the Country.

It coordinates resources towards efficient and effective disaster prevention, preparedness, mitigation and response in Nigeria. It acts in the following areas: Coordination, Disaster Risk Reduction (DRR), search and rescue, policy and strategy, Geographic Information System, Advocacy, education, administration, finance and logistics, relief and rehabilitation, planning, research and forecasting.

The NEMA Act mandated all States to establish State Emergency Management Agencies and Local Governments to establish Local Emergency Management Committees. NEMA promotes the decentralization of DRR activities at all levels. There is a national multi-sectoral platform for disaster risk reduction and a National Action Plan for DRR. NEMA has the authority to mobilise and coordinate actions by other agencies such as the Fire Service, the Police, the Nigeria Security and Civil Defence Corps, the Federal Road Safety Commission, the Federal Ministry of Health and the Red Cross.

vii. **(xv) Federal Road Safety Commission (Establishment) Act 2007**

The Federal Government of Nigeria established the Federal Road Safety Commission (FRSC) via a federal law (Federal Road Safety Commission [Establishment] Act 2007) and among others tasks it to handle traffic management and prevent accidents on the highways. The Federal Road Safety Commission (Establishment) Act 2007 binds the FRSC and its staff, so that they cannot act beyond their powers.

1.8.5 Nigerian National Social Protection Policies and Laws

In the consideration of social legislation, the acts and/or policies relevant to the proposed Project include Labour Act Cap L1, LFN 2004, Violence Against Persons (Prohibition) Act, 2005, National Gender Policy, 2006, Land Use Act of 1978, **CAP 202, LFN 2004**, Nigerian Urban and Regional Planning Act, CAP N138, LFN 2004 and National Policy on Child Labour (2013). These laws and policies collectively contribute to enhancing social well-being, reducing poverty, and promoting a life of dignity for Nigerians. the **social protection laws in Nigeria** that aim to enhance the well-being of citizens and provide a safety net for vulnerable populations.

a. **Specific Areas of Legislation and Policies**:
    - **Gender Equality**: Legislation and policies promoting gender equality.
    - **Disability**: Measures addressing disability rights.
    - **Ethnicity and Religion**: Relevant legislation.
    - **Migration and Displacement**: Policies related to migration.
    - **Children and Young People**: Laws impacting children and youth.
    - **Sexual Minorities**: Legislation affecting sexual minorities.
    - **HIV**: Policies concerning HIV

b. **Principles of Social Security**:
    The basic principles include:
    - Maximum welfare, freedom, and happiness for every citizen.
    - Provision of adequate shelter, food, national minimum living wage, old age care, and support for the disabled.
    - Ensuring opportunities for adequate livelihood and suitable employment.
    - Providing public assistance in deserving cases or during conditions of need.

c. **Social Security and Health**:
    i. **Social Work Profession**:
        - The primary legislation governing social work in Nigeria is the Social Work Profession (Registration and Regulation) Act**.**
        - This act establishes the Council for Social Work Education and Practice **(CSWEP)**, setting standards for social work education and professional practice.

    ii. **National Social Protection Policy**:
        - The Nigeria National Social Protection Policy aims to promote social justice**,** equity**,** and inclusive productive growth.

d. **National Social Protection Policy**:
    - The **National Social Protection Policy** serves as an umbrella framework in Nigeria. It incorporates related social agenda paradigms with the intention to reduce poverty and ensure a life of dignity for all citizens.
    - This multi-sectoral and multi-disciplinary approach contributes to poverty reduction and aligns with government policy priorities for sustainable development.

- The Ministry of Finance, Budget, and National Planning led the revision of this policy, involving active participation from stakeholders in both public and private sectors at federal and subnational levels. It reflects national consensus and consultation.
- Key objectives include reducing inequality, providing social incentives, and fostering human-centered development through health, education, and good governance[1].

e. **Laws Regulating Social Security**:

i. **Pension Reform Act (PRA) of 2014**:

- Regulates retirement benefits for individuals who worked in formal employment (public service, private sector, etc.).
- Ensures timely provision of retirement benefits, disability benefits, and survivors' benefits to dependents of deceased employees.

ii. **National Health Insurance Scheme (NHIS) Act of 1999**:

- Establishes a contributory health insurance scheme.
- Employers with a minimum of ten employees contribute to provide insured persons and their dependents with good-quality and cost-effective health services.

f. **Labour Act Cap L1, LFN 2004:**

The Labour Act is the primary law protecting the employment rights of individual workers. The Act covers protection of wages, contracts, employment terms and conditions, and recruitment; and classifies types of workers and special workers. While Nigeria has ratified all eight core International Labour Organization Conventions and enacted laws to enforce the provisions, there are indications of restrictions on the trade union rights of workers in Nigeria, discrimination, child labour and forced labour.

g. **Violence Against Persons (Prohibition) Act, 2005:**

The Violence Against Persons (Prohibition) Act (VAPP) was passed into law in May 2015. The Act was necessitated as a result of agitations for the protection of persons against different forms of violence. The Act has strengthened advocacy against rape, female genital mutilation, partner battery, stalking, harmful widowhood practices while prohibiting all forms of violence, including physical, sexual, psychological, domestic, harmful traditional practices and discrimination against persons. It also provides maximum protection and effective remedies for victims and punishment of offenders.

h. National Gender Policy, 2006

Nigeria put together the National Gender Policy in 2006. Its overall goal is to promote the welfare and rights of Nigerian women and children in all aspects of life: political, social and economic. The policy seeks to plan, coordinate, implement, monitor and evaluate the development of women in the county. In concrete terms, the National Gender Policy in Nigeria focus on:

- Contribution towards women's empowerment and the eradication of unequal gender power relations in the workplace and economy, in trade unions and in broader society.

- Encouragement of the participation, support and co-operation of men in taking shared responsibility for the elimination of sexism and redefining of oppressive gender roles.
- Increase the participation of women in leadership and decision-making.
- Ensure that through labour legislation and collective bargaining, the particular circumstances of women are considered and that measures are promoted to eliminate discrimination on the basis of gender.
- Ensure that there is a gender perspective in all sectors of development.

Table 1.1 shows the general overview and the specific relevance of each law and regulation to the coastal road project would require a more detailed analysis.

Table 1.1: National laws and regulation and their relevance to the coastal Highway Project

S/No	Subject Area	Relevant Laws and Regulations	Key elements	Relevance to coastal road
1	Environment	• National Policy on the Environment • EIA Act • National Environmental Impact Assessment Procedural Guidelines • National Environmental Protection (Pollution Abatement in Industries Generating Wastes) Regulations • Harmful Waste Act • National Environment Protection (Management of Solid and Hazardous Wastes) Regulations • Nigeria Climate Act • Nigeria's Long-Term Low Emission Development Strategy (LT-LEDS) • Nigeria's Nationally Determined Contributions (NDCs) • Abandonment Guidelines • National Environmental Standards and Regulations Enforcement Agency (NESREA) Act • National Environmental (Surface and Groundwater Quality Control) Regulations	• Air, water, soil, biodiversity, climate change, waste management, land use, natural resources.	• Potential impacts on coastal ecosystems, wetlands, and marine life. • Air and noise pollution from construction and vehicle emissions. • Water pollution from construction runoff and potential impacts on water bodies. • Soil erosion and disturbance during construction. • Climate change implications, including greenhouse gas emissions and vulnerability to climate hazards. • Waste management during construction and operation. • Land use changes and impacts on local communities. • Potential impacts on natural resources, such as fisheries and forestry.

Table 1.1: National laws and regulation and their relevance to the coastal Highway Project

S/No	Subject Area	Relevant Laws and Regulations	Key elements	Relevance to coastal road
		• National Environmental (Sanitation and Wastes Control) Regulations • National Environmental (Ozone Layer Protection) Regulations • National Environmental (Noise Standards and Control) Regulations • National Environmental (Electrical and Electronic Equipment) Regulations • National Environmental (Soil Erosion and Flood Control) Regulations • Forestry Act • Endangered Species Act • Wild Animals Preservation Act • National Resource Conservation Action Plan • Water Resources Act • National Guidelines on Environmental Management System		
2	Social	• Land Use Act • Nigerian Urban and Regional Planning Act	• Communities, livelihoods, land rights, cultural heritage, social impacts, resettlement.	• Potential impacts on local communities, including displacement and disruption of livelihoods.

Table 1.1: National laws and regulation and their relevance to the coastal Highway Project

S/No	Subject Area	Relevant Laws and Regulations	Key elements	Relevance to coastal road
		• Violence Against Persons (Prohibition) Act • National Gender Policy • National Policy on Child Labour		• Land acquisition and compensation issues. • Impacts on cultural heritage and historical sites. • Social cohesion and potential conflicts. • Resettlement planning and implementation.
3	Health and Safety	• Factories Act • Workmen Compensation Act • Public Health Law • National Policy on Occupational Safety and Health • The Fire Service Act • National Emergency Management Agency (NEMA) Act • Federal Road Safety Commission (Establishment) Act	• Worker health and safety, public health, emergency response.	• Occupational health and safety for construction workers. • Public health risks associated with air and water pollution, waste management, and vector-borne diseases. • Emergency response plans for accidents and disasters.
4	Transport - Sector	• FRSC Act • Road sector-related policies and laws	• Road infrastructure, traffic management, mobility, accessibility.	• Improvement of road connectivity and accessibility. • Traffic management and safety measures. • Reduction of travel time and transportation costs. • Potential impacts on public transportation and alternative modes of transport.

Table 1.1: National laws and regulation and their relevance to the coastal Highway Project

S/No	Subject Area	Relevant Laws and Regulations	Key elements	Relevance to coastal road
5	Rail System	• Nigerian Railway Corporation (NRC) Act: Establishes the NRC as the primary operator of railway services. • National Transport Commission (NTC) Act: Regulates the transport sector, including railways. • Land Use Act: Governs land acquisition for railway projects. • Environmental Impact Assessment (EIA) Act: Mandates environmental assessment for railway projects. • Other relevant laws and regulations: Safety standards, labor laws, procurement regulations.	• Infrastructure: Railway lines, stations, depots, signaling systems, rolling stock. • Operations: Freight and passenger services, maintenance, safety, efficiency. • Integration: Connectivity with other transport modes (road, air, maritime). • Economic Impact: Job creation, trade facilitation, regional development. • Environmental Impact: Reduced carbon emissions, land use efficiency.	• Intermodal Transportation: Integration of rail and road transport for efficient goods movement and passenger travel. • Reduced Road Congestion: Shifting freight and passenger traffic from roads to rail can alleviate congestion on coastal roads. • Economic Development: Improved rail connectivity can boost economic activities along the coast. • Environmental Benefits: Rail transportation generally has lower carbon emissions compared to road transport.

Lagos State Agencies and Legislations

The Table 1.2 serve as a valuable resource for understanding the legal and regulatory framework for coastal road projects in Lagos State.
The table can be further detailed by including specific sections or clauses of the mentioned laws relevant to coastal road projects.

- **Agency R**The table can expand on the roles and responsibilities of each agency to clarify their involvement in coastal road projects.
- **Collaboration:** The table can highlight potential collaborations between agencies for effective coastal road management.
- **Data Collection:** Information on specific data requirements, monitoring, and reporting for each agency can be added.
- **Permitting and Licensing:** The table can include information on necessary permits and licenses for coastal road projects.

Table 1.2: Legal and regulatory framework for coastal road projects in Lagos State

Subject Area	Relevant Laws and Regulations	Key Elements	Relevance to Coastal Road
Environment	Lagos State Environmental Protection Law, Lagos State Environmental Sanitation Law, Lagos State Environmental Pollution Control Law	Environmental impact assessment, waste management, pollution control, monitoring	Essential for assessing environmental impact, waste disposal, and pollution prevention during construction and operation
Waste Management	Lagos State Waste Management Authority (LAWMA)	Waste collection, disposal, recycling	Crucial for managing construction waste and potential marine debris
Parks and Gardens	Lagos State Parks and Garden Agency (LASPARK)	Green spaces, aesthetics	Important for coastal erosion prevention, public spaces, and visual impact

Water Management	Lagos State Water Corporation (LWC), Lagos State Water Regulatory Commission (LSWRC)	Water supply, quality, regulation	Essential for water supply to construction sites, water quality monitoring, and potential impacts on marine life
Urban Planning	Lagos State Urban and Regional Planning and Development Law	Physical planning, urban development, building control	Crucial for coastal zone management, land use planning, and infrastructure development
Emergency Management	Lagos State Emergency Management Agency (LASEMA)	Disaster management, response, prevention	Essential for handling potential emergencies like flooding, erosion, or accidents
Fire and Rescue	Lagos State Fire and Rescue Service	Fire prevention, response, rescue	Important for safety during construction and operation, especially considering potential hazards near water
Safety	Lagos State Safety Commission	Safety regulations, enforcement	Crucial for worker safety, public safety, and infrastructure safety

i. International Instruments for Social Protection

Table 1.2: International Instruments for Social Protection

No.	Applicable provisions
1. International Bill of Human Rights	• This comprises of the Universal Declaration of Human Rights, the International Covenant on Economic, Social and Cultural Rights and the International Covenant on Civil and Political Rights and its two Optional Protocols. • Universal Declaration of Human Rights, 1948. This is a common standard for all peoples and all nations and meant to be respected and upheld by every individual, every organ of society and by member States. It comprises of 30 Articles including the right to: life, to dignity, to expression, movement and from discrimination, to access judicial justice on fair terms, to privacy, to asylum and nationality, to marriage and family life, to conscience, thought and religious freedom, to association and peaceful assembly, participation in political, social and cultural activities of the society, to social security, to gainful and decent employment on equitable terms and remuneration, to a standard of living adequate for the health and well-being of himself and of his family, to work leave, rest and leisure, to education and human development, to property, to recognition as a person; and freedom from: slavery and servitude; from torture and cruel, inhuman or degrading treatment or punishment. • Duties are owed to the community to ensure the realization of these freedoms and States shall refrain from ay activities aimed at their destruction. • Article 25 of the International Covenant on Civil and Political Rights provides for the right of citizens to take part in political affairs, and Article 19 guarantees the right to freedom of expression, including the right to seek information.
2. United Nations Guiding Principles on Business and Human Rights (UNGPs)	• The UNGPs is a framework for actions by States and companies as regards business-related human rights impacts. They are non-binding on either States or companies, however, it is incumbent on them to **prevent**, **address** and **remedy** human rights abuses. • The General principles are the following: - States' have obligations to respect, protect and fulfil • human rights and fundamental freedoms; - business enterprises have a social responsibility to comply • with all applicable laws and to respect human rights; and - there should be appropriate and effective remedies when human rights are breached.
3. Equator Principles (EP) 4	• The Equator Principles serve as a common environmental and social risks framework for Equator Principles Financial Institutions (EPFIs) in evaluating projects and ensuring that they are socially responsible and reflect sound environmental practices to qualify for financing. The ten (10) principles are aligned with the United Nations Sustainable Development Goals (SDGs).

Table 1.2: International Instruments for Social Protection	
No.	**Applicable provisions**
	• Assessments of potential adverse Human Rights impacts and climate change risks are required for Category A and higher risk Category B projects. Projects that are under Category A and B are required to develop and/or maintain an Environmental and Social Management Plan (ESMS) to address issued raised in the Assessment process and incorporate actions required to comply with the applicable standards. Effective Stakeholder Engagement, as an ongoing process with Affected Communities, Workers and, where relevant, Other Stakeholders will be required for Category A and B projects.
4. International Labour Organization (ILO) Core Labour Standards	• The International Labour Organization (ILO) has maintained and developed a system of international labour standards since year 1919. The standards are aimed at promoting decent and productive work, in conditions of freedom, equity, security, and dignity. Governments, employers' and workers' organizations, international institutions, multinational enterprises and nongovernmental organizations are expected to incorporate the standards in their policies, operational objectives and processes.
5. Convention on the Rights of the Child (CRC) 6. International Programme on the Elimination of Child Labour (IPEC)	• The Convention was adopted by the UN General Assembly on 20 November 1989 and entered into force in September 1990. It incorporates in 41 articles the full range of human rights - civil, political, economic, social and cultural rights - of children under the age of eighteen years. The Convention has been ratified by Nigeria and by Lagos State. • Since 1992, the ILO has led a global effort to raise awareness of the child labour problem, to encourage member States to put in place appropriate legal and policy frameworks, and to ensure that appropriate attention is paid to the elimination of all forms, especially, the worst forms, of child labour.
7. Convention on the elimination of All Forms of Discrimination Against Women (CEDAW) 8. UN Global Compact, Women's Empowerment Principles	• The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) was adopted in 1979 by the UN General Assembly. It defines what constitutes discrimination against women and sets up an agenda for national action to end such discrimination. Countries that have ratified or acceded to the Convention are legally bound to put its provisions into practice. States parties agree to take all appropriate measures, including legislation and temporary special measures, so that women can enjoy all their human rights and fundamental freedom. The Convention has been ratified by Nigeria. • These Principles are to be adopted by business leaders to empower women in the workplace, marketplace and community and to promote gender equality and women's empowerment.
9. UN Global Compact - Labour Principles	• Principle 3. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining. • Principle 4. Businesses should uphold the elimination of forced or compulsory labour. • Principle 5. Businesses should uphold the effective abolition of child labour.

Table 1.2: International Instruments for Social Protection	
No.	**Applicable provisions**
	• Principle 6. Businesses should uphold the elimination of discrimination in respect of employment and occupation.
10. International Finance Corporation (IFC) Performance Standards (PS) Performance Standard 2 – Labour and Working Conditions	• Protection of the fundamental rights of workers as the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. • This PS is applicable during the environmental and social risks and impacts identification process, where the implementations are necessary to meet the expectations in the Company's Environmental and Social Management System (ESMS). It applies to the Company's direct workers, contracted workers and also supply chain workers. • Requirements under this PS are (i) working conditions and management of worker relationship, (ii) protection of the workforce, (iii) occupational health and safety, (iv) workers engaged by the third parties, and (v) supply chain.
12. International Finance Corporation (IFC) Performance Standards (PS) Performance Standard 8 – Cultural Heritage	• PS8 acknowledges the importance of cultural heritage for current and future generations. This is horizontal with the Convention Concerning the Protection of the World Cultural and Natural Heritage which target to ensure that the Company protect cultural heritage in the course of their project activities. • Besides that, the requirements outlined in this PS are based on standards set by the Convention on Biological Diversity which apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed. • The requirements in this PS focused on: - protection of cultural heritage in project design and execution; and - project's use of cultural heritage.
13. World Bank Group (WBG) Environmental Health and Safety (EHS) Guidelines	• The Environmental, Health and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). • The General EHS Guidelines are tailored into four (4) main sections/topics (i) Environmental, (ii) Occupational Safety and Health, (iii) Community Health and Safety, and (iv) Construction and Decommissioning. It shall be used together with the relevant Industry Sector EHS Guidelines. • Applicable topic for human rights under the World Bank EHS Guidelines is the Community Health and Safety. This section of the Guidelines is addressing some aspects of projects activities

k. Ministry of Marine and Blue Economy

In August 2023, President Bola Ahmed Tinubu announced the creation of new ministerial portfolios in Nigeria, including the Ministry of Marine and Blue Economy. This move reflects Nigeria's interest in harnessing economic opportunities from its oceans and aquatic ecosystems. However, despite this laudable step, Nigeria lacks a comprehensive policy or harmonized laws for the implementation of the blue economy.

While Nigeria has made strides in recognizing the blue economy's potential, existing legal frameworks need improvement. Nigeria's blue economy holds immense promise, but regulatory enhancements are crucial to fully realize it's potential.

l. Hospitality and Tourism - Nigerian Tourism Development Corporation

Nigerian Tourism Development Corporation Act (NTDC Act): At the core of Nigeria's travel and tourism legal framework lies the Nigerian Tourism Development Corporation (NTDC) Act. This legislation establishes the NTDC, which plays a pivotal role in promoting and regulating tourism in the country. The NTDC oversees the registration and licensing processes for tourism establishments, including hotels, travel agencies, tour operators, and tourist guides.

Compliance with these requirements ensures that establishments meet certain standards and adhere to safety protocols. The NTDC Act sets guidelines for hospitality establishment standards, ensuring that hotels, guesthouses, and other accommodation facilities maintain quality and safety for guests.
Ensuring tourism safety and security is crucial. The NTDC collaborates with relevant agencies to enhance safety measures, protect tourists, and prevent incidents that could harm visitors or tarnish Nigeria's image as a tourist destination.

While Nigeria's tourism sector has immense potential, continued investment and effective implementation of existing laws are essential for sustainable growth.

Policies and Development of Railways In Nigeria

Nigeria's railway laws aim to facilitate efficient rail transport, promote safety, and regulate railway operations. The legal framework related to railways in Nigeria.

The **Nigerian Railway Corporation (NRC) Act** provides for the establishment of the Nigerian Railway Corporation. Its purpose is to transfer the railway undertaking from the Government of the Federation to the Corporation and regulate its functions. The key provisions include the establishment and constitution of the NRC, duties and powers of the Corporation, financial provisions, staff regulations, and working of the railway system. The NRC Act outlines the duties and powers of the Corporation, including the appointment of a general manager, furnishing information, fixing rates and fares, providing additional facilities for traffic, and executing necessary works. It also addresses land acquisition, construction, and maintenance for railway purposes.

The Fifth Alteration Act empowers the National Assembly to legislate on inter-state railway tracks, infrastructure, and the establishment of a national railway agency. States can make laws for state railway carriers within their boundaries.

Generally, no person can construct or operate a railway for public carriage of passengers or goods within Nigeria without the consent of the Corporation. However, the Act allows for seeking the Corporation's consent in specific cases.

1.8.6 Lagos State Agency and Legislations

1. **Lagos State Ministry of the Environment**

This is the state government Ministry responsible for the management of the environment in Lagos State with regard to relevant policies and actual implementation through **Law Cap L23, Laws of Lagos State of Nigeria (2003**). The Ministry has agencies who work together to create a conducive environment for tourism, economic growth, and the well-being of Lagos residents. The environmental agencies and bodies under the Lagos State Ministry of the Environment and Water Resources are outlined below:

- **Lagos State Environmental Protection Agency (LASEPA)**:
  LASEPA is responsible for environmental protection and regulation in Lagos State. It focuses on monitoring, enforcement, and advocacy to ensure a cleaner and healthier environment. Citizens can report environmental issues easily through LASEPA.
  - **Lagos State Environmental Sanitation Law, CAP 44, (1984).** This is a law of Lagos State focused on environmental sanitation and protection. It punishes in varying degrees acts like street obstruction, failure to clean sidewalks, cover, refuse bins or disposal wastes property.
  - **Lagos State Environmental Pollution Control Law, CAP 46 LLS (1989**). Section 12 of this law of Lagos State makes it an offence to cause or permit a discharge of raw untreated human waste into any public drain, water course or into any land or water.

- **Lagos State Waste Management Authority (LAWMA)**:
  LAWMA manages waste collection, disposal, and recycling across Lagos State. Its goal is to maintain a sustainable waste management system and promote recycling and reuse.

  In December 1991, the Lagos State Waste Management Authority (LAWMA) was christened under Edict No. 55 (amended 2007), which made the agency to be responsible for the collection and disposal of municipal and industrial waste. LAWMA is government's cutting edge response to the need to create a clean and green Lagos State.

- **Lagos State Parks and Garden Agency (LASPARK)**:
  LASPARK oversees the development and maintenance of parks, gardens, and green spaces in Lagos. It contributes to enhancing the city's aesthetics and providing recreational areas for residents.
- **Lagos Water Corporation (LWC)**:
  LWC is responsible for water supply and distribution in Lagos State. It ensures access to clean and safe water for residents.
- **Lagos State Water Regulatory Commission (LSWRC)**:
  LSWRC regulates water-related activities, including licensing, quality control, and pricing. It aims to improve water governance and sustainability.

2. **Lagos State Urban and Regional Planning and Development Law, 2010.**
   In 2010, the Lagos State Government enacted a law to provide for the administration of physical Planning, urban development, urban regeneration and Building control in Lagos state and for connected Purposes. The law designates The Ministry of Physical Planning and Urban Development as the custodian of all Physical Planning, Urban Development, Urban Regeneration and Building Control policies of the State.

3. **Lagos State Emergency Management Agency**

The Lagos State Emergency Management Agency (LASEMA) was established vide LASEMA Law 16 of 2008 for emergency and disaster management in the State in pursuance to decree 12 of 1999 as amended by Act No. 50 of 1999 which established the National Emergency Management Agency (NEMA).

The Agency is responsible for the overall co-ordination of emergency management in Lagos State, working closely with all its Stakeholders.

- Be the umbrella body to co-ordinate the activities of relevant agencies in prevention and management of disasters in the State.
- For the development of loss prevention programmes and procures necessary technology to mitigate identified emergency situation.
- Prompt and adequate response as well as sustained interventions in any form of emergency or disaster in the State.
- Co-ordinates activities of stakeholders and NGOs who jointly carry out strategies for emergency/disaster management in the State.
- Provides relief materials/financial assistance to victims of various disasters in the State.
- Respond promptly to any emergency at hand, which includes but is not limited to the following;
- Fire fighting (co-ordinate with fire services).
- Flood Control
- Collapsed Building
- Evacuation
- Search and Rescue Operations
- Environmental Pollution
- Crowd control/cordon off affected areas.
- Public enlightenment on safety issues.
- Perform general life saving activities including provision of relief materials.
- Clear and remove objects that constitute the carcass or remains of incidents.

4. **The Lagos State Fire and Rescue Service**

Lagos State Government in readiness towards protecting the lives and property of the people on its creation in 1967 established a state-owned fire station by an Edict of Lagos State Law Cap 42 of 1972. The State Fire and Rescue Service operates from 19 (nineteen) functional Fire Stations across the State and three others at various stages of completion

The Service has the VISION To save lives and properties and to guarantee prompt response to Fire Calls, Rescue Operations and other Related Emergencies while ensuring pro-activeness through Fire Preventive Measures and Training. Its MISSION is the Provision of highly professional, motivated Staff, state of the art Fire Equipment, modern Communication Gadgets and Public Enlightenment Program towards mitigation of Fire and other related Emergencies in Lagos Stat

5. **Lagos State Safety Commission**

The Lagos State Safety Commission is responsible for the coordination of all Government matters relating to the safety of lives and property of Lagosians. The Commision is vested with powers to formulate policies, provide advisory and be the regulatory body on safety related issues.

The Lagos State Safety Commission has the Vision To proactively make safety a lifestyle in Lagos State and Mission To develop policies and strategies that will build a sustainable safety culture through a regulated and coordinated safety system.

1.8.7 Local Government

Like the State Government, the Local Government liaise and cooperate with the Federal and State Ministries of Environment to achieve a healthy or better management of the environment within their domains with the relevant bye-laws.

The Local Government, without any specific laws on environmental management, is charged with the following responsibilities, *inter alia*:

- Coordinating the activities of Local Government Council;
- Maintenance of Law and Order in collaboration with Law Enforcement Agencies;
- Collection of taxes and fees;
- Establishment and maintenance of cemeteries, burial grounds and homes for the destitute or infirm
- Establishment, maintenance and regulation of markets, motor parks and public conveniences;
- Construction and maintenance of roads, streets, drains and other public highways, parks, and open spaces;
- Naming of roads and streets and numbering of houses;
- Provision and maintenance of public transportation and refuse disposal;

1.8.8 Multilateral Environmental Agreements

A number of the Conventions, Protocols and Treaties that promote the maintenance of a viable environment and achieving sustainable development have been endorsed by Nigeria and are applicable to the proposed project based on the environmental and social dimensions alongside the inherent health and safety implications such as Paris Accord, Aarhus, 1998, United Nations Guiding Principles on the Human Environment, and Agenda 21 – United Nations Conference on Environment and Development. Alongside, are Voluntary International Standards such as Equator Principles and ISO26000, Guidance on Social Responsibility are Applicable.

Nigeria is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant development partners in this project are African Development Bank, the World Bank and a number of United Nations agencies.

(i) United Nations Guiding Principles on the Human Environment

The United Nations (UN) published the concept of Guiding Principles on the Human Environment in 1972. Ten of these Guiding Principles were defined as formal declarations that express the basis on which an environmental policy can be built, and which provide a foundation for action.

(ii) The Rio Declaration on Environment and Development

The UN Conference on Environment and Development met at Rio de Janeiro in June 1992, at which time it reaffirmed the 1972 declaration on the Human Environment and sought to build upon it. This was done with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among states, key sectors of societies and people. It was also to aid work towards international agreements, which respect the interests of all, protect the integrity of the global environmental development system, and recognize the integral and interdependent nature of the earth.

The UN Conference on Environment and Development 1992, Principle 17 of the Final Declaration is dedicated to ESIA and states: *"Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."*

The consequence of this is that the United Nations agencies concerned in various ways with people and the environment adopted impact assessment as a central tool to support decision-making.

(iii) Agenda 21 – United Nations Conference on Environment and Development

The United Nations Conference on the Environment and Development (UNCED) in 1992 led to the adoption of Agenda 21, which recommends a set of measures for waste management.
The recommendations may be summarized as follows:

- Prevent and minimize waste production.
- Reuse or recycle the waste to the extent possible.
- Treat waste by safe and environmentally sound methods.
- Dispose of the final residues by landfill in confined and carefully designed sites.

Agenda 21 also stresses that any waste producer is responsible for the treatment and final disposal of its own waste; where possible; each community should dispose of its waste within its own boundaries.

(iv) Some Relevant Principles

1. ***The precautionary principle*** is a key principle governing health and safety protection. When the magnitude of a particular risk is uncertain, it should be assumed that this risk is significant, and measures to protect health and safety should be designed accordingly.
2. ***The duty of care principle*** stipulates that any person handling or managing hazardous substances or related equipment is ethically responsible for using the utmost care in that task.

(v) Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (WIM)

The Warsaw International Mechanism for Loss and Damage promotes the implementation of approaches to address loss and damage associated with climate change impacts, in a comprehensive, integrated and coherent manner (See decision 2/CP.19 for the details). The mechanism is established under the United Nations Framework Convention on Climate Change to assist developing countries that are particularly vulnerable to the adverse effects of climate change by:

- Enhancing knowledge and understanding of comprehensive risk management approaches to address loss and damage
- Strengthening dialogue, coordination, coherence and synergies among relevant stakeholders
- Enhancing action and support, including finance, technology and capacity-building

Through these functions, the mechanism implements Article 8 of the Paris Agreement.

> Article 8 of the Paris Agreement notes that "Parties recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage."
>
> The Paris Agreement in Paragraphs 48–52 (Loss and Damage) of Decision -/CP.21reaffirmed the Warsaw International Mechanism for Loss and Damage as the main vehicle under the UNFCCC process to avert, minimize and address loss and damage associated with climate change impacts, including extreme weather events and slow onset events.

(vi) Paris Climate Change Agreement and NETZERO Trajectory
The Paris Climate Agreement represents the climate deal or pact sponsored by the United Nations to bring the world's countries together in the fight against climate change. Participating nations made a historic pact on Dec. 12, 2015, in Paris, France, to adopt green energy sources, cut down on greenhouse gas emissions and limit the rise of global temperatures (as mentioned in the overall mission).

Under the Paris Agreement, which went into effect on Nov. 4, 2016, every country has an individual plan (or "Nationally Determined Contributions (NDC)") to tackle its greenhouse gas emissions.

Nigeria's initial NDC captured five key sectors, namely: Energy(power), Transport, Industries, Oil and Gas, and Agriculture submitted to UNFCCC in 2015. Nigeria revised her NDC and submitted to UNFCCC in 2021 with two additional sectors (water and waste). This raised Nigeria's ambition by including emissions reductions from the waste sector (alongside water sector) for the first time and increasing its conditional contribution to 47% on international support with unconditional contribution still remain 20% below business-as-usual by 2030.

A. **Net Zero Trajectory and ISO Standards for Climate Change**

Net Zero occurs when human-caused greenhouse gas emissions (GHGs) are balanced by emission removals. The U.N. Intergovernmental Panel on Climate Change (IPCC) emphasizes that reaching Net Zero is crucial for limiting global temperature increase to 1.5°C above preindustrial levels. The clock is ticking, and decisive action is imperative.

Companies, governments, and individuals worldwide recognize the urgency. The goal is to achieve Net Zero emissions by no later than 2050.
Nigeria has set its target for 2060. Nigeria's commitment to its Long-Term Low-Emission Development Strategy (LT-LEDS) with the submission of this LT-LEDS to UNFCCC Secretariat who has uplodeded it to is website since April 25, 2024. By aligning with global efforts and communicating its net-zero goals, Nigeria contributes significantly to the fight against climate change (Box 1.3) .

Net-Zero Emissions Commitment:
- At COP27, Nigeria made a significant pledge: to achieve net-zero emissions by no later than 2060.
- This commitment aligns with global efforts to limit temperature rise and combat climate change.

Vision Statement for Nigeria's LT-LEDS:
- The LT-LEDS aims to provide a clear pathway toward achieving net-zero emissions.
- It considers various elements, including emission reductions, carbon offsetting, transparency, stakeholder engagement, and equity.

Existing Policies and Efforts:
- Nigeria has several existing policies and initiatives contributing to decarbonization:
- Climate Change Act, 2021
- Agenda 2050 and National Development Plan (2021-2025)
- National Climate Change Policy (2021-2030)
- National Climate Change Programme for Nigeria (2021-2030)
- The Nigerian Economic Sustainability Plan
- The Nigeria 2050 Calculator (NECAL 2050)
- National Action Plan on Gender and Climate Change (NAPGCC)

Box 1.2: Nigeria's Commitment to a Sustainable and Climate-resilient Future

b. Transport Sector -outcome of COP28, in Dubai, UAE, December, 2023

The transport sector plays a crucial role in achieving global climate goals. The transport sector is responsible for 21% of global CO_2 emissions and has the highest reliance on fossil fuels over any other industry. In order to meet climate targets, emissions from transportation must fall by over 3% per year until 2030.

At COP28 discussions also focused on how to decarbonise the transport sector.

In other words, COP28 underscored the urgency of transitioning away from fossil fuels, highlighted the importance of adaptation and resilience, and set directions for future climate commitments[1]. The key points related to transportation"

1. **Fossil Fuels & Clean Energy**:
   - The COP28 outcome emphasized the need to transition away from fossil fuels. This decision marked the first time the term "fossil fuels" appeared in a COP's formal outcome since UN climate negotiations began 30 years ago.
   - The commitment to move away from fossil fuels is a significant step toward addressing climate change's main driver
2. **Decarbonizing the Transport Sector**:
   - Global leaders discussed strategies to decarbonize the transport sector during COP28. Emissions from transportation must decrease by over 3% per year until 2030 to meet climate targets[2].
3. **National Climate Plans (NDCs)**:
   - The COP28 outcome called for the next round of Nationally Determined Contributions (NDCs) to enhance current actions to reduce emissions. NDCs should also include plans and priorities for adaptation, just transition efforts, and loss and damage.

[1] https://www.wri.org/insights/cop28-outcomes-next-steps
[2] https://www.icis.com/explore/resources/news/2023/12/06/10951339/cop28-decarbonising-the-transport-sector/

4. **Other Climate Actions**:
    - While progress was made, there were concerns. Adaptation targets lacked detail, and finance for clean energy transition remained unclear.

Outside formal negotiations, there were commitments to reduce methane emissions, create sustainable food systems, and protect forests.

c. ISO's Role in Climate Action

In the race against climate change, ISO standards pave the way toward a sustainable, net-zero future. ISO (International Organization for Standardization) plays a pivotal role in shaping climate action. At COP27 in Sharm-El Sheikh, Egypt (November 2022), ISO launched guiding principles for achieving net zero. These principles provide a roadmap for businesses and organizations on their journey toward net-zero GHG emissions.

ISO standards accelerate climate action across sectors. Members advocate for policies that promote International Standards. Sharing success stories demonstrates ISO's leadership at national and international levels. Expertise in ISO standards supports ambitious policy development.

The **Net Zero Guidelines** offer:

- Common definitions
- High-level principles
- Actionable guidance
- Transparent reporting on emissions, reductions, and removals

The Net Zero Guidelines provide clarity amidst the confusion surrounding various "Net Zero" approaches. They complement ISO's existing environmental standards (such as ISO 14000) and serve as a reference for organizations setting net-zero goals. These guidelines foster consistency and alignment across diverse efforts and initiatives.

Relevant ISO Standards:

ISO has developed several standards related to climate change:

- ISO 14090:2019: Adaptation to climate change
- ISO 14064-1:2018: Greenhouse gases
- ISO 14068-1:2023: Climate change management

The Key Elements of Net Zero Strategies:

1. **Emission Reductions**:
    - Address emissions at the source:
        - Improve energy efficiency
        - Transition to renewable energy
        - Innovate processes to reduce waste
2. **Carbon Offsetting**:
    - For unavoidable emissions, invest in carbon credits from projects that remove or reduce GHGs.
3. **Transparency and Accountability**:
    - Regular monitoring and reporting ensure transparency and track progress toward net-zero goals.
4. **Stakeholder Engagement**:

- Involve employees, customers, investors, and communities in net-zero strategies.
- Foster a culture of sustainability and collective action.

5. **Equity and Justice**:
   - Align with the UN Sustainable Development Goals.
   - Ensure equitable sharing of costs and opportunities, safeguarding vulnerable communities.

ISO 14097 and Climate Neutrality:

- ISO 14097 is a framework standard that focuses on climate neutrality.
- It provides guidelines for assessing, quantifying, and reporting the net GHG emissions associated with products, services, or organizations.
- The goal: Achieve climate neutrality by balancing emissions with removals or offsets.

d. Lagos State Government developed a Lagos Climate Action Plan
Due to the impact of climate, Lagos State Government developed a Lagos Climate Action Plan (CAP). The CAP is a 5-year plan for Lagos that aligns with the Paris Agreement and aims towards carbon neutrality by 2050 A cleaner, greener, healthier, stable, and more prosperous Lagos in a changing climate" Lagos Climate Action Plan The plan is organized around four sectors: (1) waste, (2) transportation, (3) energy, and (4) climate adaptation and resilience. The CAP contains not only a broad, stakeholder-led vision but also four sets of visions each organized around the sectors. Each sector contains sets of projects organized around actions and goals.

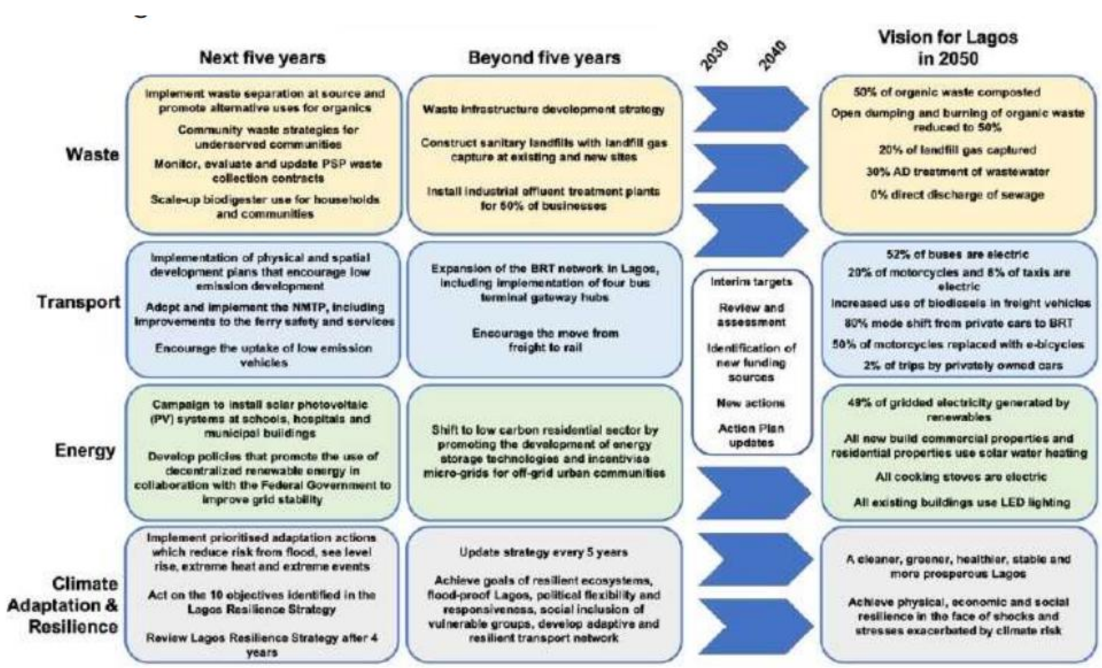


Figure 1.8: Lagos Climate Action Plan (CAP)

. Lagos-Calabar Coastal Highway and Climate Consideration

ISO standards provide the compass for a sustainable, net-zero journey, ensuring responsible infrastructure development and contributing to global climate efforts. While the highway primarily focuses on physical infrastructure, it intersects with environmental aspects. ISO 14097 principles can guide:

- Carbon Footprint Assessment: Evaluating emissions from construction, materials, and ongoing maintenance.
- Mitigation Strategies: Implementing sustainable practices and optimizing logistics.
- Offset Mechanisms: Balancing emissions through reforestation or renewable energy projects.
- Reporting and Transparency: Transparently reporting efforts toward emissions reduction.

(vii) UN Sustainable Development Goals

The Sustainable Development Goals (SDGs) (or Global Goals for Sustainable Development) are a collection of 17 global goals set by the United Nations Development Programme (Box 1.6). The formal name for the SDGs is: "Transforming our World: the 2030 Agenda for Sustainable Development," shortened to "2030 Agenda." The goals are broad and interdependent, yet each has a separate list of targets to achieve. Achieving all 169 targets would signal accomplishing all 17 goals. The SDGs cover social and economic development issues including poverty, hunger, health, education, global warming, gender equality, water, sanitation, energy, urbanization, environment and social justice.

(vii) **Equator Principles (EPs)**

The **Equator Principles (EPs)** serve as a benchmark within the financial industry for assessing and managing environmental and social risks associated with projects. Financial institutions adopt these principles to make responsible risk decisions when financing various projects. The EPs establish a minimum standard for due diligence, emphasizing both environmental and social sustainability. They have global applicability across all industry sectors and cover a wide range of financial products.

The primary purpose of the Equator Principles is to provide a common baseline and framework for financial institutions. By adhering to these principles, institutions can effectively identify, assess, and manage environmental and social risks during project financing. Large infrastructure and industrial projects often carry significant impacts on people and the environment. However, when these risks are systematically identified, evaluated, and properly managed, sustainable outcomes can be achieved. This approach leads to improved financial, environmental, and social results. The commitment ensures that projects financed or advised on by EPFIs are developed in a socially responsible manner, incorporating sound environmental management practices. The ten Equator Principles are outlined in the figure **5**

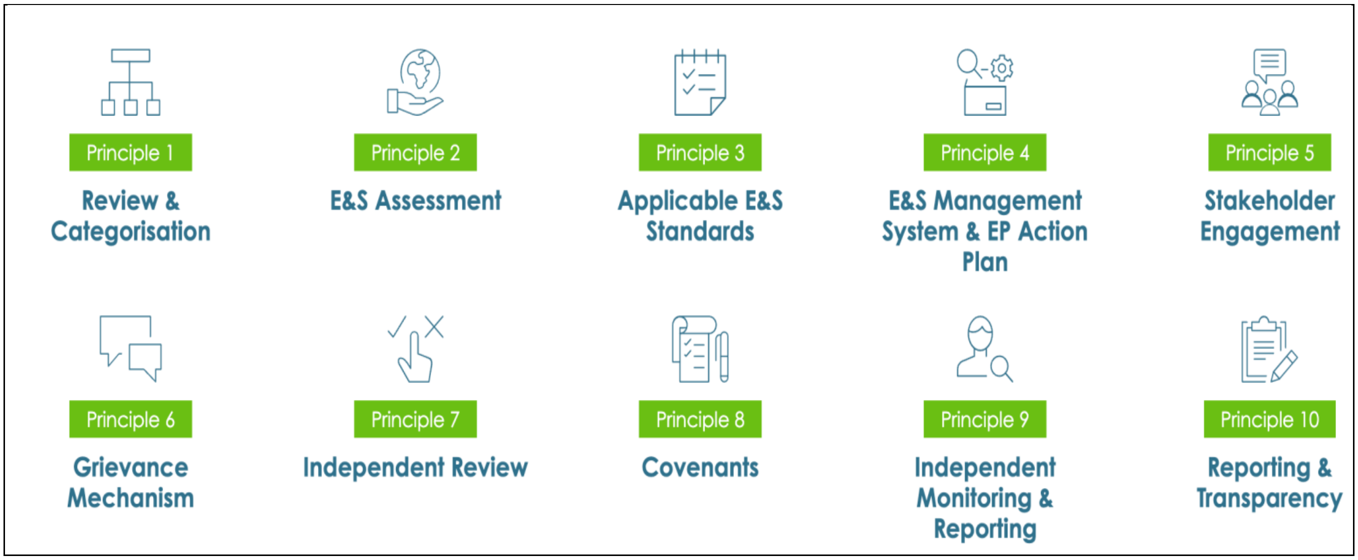


Figure 1.9: The Ten Equator Principles

1.8.9 Health and Safety International Instruments

i. World Bank Group Environment, Health, and Safety (EHS) Guidelines

The **Environmental, Health, and Safety (EHS) Guidelines** developed by the **World Bank Group** serve as technical reference documents. These guidelines provide both general and industry-specific examples of **Good International Industry Practice (GIIP)**. World Bank's EHS Guidelines.

The key features of the EHS Guidelines:

- **Purpose and Scope**:
  - The EHS Guidelines cover a wide range of sectors and industries.
  - They offer practical guidance on managing environmental, health, and safety risks.
- **Industry-Specific Examples**:
  - The guidelines include specific examples relevant to various industries.
  - These examples align with international best practices.
- **Integration with World Bank Policies**:
  - The EHS Guidelines are referenced in the **World Bank's Environmental and Social Framework**.
  - They also relate to the **International Finance Corporation's (IFC)** Performance Standards.
- **Implementation**:
  - When World Bank Group members are involved in a project, the EHS Guidelines are applied as required by their respective policies and standards.
  - They ensure that projects adhere to environmental and social best practices.

ii. International Labour Standards on Occupational Safety and Health

The **International Labour Organization (ILO)** has adopted more than 40 standards specifically dealing with OSH. ILO's page on Occupational Safety and Health. These standards provide essential tools for governments, employers, and workers to establish sound prevention, reporting, and inspection practices for safety and health at work.

Key ILO instruments related to OSH include:

- **Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)**: This Convention aims to establish coherent national policies on OSH through dialogue between government, workers' and employers' organizations.
- **Occupational Safety and Health Convention, 1981 (No. 155)**: This Convention provides for the adoption of a coherent national OSH policy and action to promote OSH and improve working conditions.
- Occupational Health Services Convention, 1985 (No. 161) **Working Environment (Air Pollution, Noise and Vibration) Convention, 1977 (No. 148)**
- **Integration with ESIA**:
  - ESIA processes consider the potential environmental and social impacts of projects.
  - OSH is a critical aspect of ESIA, especially for projects involving construction, industrial activities, or hazardous materials.
  - ESIA assesses the impact of a project on workers' health and safety, as well as the surrounding environment.
- **Role of ESIA in OSH**:
  - ESIA identifies OSH risks associated with project activities.
  - It proposes mitigation measures to prevent accidents, occupational diseases, and adverse environmental impacts.
  - Monitoring during project implementation ensures ongoing compliance with OSH standards.
- **Stakeholder Engagement**:
  - ESIA involves stakeholders, including workers, communities, and relevant authorities.
  - OSH concerns are addressed through consultations, public hearings, and feedback mechanisms.
- **Reporting and Auditing**:
  - ESIA reports include OSH-related information.
  - Audits assess OSH performance during project execution.
  - Compliance with ILO standards is a key consideration.

1.8.10 Development Partners (DP) Safeguards System

Safeguards are powerful tools that help analysts to identify risk, reduce development costs and improve sustainability for projects. Towards the march to sustainable development, safeguards are seen to play a critical role in sustainable development, especially in protecting livelihoods and the environment and ensuring inclusive and green growth.

When it comes to environmental and social outcomes, adhering to international best practices is crucial. Some of the prominent standards and guidelines set by reputable institutions:

1. **African Development Bank (AfDB)**:
   - The **African Development Bank Group** recently updated its **Integrated Safeguards System (ISS)** approved on **April 12, 2023**.
   - The updated ISS reinforces the AfDB's commitment to responsible development while addressing environmental and social risks in its projects
   - The revised ISS clarifies the bank's roles, responsibilities, and accountability to borrowers and clients.

- The ISS builds upon existing safeguard policies, including those related to environmental protection, involuntary resettlement, gender, and civil society engagement.
- it integrates environmental and social considerations into its project design, implementation, and monitoring processes.
- The AfDB promotes sustainable development, poverty reduction, and inclusive growth across Africa.
- By adhering to these standards, the AfDB ensures sustainable development while managing environmental and social risks in its projects

2. **World Bank Environmental and Social Framework (ESF)**.
   - The World Bank has developed a comprehensive framework known as the **Environmental and Social Framework (ESF)**.
   - It serves as a comprehensive guide for managing environmental and social risks associated with projects financed by the World Bank.
   - The ESF enables the World Bank and borrowers to better manage environmental and social risks, leading to improved development outcomes while ensuring sustainability and transparency.
   - This framework includes **Environmental and Social Standards (ESS)** that guide projects supported by the World Bank through Investment Project Financing (IPF).
   - **Environmental and Social Standards (ESS)** which are ten (10) standards set out requirements for borrowers (project proponents) and the World Bank.
   - ESS guide project design, implementation, and monitoring

The 10 ESS which promote responsible project management, benefiting both development outcomes and environmental/social sustainability include:

- **ESS1: Assessment and Management of Environmental and Social Risks and Impacts**:
  - Borrowers assess, manage, and monitor risks throughout project stages.
  - Aims for environmental and social outcomes consistent with the ESSs.
- **ESS2: Labor and Working Conditions**:
  - Promotes fair treatment of workers and safe working conditions.
  - Enhances development benefits by treating workers fairly.
- **ESS3: Resource Efficiency and Pollution Prevention and Management**:
  - Addresses pollution (air, water, land) and resource consumption.
  - Ensures sustainable resource management throughout the project life cycle.
- **ESS4: Community Health and Safety**:
  - Focuses on health, safety, and security risks for affected communities.
  - Special attention to vulnerable groups.
- **ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement**:
  - Aims to avoid involuntary resettlement.
  - If unavoidable, minimizes impacts and supports affected persons.
- **ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources**:
  - Protects biodiversity and core ecological functions.
  - Considers livelihoods of affected parties, including Indigenous Peoples.
- **ESS7: Indigenous Peoples**:
  - Recognizes Indigenous Peoples' rights and cultural heritage.
  - Ensures their participation and benefits.
- **ESS8: Cultural Heritage**:

  - Safeguards cultural heritage sites and artifacts.
  - Balances development with preservation.
- **ESS9: Financial Intermediaries**:
  - Applies when the World Bank provides funds to financial intermediaries (e.g., banks).
  - Ensures environmental and social risk management in their lending practices.
- **ESS10: Stakeholder Engagement and Information Disclosure**:
  - Requires meaningful consultation and information sharing.
  - Establishes accessible grievance mechanisms.

Thus, for the proposed project, an effective institutional framework must be set up to achieve the needed coordination among policymakers, planners, highway authorities, environmental agencies, consultants and specialists, and other related public and private organizations and the general public.

1.9 Declaration by Project Proponent

FMW and Hitech shall abide by all applicable international conventions, protocols, and agreements; national, state, and local government laws/regulations and guidelines governing effective environmental management and good practices in handling this proposed Project.

Specifically as the contractor, Hitech Construction Africa Limited has an established an Environmental and Social Management System (ESMS) in line with the IFC Performance Standards, the World Bank EHS guidelines and regulations, the Equator Principles IV as well as national regulations. This system details all the responsibilities of the E&S Team, monitoring, reporting, and auditing procedures to ensure compliance with the regulatory framework. As part of this ESMS, Hitech develops project specific management plans tailored to the impacts and needs of the project.

Hitech Management Plans, Protocols and Procedures as per the ESMS considered relevant to the proposed project are outlined below:

- **Blasting Management Plan:** This plan details procedures for safe and controlled blasting activities, ensuring compliance with environmental and safety regulations to minimize impacts on surrounding areas.
- **Community Health and Safety Management Plan:** This plan addresses health and safety concerns of local communities near the project site, focusing on mitigating risks from construction activities and promoting community well-being.
- **Dust Management Plan:** This plan identifies sources of dust, outlines measures to control emissions, and includes monitoring strategies to protect air quality and public health.
- **Environmental Construction Method Statement:** This statement describes environmentally friendly construction methods and practices to minimize environmental impacts during project implementation.
- **Emergency Management Plan:** This plan outlines procedures for responding to emergencies, including natural disasters and accidents, to minimize harm to people, property, and the environment.
- **Human Resources Management Plan:** This plan outlines strategies for managing human resources, including recruitment, training, and welfare, to ensure a safe and healthy work environment.

- **Management of Waste Procedure:** This procedure outlines the proper management of construction and hazardous waste, including storage, handling, transportation, and disposal, to minimize environmental impacts.
- **Occupational Health and Safety Management Plan:** This plan outlines measures to ensure the health and safety of workers, including training, protective equipment, and monitoring, in accordance with international standards.
- **COVID-19 Management Procedure:** This procedure outlines measures to prevent and control the spread of COVID-19 among workers and the community, including hygiene practices, tests and awareness campaigns.
- **Construction Environmental & Social Management Plan:** This plan integrates environmental and social considerations into construction activities, including biodiversity conservation, stakeholder engagement, and cultural heritage protection.
- **Traffic Management Plan:** This plan addresses traffic safety and congestion issues related to construction activities, including measures to minimize disruptions and ensure the safety of workers and the public.
- **Site Rehabilitation and Restoration Management Plan:** This plan outlines strategies for rehabilitating and restoring the project site after construction activities, including revegetation and erosion control measures.
- **Wastewater Management Plan:** This plan outlines procedures for managing wastewater generated during construction activities, including treatment and disposal methods to protect water quality.
- **Construction Contaminated Land Management Plan:** This plan outlines procedures for managing contaminated land during construction activities, including remediation measures to protect human health and the environment.
- **Soil and Water Management Plan:** This plan outlines measures to protect soil and water resources during construction activities, including erosion and sediment control measures.
- **Contractor and Supplier Management Protocol:** This protocol outlines procedures for selecting, contracting, and managing contractors and suppliers to ensure compliance with environmental, social, and health and safety requirements.
- **Stakeholder Engagement Plan:** This plan outlines strategies for engaging with stakeholders, including local communities, to address their concerns and ensure their participation in decision-making processes.
- **Community Health and Safety Management Plan:** This plan addresses the health and safety of local communities near the project site, including measures to mitigate risks from construction activities and ensure community well-being.
- **Occupational Health and Safety Management Plan:** This plan outlines measures to ensure the health and safety of workers, including training, protective equipment, and monitoring, in accordance with international standards.
- **Chance Find Procedure:** This procedure outlines steps to follow in case of unexpected archaeological or cultural discoveries during construction activities, including notifying relevant authorities and taking protective measures.
- **Livelihood Restoration Plan:** This plan outlines measures to restore or improve the livelihoods of affected communities, including training, alternative income opportunities, and support for vulnerable groups.
- **Workers Grievance Mechanism:** This mechanism provides a channel for workers to raise grievances related to their working conditions, including health, safety, and welfare, and ensures their concerns are addressed promptly and fairly.

Hitech Policies:

- **Environmental Policy:** This policy outlines the organization's commitment to environmental protection and sustainable practices, including compliance with applicable laws and regulations.
- **Social Policy:** This policy outlines the organization's commitment to social responsibility, including respect for human rights, community engagement, and stakeholder consultation.
- **Health and Safety Policy:** This policy outlines the organization's commitment to providing a safe and healthy work environment, including compliance with health and safety regulations and the promotion of a safety culture.
- **Gender-Based Violence (GBV) and Sexual Harassment Policy:** This policy outlines the organization's commitment to preventing and addressing gender-based violence and sexual harassment in the workplace, including reporting mechanisms and support services for victims.
- **Smoke-Free Policy:** This policy prohibits smoking in project areas to protect workers and the environment from the harmful effects of tobacco smoke.
- **Drugs and Alcohol Policy:** This policy prohibits the use of drugs and alcohol in project areas to ensure the health and safety of workers and prevent accidents and incidents related to substance abuse.

Hitech will elaborate project specific policies, protocols and procedures from the ESIA findings to be used during the entire project duration and in line with the regulatory framework described in this chapter.

1.10 Structure of the Report

The ESIA is structured to conform with the EIA Report Writing Format as presented in the Procedural Guidelines Annex C as presented below.

- Preliminary Pages (Cover Page, Title Page, Table of Contents, List Tables, List of Figures, List of Maps, List of Plates, List of Acronyms and Abbreviations, List of ESIA Preparers, Declaration, Acknowledgement and Executive Summary)
- Chapter 1 - Introduction
- Chapter 2 - Project Justification
- Chapter 3 - Project and Process Description
- Chapter 4 - Description of the Environment
- Chapter 5 - Associated and Potential Impacts
- Chapter 6 - Mitigation Measures
- Chapter 7 - Environmental and Social Management Plan
- Chapter 8 - Decommissioning and Restoration Plan
- Chapter 9 - Recommendations and Conclusions
- References
- Appendices

CHAPTER TWO
PROJECT JUSTIFICATION AND ALTERNATIVES

2.1 Introduction

The coastal areas of Nigeria and indeed Lagos need more attention to realize their full economic, social, and environmental potential. The proposed Lagos-Calabar Coastal Highway project reflects Nigeria's vision for progress, self-reliance, and prosperity. This chapter justifies the project and explains why the proposed route was chosen over alternatives, focusing on Section 1 of the Lagos-Calabar Highway.

2.2 Nigeria Transportation Infrastructure development

1. Contribution of the transport sector to real GDP

Recent data on Nigeria's transport sector and its contribution to the country's GDP show the situation of the transport sector in Nigeria as revealed in Box 2.1. The ***Overall Sector Growth shows that*** the transportation sector increased by 51.66 percent in real terms during the second quarter of 2022. Quarter-on-quarter growth was 66.19 per cent. The sector's contribution to real GDP in Q2 2022 totalled 1.84 percent, an improvement from the preceding year's 1.26 percent and higher than the first quarter of 2022 was 1.10 per cent.

However, it's essential to note that this growth rate represents a decline from the exceptional 92.38 percent growth rate observed in Q2 2021 and an improvement from the negative growth (-24.63 percent) in Q1 20221. Despite the challenges faced by Nigeria's transport sector, the road transport subsector's robust growth underscores its critical role in the country's economic development.

- ***Transport Sector Contribution to Nominal GDP:***
    - In the second quarter of 2022, transport activities contributed 2.79 percent to nominal GDP. This was greater than the 1.60 percent contribution in the first quarter of 2022 and higher than the 2.09 per cent reported in 20211.
    - The road transport sector emerged as the best-performing sub-sector during this period, experiencing remarkable growth with a 56.38 percent increase.
    - ***Other transport modes had varying performance:***
        - ***Air Transport*:** Recorded 22.45 percent growth in Q2 2022.
        - ***Rail Sector:*** Suffered a 37.90 percent decline during the same quarter.
        - ***Water Transport*:** Experienced a decrease of 3.02 percent in Q2 2022.

Box 2.1: Transportation Sector Performance in Nigeria

2. Key elements of the transportation infrastructure

Table 2.1 depicts the key elements of Nigeria's transportation infrastructure, and **Figure 4.93** shows the networks. The Lagos-Kano transport corridor, the main channel for domestic, regional, and international trade in Nigeria, is also the central axis of cattle and leather trade. It spans approximately 990km and links the country's two most populous cities (Kano and Lagos), passing through Kaduna, Ilorin, and Ibadan. In comparison to the African region, Table 4.47 shows Nigeria's transport infrastructure's position

Table 2.1: key elements of Nigeria's transportation infrastructure

Modes	Infrastructure	Mode of Transportation	Services
Air	Airport infrastructure Aerodromes Air Navigation Infrastructure	Airplanes Helicopters	Airline and air freight services Airport services Training
Land (Road)	Roads Bridges Terminals	Motorized Vehicles Non-motorized vehicles	Passenger services Road Haulage Informal services Training
Land (Rail)	Railways Rail Stations Signaling Infrastructure	Trains	Passenger services Freight services (Urban) Mass Rapid Transit Training
Land (Pipelines)	Pipelines	Line Pipes	Pipeline services
Water	Waterways (Inland and Sea) Port Infrastructure Navigation Infrastructure	Ferries Ocean-going vessels	Stevedoring services Shipping/Barge services Training

Source: Federal Ministry of Transportation.

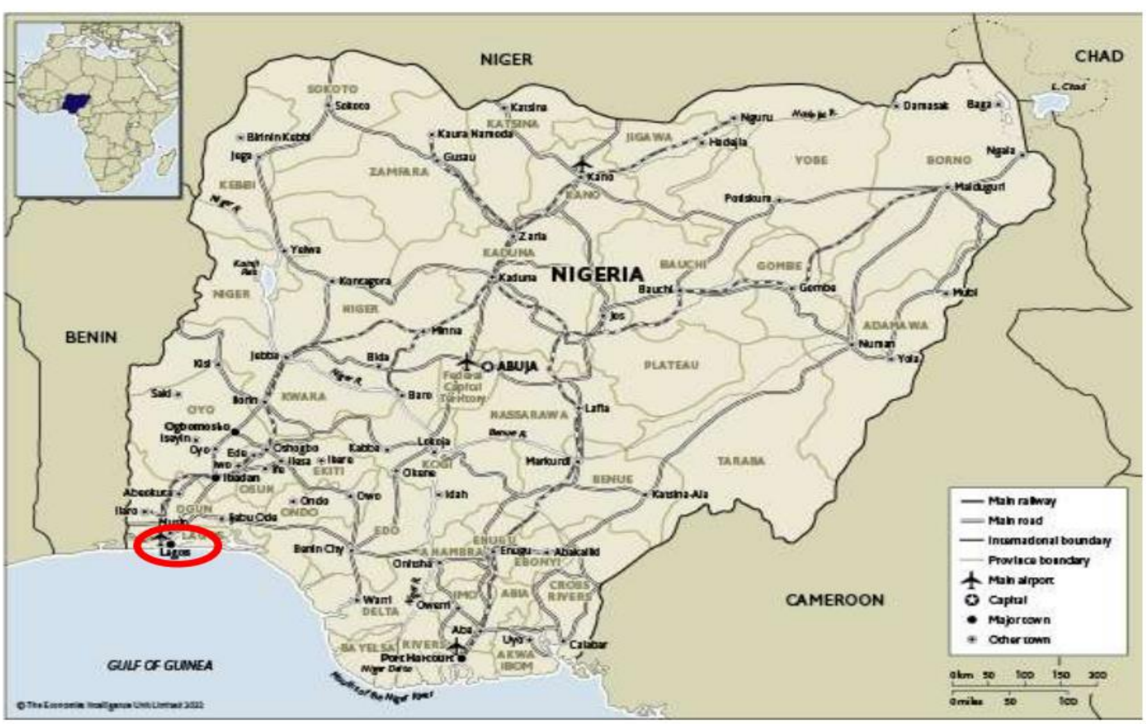


Figure 2.1: Transport Arteries in Nigeria

Table 2.2: Nigeria's Transport Infrastructure in Africa's

	Nigeria			Africa		
	total	per 1 mio inhabitants	per km²	total	per 1 mio inhabitants	per km²
Roadways	195,000 km	892.28 km	211.09 m	2,997,800 km	2,101.59 km	98.01 m
Railroads	3,800 km	17.38 km	4.11 m	88,600 km	62.10 km	2.90 m
Waterways	8,600 km	39.35 km	9.31 m	68,400 km	47.95 km	2.24 m
Commercial harbors	791	3.62	0.001	7,949	5.57	0.000
Airports	22	0.10	0.024	414	0.29	0.000

worldData.info

3. **Classification of Road Infrastructure in Nigeria:**

- **Trunk A Roads:**

These roads transcend regional boundaries and are of national significance.
They are financed, constructed, and maintained by the Federal Government of Nigeria.
Trunk A roads connect different states and facilitate inter-state transportation.

- **Trunk B Highways:**

Trunk B highways primarily connect major cities within a state.
They fall under the supervision and ownership of the respective state governments.
These highways serve as vital links for intra-state travel and commerce.

- **Trunk C Roads:**

Trunk C roads operate at the local level and are within the purview of local governments.
They connect communities, neighbourhoods, and rural areas.
Local governments are responsible for their maintenance and development.

4. **Construction Materials:**

Most roads in Nigeria are constructed using either concrete (cement) or asphalt (bitumen).
Concrete roads offer durability and strength, while asphalt roads provide flexibility and smoother surfaces.

5. **Road Transportation**:

Nigeria's roads and highways serve as the lifelines of the country's transport system. Nigeria's road infrastructure is a multi-tiered system that spans national, state, and local levels. Each category plays a distinct role in ensuring efficient transportation and connectivity across the country. According to the national integrated infrastructure master plan, they handle a staggering 90% of passenger and freight traffic. With a total road length of approximately 195,000 kilometres, Nigeria's road network is crucial in connecting communities and driving economic activities.

Despite its extensive road network, Nigeria faces spatial inefficiencies. The country's land mass of 923,768 square kilometres and population density (around 237 inhabitants per km²) must be considered. Nigeria ranks 210th globally in terms of road length per inhabitant, with an average of 0.89 meters of road per person.

Nigeria's road infrastructure falls short of expectations. Approximately 63% of the roads are untarred, and many are in disrepair. Commuters describe them as death traps, deplorable, or dilapidated.

Nigeria's road infrastructure faces challenges, but strategic investments, effective management, and community involvement can pave the way for a better-connected and more prosperous nation. Stakeholders emphasize the urgent need for action:

- Massive Investment: The government should attract private investment to expand and upgrade the road network.
- Effective Management: Efficient management practices are essential to maintain and improve existing roads.
- Local Inputs: Involving local communities and stakeholders can lead to better road planning and execution.
- Rural Connectivity: Linking rural areas is crucial for overall development and accessibility.

In recognition of these, the current Nigerian government has been actively investing in road infrastructure across the country. Some notable road projects include:

1. **Over 800 Roads and Bridges**: The Federal Government is currently executing **over 800 contracts** for roads and bridges, covering more than **13,000 kilometers** of the **35,000-plus kilometers** of federal highways and bridges nationwide. These projects aim to enhance connectivity, boost economic growth, and create employment opportunities.
2. **2024 Budget Allocation**: In the **2024 budget**, the government has earmarked **N837 billion** for the construction of **2,254 roads and bridges** across Nigeria. Notable projects include the rehabilitation of the **Kabba-Ayere-Isua-Ipele road** in Kogi and Ondo states and the construction of the **Ikot Ekpene border Aba-Owerri dual road**.

The Lagos state government, who over the years have embarked on a number of road and rail projects, has further added the 4th Mainland Bridge (4MB) project. This is a significant infrastructure endeavour aimed at enhancing connectivity and promoting economic growth. The 4MB will cover a distance of approximately 37 kilometers. It will be constructed under a Design, Build, Finance, Operate, Maintain, and Transfer (DBFOMT) concession. The project is part of Lagos State's Public-Private Partnership (PPP) program, emphasizing collaboration between the government and private investors. The 4th Mainland Bridge represents a crucial step toward improving infrastructure, fostering economic development, and ensuring efficient transportation in Lagos State.

With regard to Nigeria's Railway System, in recent time there have been significant progress in railway system, including the Abuja-Kaduna Railway (Africa's first modernized railway based on Chinese technical standards) and ongoing projects like the Kano-Maradi and Kano-Kaduna standard-gauge railway lines. In fact, the railway sector has attracted more significant attention and investment as represented by the following:

- Lagos-Calabar Railway (West-East Coastal Rail Line): The Lagos-Calabar Railway is a major rail infrastructure project under development in Nigeria. It aims to link Lagos (the largest and capital city in the southwest) to Calabar (a port city in the southeast near the border with Cameroon). The railway line will pass through several states, including Lagos, Ogun, Oyo, Osun, Ondo, Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross River. The project involves: Construction of 1,402 kilometers of railway line. Establishment of 22 railway stations, along with ancillary facilities, administrative spaces, and level crossings. Installation of safety systems, electrical systems, lighting systems, and signaling systems. Laying of tracks and electricity lines.

- Lagos Light Rail (Lagos Rail Mass Transit): The Lagos Light Rail is a 35-kilometer urban rail system currently under construction in Lagos. Once completed, it will enhance intra-city transportation within Lagos.

These projects reflect Nigeria's commitment to improving transportation infrastructure and fostering economic growth. These infrastructure developments play a crucial role in Nigeria's economic growth, job creation, and sustainable future.

2.3 The Need for Proposed Project

The Lagos-Calabar Coastal Highway Project is a significant initiative spanning approximately 650-700 kilometers along the southern coastline. The coastal highway aims to address these issues and improve connectivity. The Lagos-Calabar Coastal Highway represents a significant step toward improving transportation infrastructure in Nigeria and specifically, fostering economic development along Nigeria's southern coast. This ambitious project aims to connect Lagos (in the southwest) to Calabar (in the southeast) along the southern coast of Nigeria.

Figure 2.2: Entire Length of the Proposed Coastal Highway

The Lagos-Calabar Coastal Highway represents a pivotal step toward improving transportation infrastructure and fostering economic development along Nigeria's southern coast. It's exciting to see such transformative projects shaping the nation's future. This ambitious infrastructure initiative holds immense significance for Nigeria's economic growth and regional connectivity such as the following:

1. Economic Boost for Lagos State:
   - The highway's Section 1, spanning from Eko Hotel (0 km) to Ibeju Lekki (47.5 km), has the potential to transform Lagos State's economy.
   - By connecting to the Lekki Deep Seaport, the project will facilitate efficient movement of goods, enhancing trade and industrial activities in the Lekki economic corridor.
2. Alignment with Lagos State Master Plans:
   - The Lagos-Calabar Coastal Highway's alignment with Lagos State Master Plans underscores its strategic importance.
   - Sustainable urban development, improved transportation infrastructure, and economic growth are central themes in these plans.
3. Reduced Travel Time:
   - The coastal road will significantly shorten the distance between Lagos and Ondo state.
   - For example, the route from Ibeju-Lekki to Araromi in Ondo state will be approximately 50 kilometers along the coast, resulting in faster travel times.
4. Enhanced Regional Connectivity:
   - By linking coastal states such as Ogun, Ondo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross River, the highway will promote the seamless movement of goods, people, and services across Nigeria's southern region.

2.4 Strategic Goals and Objectives of the Project

Strategically, by linking multiple states, the highway aims to enhance economic integration and trade. It will facilitate access to tourist destinations, industrial zones, and economic hubs. The highway stands to alleviate traffic congestion in Lagos and surrounding areas. It contributes to better connectivity between states in Southern Nigeria.

The main objectives of the proposed project are to:

- Increase travel efficiency and productivity.
- Improve the quality of the environment.
- Improve the quality of life and social standards.
- Increase and spread economic activity throughout the corridor and states connected.
- Remove poor safety and security records on the road that affect travelers journeying in the coastal areas.
- Remove undue stress for travelers.
- Afford comfortable ride for those who take the routes.
- Reduce carbon footprint and increase general environmental aesthetics due to adequate maintenance of the road and provision of greenery on the corridor which could readily absolve carbon.

2.5 Benefits of the Project

The Lagos-Calabar Coastal Highway holds immense potential for national integration, economic growth, and improved security. It is a pathway to national integration, economic prosperity, and improved livelihoods.

The construction of the coastal highway connecting Lagos and Calabar will engender a genuine feeling of national integration in the people of the country in general and South-West, South-East and South-South and Niger Delta Coastal Area in particular and enhance the wider security of the region. The New Highway will strengthen the economic opportunities among the coastline on all ports existing and planned.

The New Highway will:

- Establish connections between key ports (existing and planned), fostering trade and economic activity in the region. This connectivity has the potential to draw in additional shipping traffic, foreign investments, and trade collaborations, ultimately resulting in heightened revenue of the coastal communities, job opportunities, and overall economic advancement.
- Connect communities together and strengthen the relationship between economic centers, export processing zones, tourism destinations, and markets, across both central and northern Nigeria.
- Concentrate regional traffic onto a few routes that can also justify viable rail transport.
- Enhance the prospects of natural resource exploitation in the Niger Delta - oil and gas, salt, sand, timber, etc.
- Operate as an infrastructure corridor for gas pipeline, power transmission lines, etc.

Some additional specific benefits and opportunities it brings are listed in Table 2.3

Table 2.3: Specific Benefits and Opportunities

S/No	Benefits	Opportunities
1	Enhanced National Integration:	• The Highway physically connects regions across Nigeria, fostering a sense of unity and shared development. • It strengthens ties between the South-West, South-East, South-South, and Niger Delta coastal areas.
2	Economic Opportunities and Trade:	• Port Connectivity: The Highway establishes connections between key ports (existing and planned). • This connectivity can attract additional shipping traffic, foreign investments, and trade collaborations. • Resulting economic growth leads to heightened revenue and job opportunities. • Upon completion, the highway is expected to significantly improve Nigeria's Logistics Performance Index (LPI) for trade and transport infrastructure. It could contribute at least 0.5 to 1.0 points to the LPI.
3	Community Connectivity and Relationships:	• The Highway links communities, economic centers, export processing zones, and tourism destinations. • It strengthens relationships across central and northern Nigeria.

Table 2.3: Specific Benefits and Opportunities

S/No	Benefits	Opportunities
4	Infrastructure Corridor:	• Beyond transportation, the Highway operates as an infrastructure corridor. • It facilitates the transmission of gas pipelines, power lines, and other utilities.
5	Improved Travel Efficiency:	• Shorter routes link via Lagos to the coastal areas of Ogun, Ondo, Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross River States. • Faster and uninterruptable highway access and decreased journey delays leading to driver and passenger time savings. • Better pavement maintenance reduces vehicle operating costs. • Enhanced safety standards decrease accident costs.
6	Enhanced Connectivity:	• The Highway establishes new links between Eko Atlantic and the Lekki trade zone, as well as other economic zones along the coastal highway. • It passes through five planned city centers along the Atlantic Ocean waterfront, including touristic resorts and support facilities.
7	Unlocking Development Potential:	• Development sites south of the Lekki Peninsula can now be fully utilized. • These areas hold promise for both commercial and residential ventures.
8	Scenic Views and Beach Proximity:	• Residential developments near the beaches can offer attractive tour views overlooking the Atlantic Ocean. • The combination of coastal beauty and accessibility enhances the prospects for real estate.
9	Relieving Congestion:	• The Highway serves as a relief valve for the congested Lekki Expressway. • Improved traffic flow benefits commuters and businesses alike.
10	Multi-Modal Transit Artery:	• The Highway provides a high-quality multi-modal transit artery. • It accommodates public transport and ensures attractive spaces for walking and cycling.

Table 2.3: Specific Benefits and Opportunities

S/No	Benefits	Opportunities
11	Infrastructure Corridor:	• Beyond transportation, the highway functions as an essential infrastructure corridor. • It can facilitate the transmission of gas pipelines, power lines, water pipes, and fiber optics.
	Integration with Existing Routes:	• The Lagos-Calabar Coastal Highway will integrate significant routes such as the Badagry Expressway, the Fourth Mainland Bridge, and the Lekki Deep Seaport Road. • This integration will facilitate seamless movement across various regions in North Nigeria. •
	Rail Lines and Transportation Flexibility:	• The project envisions incorporating rail lines within the median strips of main roads, enhancing transportation flexibility

2.6 The Coastal Highway and Theory of Change

The Lagos-Calabar Coastal Highway holds immense potential for economic growth, regional integration, and improved accessibility. By following a well-structured Theory of Change, it is possible to maximize its positive impact on communities and businesses along the southern coast. A **Theory of Change** (ToC) outlines how the activities within an intervention contribute to a chain of results, ultimately leading to intended or observed impacts. In the context of the Lagos-Calabar Coastal Highway project, the ToC reflect its unique features and objectives as depicted in Figure 2.3 with strategic planning (inputs and activities) and the effects (outputs, outcomes and impacts)

Strategic Planning **Effects**

Inputs:

Funding: Financial resources allocated for construction, maintenance, and operation.

Land Acquisition: Land along the coastal route for road construction.

Skilled Labor: Engineers, construction workers, and project managers.

Materials: Cement, steel, etc., required for building the highway.

Activities:

Design and Planning: Detailed engineering plans, environmental impact assessments, and alignment studies.

Construction: Building the highway, including earthworks, bridges, tunnels, and drainage systems.

Maintenance: Regular upkeep, repairs, and safety measures.

Outputs:

Physical Infrastructure: Completed highway with multiple lanes, bridges, and train tracks.

Improved Connectivity: Enhanced transportation links between coastal states.

Reduced Travel Time: Shorter distances between cities along the route.

Outcomes:

Economic Growth: Increased trade, investment, and industrial development due to improved connectivity.

Job Creation: Employment opportunities during construction and maintenance.

Environmental Impact: Reduced congestion and pollution as traffic flows more efficiently.

Impacts:

Regional Development: Boosted economic activity, tourism, and urbanization.

Social Well-Being: Better access to healthcare, education, and services.

National Progress: A landmark infrastructure project contributing to Nigeria's growth and global recognition.

Figure 2.3:The Project's Theory of Change

As part of maximizing the positive impact on communities and businesses the trajectory of the green economy has also been taken into consideration (Box 2.2)

The Lagos-Calabar Coastal Highway Project represents a transformative opportunity for Nigeria, combining economic development with environmental considerations. It's a step toward a more connected, prosperous, and sustainable future. While the project primarily focuses on transportation, its positive impact on the environment can contribute to a greener economy:

- Reduced Emissions: Efficient transportation reduces carbon emissions, benefiting air quality and overall sustainability.
- Promotion of Sustainable Practices: The project can incorporate eco-friendly materials and energy-efficient designs.
- Enhanced Livelihoods: Job creation and economic growth can lead to better living standards and increased environmental awareness.

Natural Capital:

- The coastal road traverses diverse ecosystems, including mangroves, wetlands, and forests. Proper planning and management can enhance natural capital by preserving biodiversity, carbon sequestration, and ecosystem services.

Blue Economy:

- The road connects coastal communities, fishing ports, and maritime activities. It can stimulate the blue economy by improving transportation for fisheries, aquaculture, and marine tourism.

Net Zero:

- While not directly tied to the road, achieving net-zero emissions requires sustainable infrastructure. The road's design, materials, and energy sources impact its carbon footprint.

Green Economy:

- The road's construction and maintenance can align with green economy principles, promoting sustainable practices, job creation, and resource efficiency.

Circular Economy:

- Circular design for road materials, waste management, and recycling can minimize environmental impact.

Climate Change:

- The road's resilience to climate-related events (e.g., sea-level rise, storms) is crucial. Mitigation efforts should consider adaptation strategies.

Sustainable Development Goals (SDGs):

- The road intersects with various SDGs, including Goal 9 (Infrastructure), Goal 11 (Sustainable Cities), and Goal 13 (Climate Action).

Box 2.2: Green Economy Considerations for the Project

2.7 Coastal Road Alignment with National Strategies

Lagos-Calabar Coastal Highway represents a significant milestone in Nigeria's infrastructure development.

The National Economic Recovery and Growth Plan (ERGP) prioritizes infrastructure development as a catalyst for economic diversification. The highway project aligns with ERGP's goals by improving transportation links and fostering economic activities.

2.8 Lagos State's Development journey and the Coastal Road

Lagos State's development journey involves a mix of visionary plans, targeted policies, and a commitment to resilience. As the city continues to evolve, balancing growth with sustainability remains a critical challenge. **Box 2.3 shows the development priorities and policies shaping Lagos State.**

Some related milestone project in the State is outlined below: **a. Lagos State has adopted masterplans and Model City Plans**
The Lagos-Calabar Coastal Highway aligns with the broader vision outlined in the Lagos Master Plan. The plan emphasizes sustainable urban development, transportation infrastructure, and economic growth. The highway's construction is a step toward realizing this vision.

Its alignment with some Master Plans underscores its importance in shaping the State's future. The Lagos-Calabar Coastal Highway aligns with the broader vision outlined in the Lagos Master Plan. The plan emphasizes sustainable urban development, transportation infrastructure, and economic growth. The highway's construction is a step toward realizing this vision.

Lagos State has adopted masterplans and Model City Plans that cover the entire state. These plans provide guidance on growth and development.
Specifically, for the Lekki sub-region, the Lekki Comprehensive Masterplan serves as the spatial planning framework. It outlines the road infrastructure to be developed from 2013 to 2032. The Lekki Peninsula holds great potential for sustainable urban development, and strategic planning ensures that infrastructure aligns with long-term goals. The Proposed Coastal Road is already integrated into the Strategic Masterplan, indicating its importance in the overall development vision (Figure 2.4).

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1. **Lagos State Development Plan (LSDP):**
- The LSDP outlines the vision and mission for Lagos, spanning from 2012 to 2052. It builds upon the THEMES agenda, which focuses on six key areas: Traffic Management and Transport, Health and Environment, Education and Technology, Making Lagos a 21st-century economy, Entertainment and Tourism, and Security and Governance.
- The LSDP aims to eradicate poverty, promote economic growth, and drive infrastructural renewal and development. It envisions Lagos as Africa's model megacity and a global economic and financial hub that is safe, secure, functional, and productive.

2. **Lagos Resilience Strategy (2020):**
- The Resilience Strategy takes an integrated approach to address shocks and stresses experienced by the city. It focuses on building resilience across various sectors, including infrastructure, governance, and social services.
- By enhancing resilience, Lagos can better withstand challenges such as rapid urbanization, climate change, and socioeconomic disparities.

3. **Climate Action Plan:**
- Lagos committed to the C40 Cities Climate Leadership Group's Deadline 2020. This plan emphasizes climate action, sustainability, and reducing the city's carbon footprint.
- Initiatives include promoting renewable energy, improving waste management, and enhancing green spaces. These efforts align with global climate goals.

4. **Sector-Specific Policies:**
- While visionary and strategic policies like the LSDP and Resilience Strategy provide overarching direction, Lagos also has sector-specific policies.
- Examples include the Integrated Resource Plan (focused on electricity) and the Strategic Transportation Master Plan. These policies address specific challenges within their domains.

5. **Spatial Integration and Investment Coordination:**
- To achieve sustainable development, Lagos must spatially integrate and coordinate investment actions. This involves aligning infrastructure development, land use planning, and economic growth.
- By strategically linking investments, Lagos can create a more efficient, interconnected urban fabric that benefits residents and businesses alike.

Box 2.3: Development Priorities and Policies Shaping Lagos State

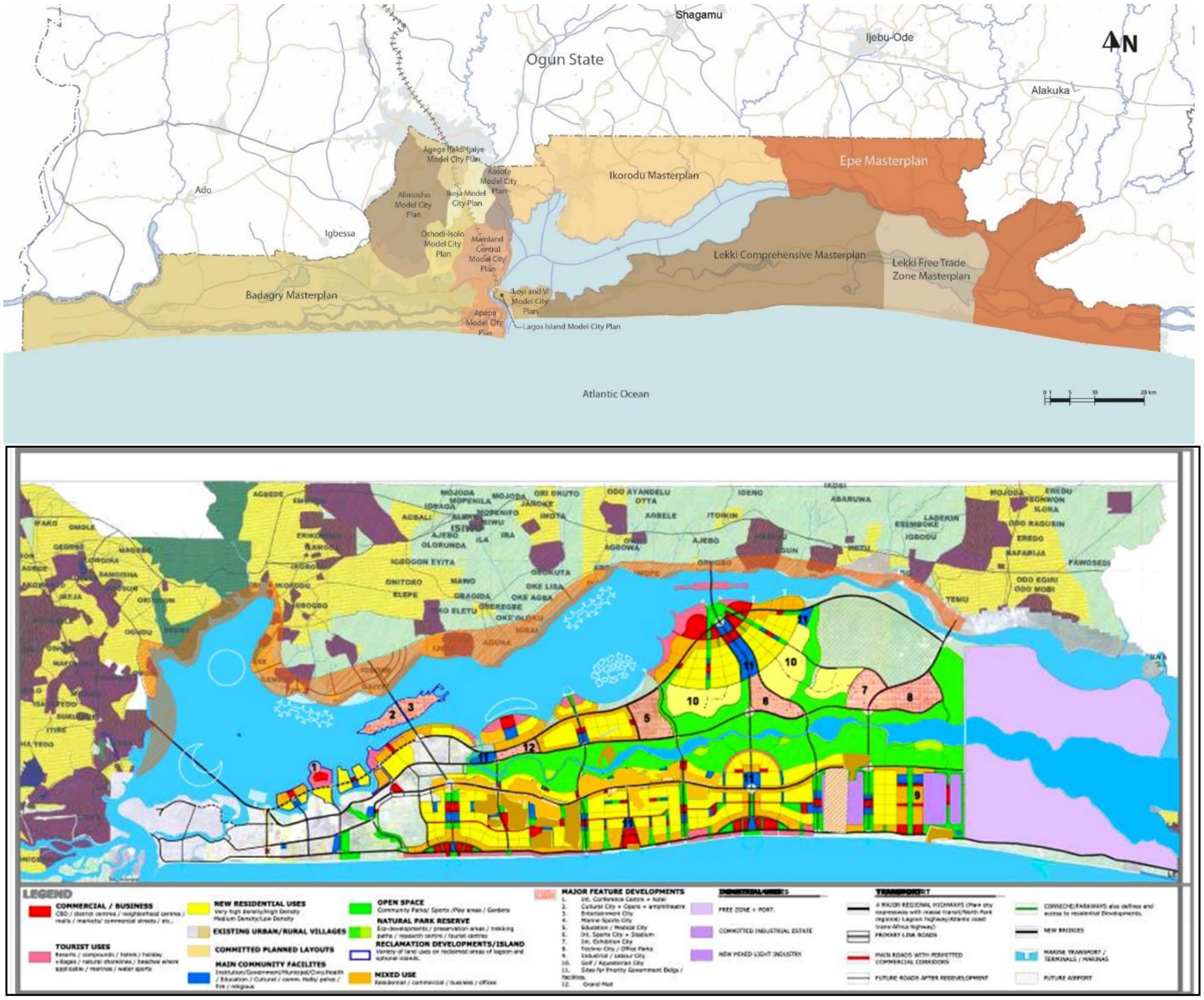


Figure 2.4: Lekki Masterplan and Proposed Coastal Road in Lagos

b. Eko Atlantic Masterplan and Lagos Coastal Road

The Lagos Coastal Road plays a pivotal role in unlocking Eko Atlantic's potential. It connects this dynamic district to the rest of Lagos, fostering economic prosperity and creating a thriving urban environment.

Eko Atlantic is a visionary development project located in Lagos, Nigeria. It is a new district constructed on land reclaimed from the Atlantic Ocean by DEME Group[1]. The project aims to create a vibrant ecosystem within Lagos—a city within a city—where dreams come to life. As Lagos's population approaches 30 million by 2030, the demand for space is escalating, and Eko Atlantic provides a solution.

The coastal road integrates with Eko Atlantic's master plan. It provides access to residential areas, commercial zones, and recreational spaces. As the city develops, the road network ensures efficient transportation for residents, workers, and visitors.

The **Lagos Coastal Road** is a critical infrastructure project that connects various parts of Lagos along the coastline. Eko Atlantic leverages the coastal road through the following:

- **Accessibility and Connectivity**:

Eko Atlantic is strategically positioned along Lagos' Bar Beach. The coastal road ensures seamless connectivity between Eko Atlantic and other parts of the city.
Residents, commuters, and businesses benefit from improved access, reducing travel time and enhancing mobility.

- **Economic Impact**:

Eko Atlantic serves as a hub for trade, commerce, and business. The coastal road facilitates the movement of goods, services, and people.
It connects Eko Atlantic to the broader Lagos economy, contributing to job creation and economic growth.

- **Environmental Considerations**:

The Eko Atlantic Shoreline Protection and Reclamation Project reclaimed approximately 1000 hectares of land within Lagos. It addresses shoreline erosion problems at Victoria Island. The coastal road aligns with sustainable development principles, balancing urban growth with environmental conservation.

Figure 2.5: Eko Atlantic Development and the Coastal Road

c. 4th Mainland Bridge Project

The Fourth Mainland Bridge is an ambitious infrastructure project initiated by the Lagos State Government in Nigeria. The Fourth Mainland Bridge aims to connect Lagos Island to other parts of the state, including Langbasa (Lekki) and Baiyeku (Ikorodu), spanning the Lagos Lagoon to Itamaga in Ikorodu.

It is designed as a 38 km long bridge with a 2 × 4 lane carriageway cross-sectional road. The project includes provisions for a Bus Rapid Transit (BRT) Lane and future road expansion.

Once completed, the Fourth Mainland Bridge will become the second longest bridge in Africa.

Notable features include three toll plazas, nine interchanges, a 4.5 km Lagoon Bridge, and an eco-friendly environment. The project aims to enhance transportation infrastructure, ease traffic congestion, and improve connectivity between Lagos mainland and the island.

In December 2022, the Messrs CCECC - CRCCIG Consortium was announced as the preferred bidder for the bridge construction. The Lagos State Government expects the project to be completed within four years from the announcement date.

The Fourth Mainland Bridge holds great promise for Lagos State, offering improved connectivity, reduced traffic congestion, and enhanced economic opportunities. The intersection with the Coastal Road will further make this a significant milestone in Nigeria’s infrastructure landscape.

2.9 Positive Impacts on Existing Situation

2.9.1 Positive Impacts on Local Communities

The project's positive impacts extend to local communities within its area of influence, contributing to their well-being and development through:

1. Offering job opportunities to locals, including women and youths, with a strategy aligned with community representatives and women's associations.
2. Enhancing locals' skills through training and capacity-building programs, empowering them for future opportunities.
3. Conducting toolbox talks and technical trainings to enhance local technical capacities and develop workers' expertise.
4. Prioritizing health and safety measures, conducting awareness campaigns, and providing training for workers and communities.
5. Actively engaging with local communities to foster a sense of ownership and collaboration for long-term sustainability.
6. Create and enhance Communities accessibility by good road.

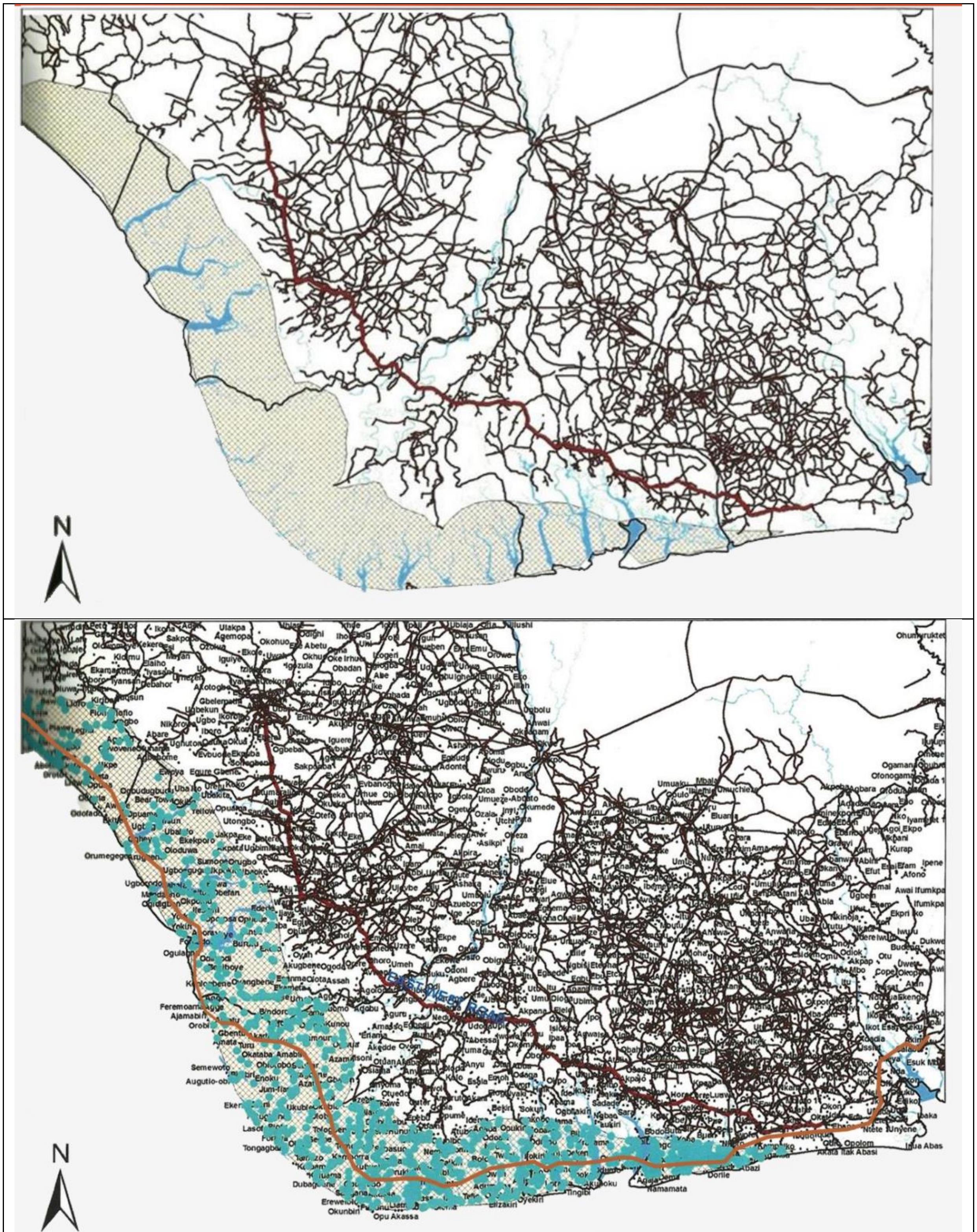


Figure 2.6: Communities Inaccessible by Road and the Proposed Project

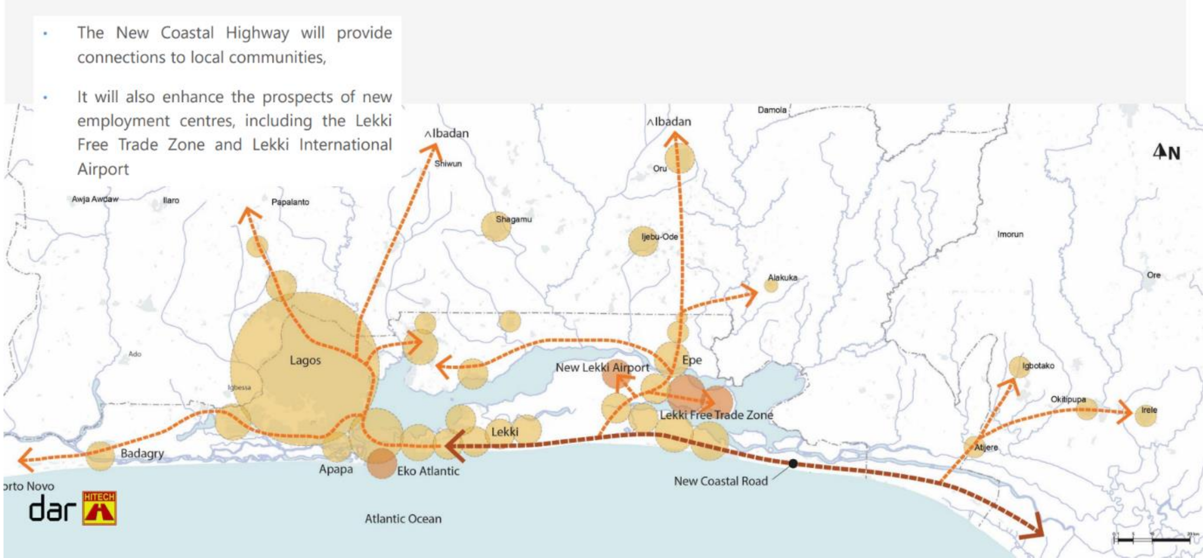


Figure 2.7: Local Opportunities

2.9.2 Positive Impact on Coastal Erosion and Shoreline Change

The coastal region around Lagos, Nigeria, has experienced significant changes over the years due to natural processes and human development. Let's delve into the details:

A study[1] assessed the evolution of the Lagos coast over a 20-year period (2001 to 2020). Researchers relied on archived Google Earth imagery to estimate and visualize the magnitude of erosion and accretion along the Lagos coastline. The study used the Analyzing Moving Boundaries Using R (AMBUR) software package, an R programming language add-in. The key findings included:

- Cumulative mean rate of shoreline change: +0.93 meters/year (indicating overall accretion).
- Mean erosion rate: -1.94 meters/year.
- Mean accretion rate: +4.84 meters/year.
- Victoria Island, a prominent area, experienced the highest shoreline change rate (+6.24 meters/year) due to land reclamation activities.
- However, eastward of Victoria Island, there was unabated erosional activity, resulting in disappearing beaches and urban structures.

The impact has been coastal erosion affecting various communities along the shoreline.

The coastline is experiencing annual retreats of 1-2 meters due to coastal erosion[3]. This erosion poses risks to infrastructure, including buildings, railroads, bridges, and roads, and threatens populations living close to the coastline (Table 2.2). Managing coastal erosion in Lagos requires a holistic approach that balances development with environmental preservation. The proposed project would support in ensuring careful planning to address both accretion and erosion challenges.

1. Lagos Coast Erosion Section of Coastline in Marwa, Lekki, Faces Threat **https://www.youtube.com/watch?v=CVpIQwKJdS4** **https://youtu.be/CVpIQwKJdS4** **Channels Television**
2. Lagos Coastal Erosion **https://www.youtube.com/watch?v=62uHzyoSz84** **https://www.youtube.com/watch?v=lGDfPAgM4K8** **Channels Television**
3. WASHED AWAY: THE LAGOS EROSION CRISIS **https://www.youtube.com/watch?v=lGDfPAgM4K8** **Arise News**
4. Erosion in Lagos chases communities away: More than 180 kilometers submerged in a decade. **https://www.youtube.com/watch?v=zDKLYep8A98** **Al Jazeera English**
Box 2.3: Coastal Erosion Along Lagos shoreline and Media Concerns

2.10 Value of the Project

Economic analysts predict that completing the first phase could increase Lagos State's economy by **50%**, thanks to connections with the Lekki Deep Seaport and the Lekki economic corridor, where the Dangote Refinery and Petrochemical Complex are located[1].In terms of monetary cost, the proposed project is estimated at N1,067,887,381,148.61 (VAT inclusive. The project is estimated at N4.33bn per kilometre using reinforced concrete technology for a carriage width of 59.7 metres, to include 10 lanes, shoulders and rail with additional designs of service ducts, streetlights, drainages and shore protection. The 10-lane coastal road is designed to connect Lagos to Cross River, passing through Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom states before culminating in Calabar, the Cross River State capital.

The estimated costs and benefits for Section 1 of the Lagos-Calabar Coastal Road:
Section 1 spans approximately 47.47 kilometers, so the total estimated cost for this phase would be around N189.88 billion. The Potential Benefits:

- Improved Connectivity: The road will link major urban centers, industrial hubs, and seaports along the southern coast, enhancing regional integration.
- Economic Growth: Reduced travel times and improved transportation infrastructure stimulate economic activity and attract investments.
- Employment Opportunities: Construction and subsequent maintenance create jobs.
- Market Access: Businesses of all sizes benefit from better access to markets.
- Inclusive Development: Bridging rural-urban gaps fosters inclusive growth and reduces income disparities.

While the costs are substantial, the long-term benefits of the Lagos-Calabar Coastal Road are expected to significantly impact economic development and living standards in the region.

The Lagos-Calabar Coastal Highway is an investment with net positive benefits, promoting sustainable development and improved livelihoods. Also, the **value of the Lagos-Calabar Coastal Highway project** and its critical contributions could be stated in the following ways:

Table 2.4: Value Consideration for the Lagos-Calabar Coastal Highway project

S/No	Value	Consideration
1.	Cost	• The project cost encompasses several aspects: • Engineering: Basic and detailed planning and design. • Civil and Mechanical Works: Construction and maintenance. • Operational Costs: Ongoing expenses for management and upkeep.
2.	Critical contributions	• The highway's critical value lies in its contributions: • Increased Economic Activities: The corridor fosters trade, commerce, and industrial growth. • Employment Generation: Infrastructure development creates jobs. • Ease of Movement: Efficient transportation benefits commuters and businesses.
3.	Long-Term Benefits:	• The Project's evaluation considers: • Economic Returns: Enhanced trade, investment, and revenue. • Environmental and Socioeconomic Benefits: Positive impacts on communities and health.
4.	Economic Growth and Trade:	• Trade Routes: The highway will serve as a vital trade route connecting major cities, industrial zones, and ports. • Investment Opportunities: The corridor can attract investments in agriculture, manufacturing, logistics, and tourism. • Job Creation: the infrastructure development is expected to generate employment opportunities, benefiting local communities.
5.	Tourism and Hospitality:	• Tourist Attractions: The highway passes through scenic coastal areas, national parks, and cultural heritage sites. • Hospitality Industry: Hotels, restaurants, and recreational facilities can thrive along the route.
6.	Urbanization and Real Estate Development:	• Urban Expansion: The corridor can spur urban growth, leading to new residential and commercial developments. • Property Value: Well-planned infrastructure enhances property values and attracts real estate investments.

Table 2.4: Value Consideration for the Lagos-Calabar Coastal Highway project

S/No	Value	Consideration
7.	Industrial Zones and Special Economic Zones (SEZs):	• Industrial Clusters: The highway can link existing and new industrial clusters. • SEZs: Designated SEZs can attract foreign direct investment, boost exports, and create jobs.
8.	Transport and Logistics Efficiency:	• • Port Connectivity: Efficient road networks enhance seaport connectivity (e.g., Lekki Deep Seaport). • Reduced Transit Time: Improved highways minimize transit time for goods and passengers.
9.	Social Services and Livelihood Enhancement:	• Healthcare and Education: Corridor development can lead to better healthcare facilities and educational institutions. • Livelihood Diversification: Communities can engage in tourism-related activities, handicrafts, and services.
10	Environmental Sustainability:	• Green Infrastructure: Incorporating green belts, wildlife corridors, and sustainable drainage systems helps preserve natural ecosystems and enhances the environment. • Biodiversity Conservation: Protecting natural habitats and promoting eco-tourism contribute to biodiversity preservation.
11	Community Participation and Inclusivity:	• • Stakeholder Engagement: Involving local communities, indigenous groups, and civil society in planning and decision-making ensures their voices are heard. • Social Inclusion: Ensuring that project benefits reach marginalized groups fosters social equity.
12	Coastal Morphological Change:	• Addressing morphological changes: Lagos shoreline experiences morphological changes due to both natural processes and human development. • Over a 20-year period: Cumulative mean rate of change: +0.93 m/year, Erosion rate: -1.94 m/year and Accretion rate: +4.84 m/year and Victoria Island, with the highest shoreline change, had a mean accretion rate of 81.99 m/year. • Appropriate land use and management plan: ensuring appropriate land use and management plan to create lasting positive impacts on the environment, communities, and coastal resilience.

2.10.0 Envisaged Sustainability

The **sustainability** of the proposed Lagos-Calabar Coastal Highway project runs across four key areas: **Economic Sustainability**, **Technical Sustainability**, **Social Sustainability**, and **Environmental Sustainability**. Integrating these considerations serves as a model for sustainable development, benefiting present and future generations as described below and depicted in Figure 2.5.

Figure 2.8: Highway Added Values of the Proposed Project

2.10.1 Economic Sustainability:

The proposed Highway stand to demonstrate a commitment to financial sustainability, benefiting both the government and residents. This highway project is not just about roads; it is a strategic investment with long-term benefits for Nigeria’s economy and local communities as briefly described below:

1. **Long-Term Economic Benefits**:

The Lagos-Calabar Coastal Highway aims to enhance trade, investment, and revenue. By seamlessly connecting major cities and ports along the coast, the highway serves as a catalyst for economic expansion, bolstering trade and tourism activities throughout the region.

2. **Job Creation**:

The Lagos-Calabar Coastal Highway is designed to create sustainable employment opportunities which is expected to contribute to economic stability. During the construction phase, the project will create jobs for both skilled and unskilled labor, benefiting local communities.

3. **Revenue Generation**:

The Lagos-Calabar Coastal Highway is proposed to provide efficient transportation infrastructure which can attract additional shipping traffic and foreign investments.

The highway's economic sustainability relies on several key revenue streams such as the following:

- Revenues from Road Users: Toll collection from road users contributes to ongoing maintenance and operational costs, ensuring the highway's functionality.
- Parking and Service Station Facilities: Providing parking, and travel break areas and service stations generates additional income while catering to travelers' needs.
- Utilities and Telecommunications Ducting: Leasing space for utility ducts (such as fiber optics and power lines) generates revenue and benefits both the highway and adjacent communities.
- Advertising Hoardings: Leasing advertising spaces along the highway generates advertising revenue.
- Leasing Land for Hotels and Retail Centers: The highway corridor can attract hotel chains and retail developments, generating long-term revenue.
- Job Creation and Socioeconomic Obligations: The project creates jobs during construction and operation, fulfilling the government's financial and socioeconomic obligations to host communities.

4. **Funding**

The proposed project is designed to support its sustainability through financing mechanisms that will allow the private sector to support the project ends. The highway is conceived as an Engineering, Procurement and Construction plus Financing project. The funding model entails part-funding by the Federal Government between 15 to 30 per cent. The private sector counterpart will provide the balance and toll the road when completed for a minimum period of 15 years, to ensure full recovery of all debts and equity applied for the delivery of the project. Under this model, the investor provides all designs, part of the financing and construction while the Federal Government provides the counterpart funding.

The Federal Ministry of Works received such a bid, worked on it and sent it to Bureau of Public Procurement (BPP).

2.10.2 Technical Sustainability:

The proposed coastal highway is designed to demonstrate a holistic commitment to technical sustainability, to benefit Nigeria's infrastructure growth and its people. This highway project goes beyond mere construction; it embodies a commitment to long-lasting benefits for both the project itself and the local community.

The Federal Ministry of Work and the Contractor boast of an assemblage of a team of professionals with impressive relevant experience that would be involved in the implementation of the project and would where necessarily source for necessary technical expertise to ensure the sustainability of the project. The Ministry shall employ Best Available Technology in the implementation of the project and adhere strictly to all relevant engineering codes and standards. Specifically, the following shall be adopted to ensure the technical sustainability:

1. **Quality Infrastructure**:

Ensuring the highway's durability and resilience is paramount to the project. High-quality construction materials, engineering standards, and rigorous testing would contribute to its longevity.

2. **Maintenance and Upkeep**:

Regular maintenance is embedded in the overall [project management and this is essential to prevent deterioration. By promptly addressing wear and tear, the highway will remain safe and efficient for years to come.

3. **Adaptability**:

Designing with future needs in mind ensures the highway would remain relevant. The flexibility of the technical design would allow for adjustments as traffic patterns, technology, and urban development evolve.

4. **Best Available Techniques (BAT)**:

The project will adopt BAT for design, construction, and operation. BAT ensures the most effective and efficient methods are employed, minimizing environmental impact, and maximizing performance.

5. **Local Content Utilization**:

The project will generously utilize local content supports regional industries and creates jobs. This will foster economic growth within the communities directly impacted by the highway.

6. **Skills Transfer and Capacity Building**:

Adequate collaboration between expatriate engineers and local engineers to ensure knowledge exchange shall be the key in implementation. Local engineers gain valuable experience, enhancing their capabilities and contributing to sustainable development.

2.10.3 Social Sustainability:

The proposed Coastal Highway has sown a commitment to social sustainability by engaging communities, addressing grievances, and prioritizing safety. In order to ensure that the persons and assets along the proposed alignment do not get adversely impacted, this project has conducted a Resettlement Action Plan (RAP), which ensured that all persons doing business or living within the Right of Way were all captured and documented. The RAP was prepared as stand-alone document and appropriate mitigations such as compensations and assistance were proffered. Also, project specific social and environmental management activities to ensure social sustainability of the proposed project has been developed as part of the overall project management plan.

This highway project prioritizes the well-being of local communities and safety as follow:

1. **Robust and Sustained Stakeholder Engagement**:

The Federal Government engages with affected communities in a structured and culturally appropriate manner. Tailored consultations consider risks, impacts, language preferences, decision-making processes, and the needs of vulnerable groups. Community engagement during the Environmental and Social Impact Assessment (ESIA) work and the development of a comprehensive Resettlement Action Plan (RAP) demonstrate this commitment.

2. **Establishment of a Grievance Mechanism**:

A grievance mechanism will be designed to receive and address concerns and grievances related to environmental and social performance. It will ensure transparency, accountability, and conflict resolution. The Potential sources of grievances, including community youth groups and tribal conflicts, will be considered.

3. **Security Surveillance of the Highway**:

Monitoring efforts will include:

- Preventing unauthorized interference with the highway.
- Ensuring security against intentional harm.

The key strategies for community engagement would include:

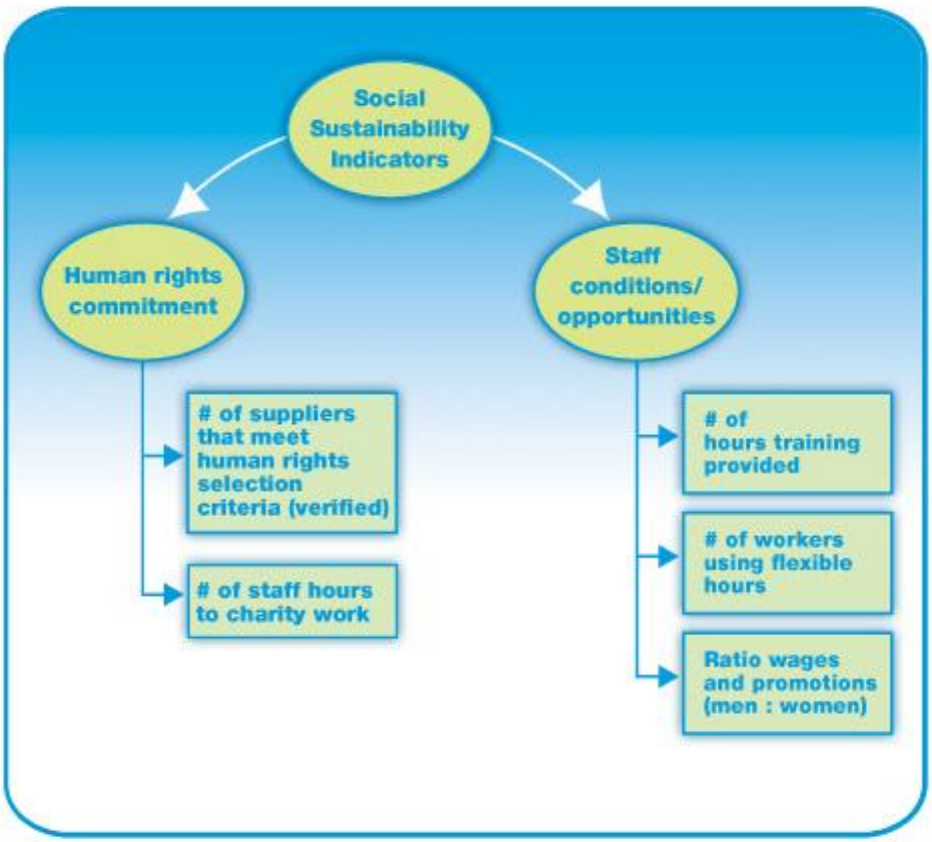
1. **Stakeholder Consultations**:
    - Organize regular **meetings and consultations** with community leaders, residents, and relevant stakeholders.
    - Seek input on environmental issues, potential impacts, and mitigation measures.
2. **Environmental Awareness Campaigns**:
    - Conduct **awareness programs** to educate communities about the Project's environmental aspects.
    - Explain the benefits, risks, and steps taken to minimize adverse effects.
3. **Community Participation in Decision-Making**:
    - Involve communities in **decision-making processes** related to the highway.
    - Seek consensus on environmental protection measures.
4. **Environmental Impact Assessment (EIA) Workshops**:
    - Host workshops to present the **EIA findings** to local communities.
    - Address concerns, clarify doubts, and gather feedback.
5. **Community Liaison Officers (CLOs)**:
    - Appoint CLOs to serve as **a bridge between the project team and communities**.
    - CLOs can relay information, address grievances, and ensure transparency.
6. **Mitigation Measures and Compensation**:
    - Communicate **mitigation plans** for environmental impacts.
    - Discuss compensation for any adverse effects on livelihoods or property.
7. **Monitoring and Reporting**:
    - Establish a system for **ongoing monitoring** of environmental aspects.
    - Regularly update communities on progress and any necessary adjustments.
8. **Cultural Sensitivity**:
    - Respect local customs, traditions, and cultural practices.
    - Consider sacred sites, burial grounds, and other sensitive areas.

As part of ensuring Social Responsibility and Sustainability in the Project Development, the businesses about the project shall be conducted in a manner that safeguards both the environment and the well-being of workers and community. When considering social sustainability, the proposed project shall adhere to the following principles:

- Positive Impact: The project should contribute positively to the host community.
- Meeting Human Needs: It must address an extended range of human needs.

- Preserving Nature: The project design should ensure the long-term preservation of nature's reproductive capabilities.
- Social Justice and Dignity: Normative claims related to social justice, human dignity, and participation should be fulfilled.

The project Management's obligation extends to the welfare of the host community. Ethical practices benefit society at large while maintaining a balance between the economy and ecosystems. Figure 2.3 illustrates the path toward social sustainability. Additionally, specific Corporate Social Responsibility (CSR) activities will enhance the socio-economic stability of the project. Employing local unskilled laborers from the host and surrounding communities contributes to their economic well-being.



Source : http://www.sustainabilityskills.net.au

Fig. 2.9: Social Sustainability

2.10.4 Environmental Sustainability:

The proposed project is guided by commitment to cost reduction, environmental responsibility, safety, and community health:

1. The project is guided by principles that focus on **Minimization of negative environmental and social impacts** Adequate attention will be given to **Environmental**, **public safety**, and **health aspects and** Implementation of appropriate **mitigation measures** and an **Environmental Management Plan**

2. ESIA: Preparation of the Environmental and Social Impact Assessment (ESIA) to identify upfront the impacts and suggest mitigation measures.
3. **Biodiversity Conservation**: The project during implement would protects natural habitats. Measures to be taken to safeguard biodiversity along the highway route are embedded in the ESIA.
4. **Climate Resilience**: Climate change effects have been considered in planning and design. The highway is designed to withstand potential climate-related challenges.
5. **Environmental Management System (EMS)**: The project adopts an EMS based on ISO 14001:2015 standards. This proactive approach ensures responsible environmental practices.
6. **Eco-Friendly Design**: During construction, the project shall minimize its environmental impact. It will Sustainable practices reduce harm to natural ecosystems.
7. The FMW will work with FMENv to enforce compliance with **Statutory regulations** and its own **corporate guidelines** on Health, Safety, and Environment (HSE). Simultaneously, the project aims for continuous **performance improvement**. All project facilities will be designed and constructed to keep environmental impacts at minimal and acceptable levels.
8. All operations will conform to relevant **International**, **national**, and **state regulations.** The project adheres to national and international environmental regulations. Responsible execution aligns with global industry practices.
9. Beyond environmental aspects, the project focuses on **Occupational Health and Safety and Community Health and Safety.** Handling, storage, and disposal of solid and liquid wastes will follow regulatory requirements and company Standard Operational Procedures.
10. Engaging with local communities ensures that environmental concerns are heard and integrated into project planning, and this has started during the ESIA preparation.

The FMW working with FMENv shall cause the contractors to carry out the Project in accordance with the ESIA and the applicable national legislation in a manner and in substance that is satisfactory to the potential funders. The contractor shall not commence implementation of any works on any section of the road, unless all project affected persons (PAPs) on such sections have been compensated and/or resettled in accordance with the RAP.

2.11 Project Options and Alternatives

2.11.1 Project Options

By carefully analyzing the options and alternatives, making informed decisions that balance development goals with environmental preservation is possible. The ultimate aim is to create a sustainable and efficient transportation corridor for Nigeria. The **project options and alternatives** for the **Lagos-Calabar Coastal Highway were weighed** through an evaluation that ensures that it considers environmental and social factors while making informed decisions.
In Table 2.5, the key options are appraised.

Table 2.5: Key Project options

No	Project Options:	What it means	Considerations
1	No Project Options:	This scenario involves not proceeding with the highway project. It would mean maintaining the status quo without any new infrastructure.	• The "No Project" option seems prudent in the short term. However, it risks stifling Nigeria's growth potential, considering the nation's aspirations to pursue viable infrastructure projects remain crucial. In this choice, which was rejected, the implications include: • Economic Impact :Without the highway, Nigeria's local and national economies would miss out on significant growth opportunities. The proposed development promised various socioeconomic and industrial benefits: • Increased Business Opportunities: The highway would have facilitated trade, transportation, and connectivity, leading to more business ventures. • Government Revenue: The Project would have generated revenue through taxes, tolls, and other sources. • Foreign Exchange Earnings: Improved infrastructure attracts foreign investment and boosts foreign exchange reserves. • Employment Opportunities: Construction, maintenance, and related jobs would have provided employment. • These potential gains would be forfeited by opting for the "No Project" route. As a developing country, Nigeria relies on infrastructure development to spur economic growth. The highway would have bridged regions, fostering national integration and development. The absence of the Project could hinder progress and limit opportunities. • The decision against the Project assumes that feasibility studies deemed it non-viable. However, it's essential to weigh long-term benefits against short-term challenges.
2	Delayed Project Options:	In this case, the Project could be postponed later. This might allow further studies,	• The highway's development is anticipated to proceed without delay as it contributes to Nigeria's growth and connectivity. • However, project implementation may face delays in certain circumstances due to various

Table 2.5: Key Project options

No	Project Options:	What it means	Considerations
		adjustments, or better alignment with environmental goals.	factors. This option is not needed for the Project due to the following: • Unfavourable Conditions: Civil unrest, hostilities, or unfavourable government policies can hinder progress. Malicious public opinion and economic downturns may also contribute. • Stakeholder Communities: The highway project involves various stakeholders—local communities, authorities, and investors. If these stakeholders face challenges, the Project could be delayed. • Force Majeure: Natural disasters, pandemics, or unforeseen events fall under force majeure. Such events disrupt schedules and require adaptation. • Current Scenario: Interestingly, none of these delaying factors currently exist for the Lagos-Calabar Coastal Highway. Conditions are conducive to progress. • Preferred Option: Given the absence of hindrances, the “Delayed Project” option was not selected. Instead, the focus remains on timely execution and reaping the benefits.
3	Go-Ahead Option:	The highway project proceeds as planned, with the aim of timely completion and implementation.	• The Lagos-Calabar Coastal Highway represents a path toward prosperity, connecting people, commerce, and aspirations. Acknowledging the vital need for the planned Lagos-Calabar Coastal Highway, the following are the positive aspects of the option to go ahead with the Project: • Economic Boost: The highway project promises substantial benefits. • Increased Production: Improved connectivity facilitates efficient movement of goods and services, enhancing production. • Revenue Enhancement: The Project generates revenue through tolls, taxes, and economic activity. • Job Creation: Construction, maintenance, and related jobs provide employment opportunities. • Socioeconomic Impact: The highway positively affects livelihoods and communities.

Table 2.5: Key Project options

No	Project Options:	What it means	Considerations
			• National Progress: Nigeria's growth hinges on strategic infrastructure development. The highway bridges regions, fostering national integration and economic expansion. It aligns with the nation's vision for progress. • Viability and Execution: The "Go-Ahead" option is deemed viable. Implementation should proceed as planned, considering feasibility studies and stakeholder support Implementation will lead to social and environmental impacts including displacement of assets and people

2.11.2 Project Alternatives

A thorough consideration of alternatives ensures that the chosen Project aligns with environmental sustainability, social well-being, and economic viability. By evaluating trade-offs and making informed decisions, creating a more resilient and responsible future is possible.

During the scoping phase, project planners considered various potential sites or locations for the proposed development. These alternatives involved different geographical areas, land parcels, or regions. Each site's advantages and disadvantages were assessed, considering factors such as accessibility, environmental sensitivity, and social impact. Feasibility from both technical and environmental perspectives were crucial.

The alternatives to ensure informed decision-making relate to the different aspects of other options within the ESIA framework:

1. **Alignments Consideration Alternatives**:

The Lagos-Calabar Coastal Highway project is crucial for economic growth and connectivity, and the government is actively seeking solutions that balance development with environmental and community considerations. The Lagos-Calabar Coastal Highway has been a topic of significant discussion and planning. The involvement of stakeholders, experts, and community representatives have helped shape the route alignment ensuring a well-informed decision.

The assessment using various factors/criteria as outlined in the Appendix 2.2 based on location, design, and local context.

Below were the proposed alternatives:

a. **Original Right-of-Way/Alignment via Water Corporation Road**:

Initially, the Lagos-Calabar Coastal Highway was planned to follow a specific alignment that would have affected private businesses, including the $200 million Landmark Beach Resort, a popular tourist destination.

The original right-of-way designated for the highway passed through the Water Corporation Road median. Along this 1.5 km coastal road route, there were no permanent structures whatsoever. This original alignment remained unused and undeveloped until now.

However, access to this corridor from the most viable options such Ajose Adeogun Street or other alternate route to this original right of way encountered significant challenges. The existing traffic situation is already congested, and adding the Coastal Road would further exacerbate the congestion. This was rejected.

b. Discontinuation of Initial Proposed Realignment:

At the conclusion of the 3rd Stakeholders Meeting in Lagos, the Federal Government of Nigeria announced that it would discontinue with the proposed Lagos-Calabar Coastal Highway realignment. The reason for discontinuation was the presence of submarine cables along the coastline, which posed challenges to the original plan.

The decision not to proceed with the proposed realignment was welcomed by the Okun-Ajah community, as it would have led to the demolition of ancestral homes. Members of the community expressed gratitude for the government's reconsideration of the route

c. Redesigned Right of Way:

To mitigate the loss of direct beach access due to the new highway alignment, a key solution proposed was the construction of artificial pools at Landmark Beach Resort.

d. **Current Proposed Route and Right-of-Way Choice**:

The Lagos-Calabar Coastal Highway will link several key infrastructure points, namely, Lagos-Badagry Expressway superhighway, Fourth Mainland Bridge and Lekki Deep Sea Port Road. It will also connect various points in Northern Nigeria via Ogoja-Ikom road.

Additionally, the project will feature rail lines running in the middle of the main carriageways. The choice of the new proposed Right-of-Way was a testament to the balanced approach which carefully weighed infrastructure preservation, operational considerations and environmental impact. This decision was made with the utmost consideration for all aspects of the project, instilling confidence in stakeholders about the commitment to a sustainable and efficient project. The new proposed Right of Way was selected over other available alternatives for the following reasons

i. **Traffic flow**.

- The chosen current right-of-way balances the need for development with the practical realities of traffic flow.

ii. Public Opinion.

- Resistance from residents and developers is a common, yet challenging, aspect when enforcing the 'right of way.' This is especially true when these regulations often involve the difficult decision of demolishing structures built within setbacks.
- Thus, the project was designed with a clear aim-to strike a balance between progress and public sentiment, a balance that is essential for sustainable development. In other words, the project was not just about infrastructure development, but about understanding and respecting the public's voice. Public opinion was not just considered, but actively sought and incorporated, influencing the delicate dance between infrastructure development, environmental protection, and political dynamics in Lagos. This was particularly evident

in the choice of the right-of-way for the Lagos-Calabar Coastal Highway (Section 1), where public sentiment played a significant role. Public opinion, therefore, is not just a factor, but a cornerstone, influencing land use, infrastructure, and environmental protection decisions.

iii. Complex Interplay of Factors:

- Integration with other infrastructure projects, such as the Lagos Master Plan, which involves infrastructure development, environmental stewardship, and political manoeuvring, was also key.
- The Proposed Coastal Road Already Part of Masterplan—The Proposed Coastal Road is already part of the Strategic Transport Masterplan (Figure 2.6 and 2.7).
- The “right of way” chosen ensures infrastructure projects have the necessary space for safe operation. This decision was made after careful consideration of the benefits it brings, including improved safety, reduced environmental impact, and enhanced operational efficiency. Clearances around electric power networks, water bodies, and drainage channels are crucial.
- The redesign of the highway, now tracing the coastal path, was a meticulous and necessary step. This decision was driven by unwavering commitment to preserve the extensive infrastructure along the original route, demonstrating practical and resourceful approach to the project, and reassuring stakeholders of the project's dedication to infrastructure preservation.

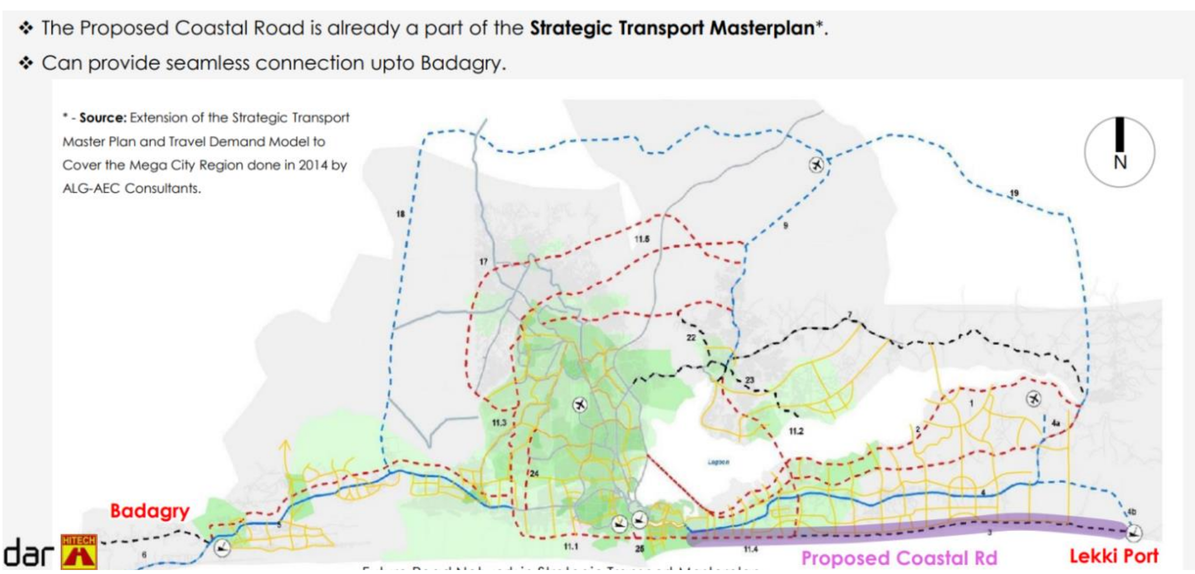


Figure 2.10: Strategic Transport Masterplan to which the Proposal falls.

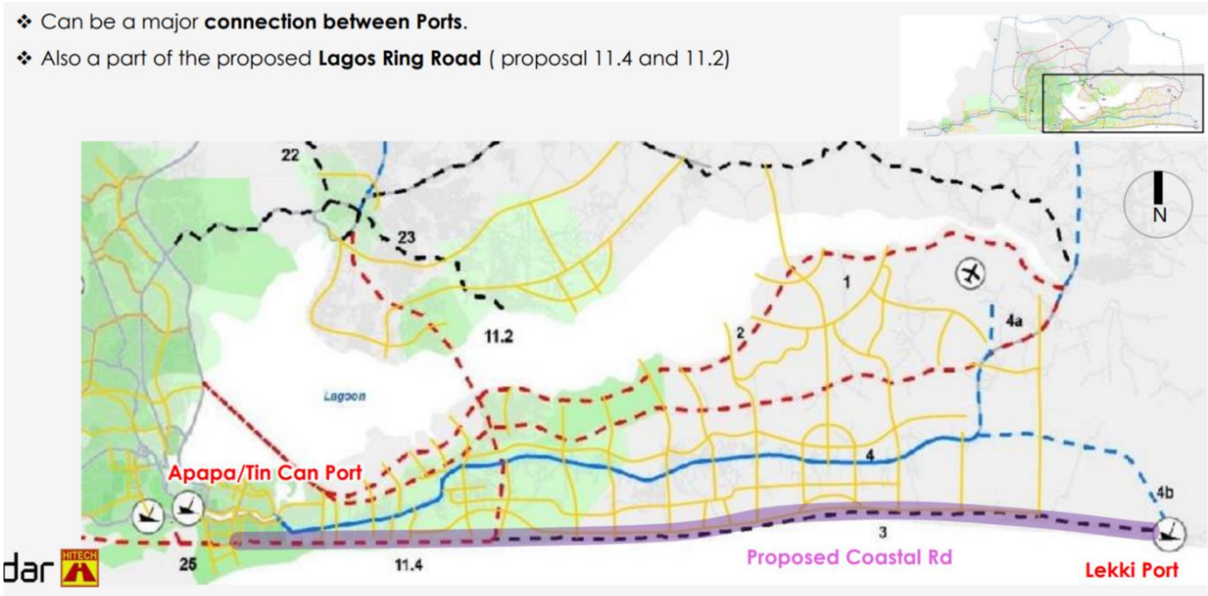


Figure 2.11: The proposed Lagos Ring Road and Proposed Coastal Road

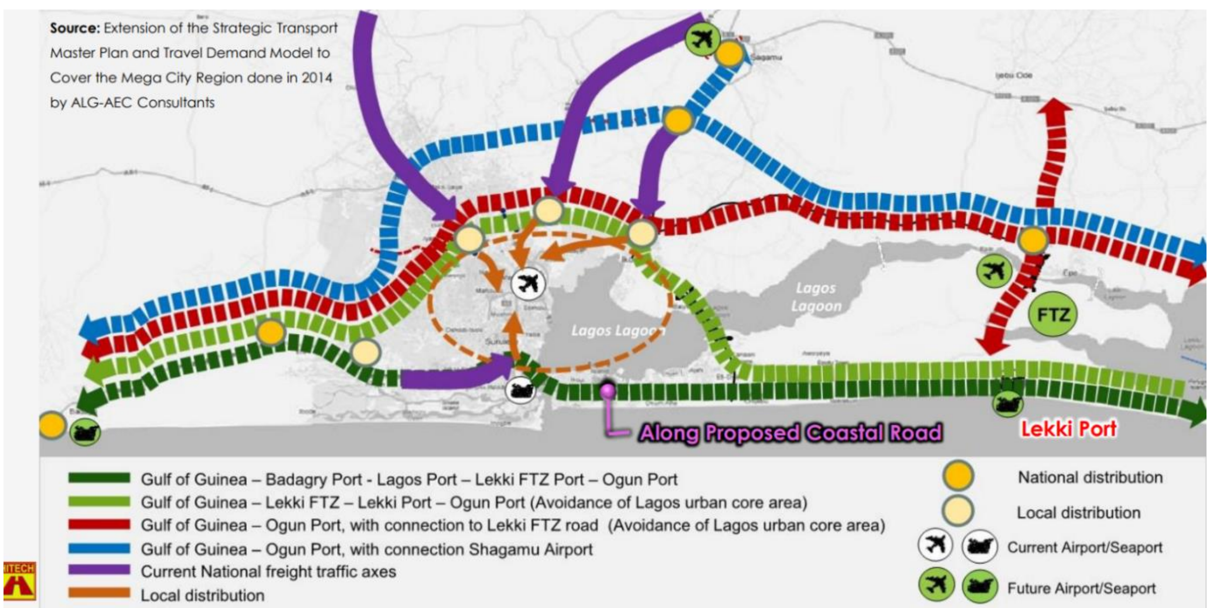


Figure 2.12: Proposed Coastal Road Vision for Freight Transportation

Thus, in summary the alignment rroposals were considered using various factors to minimize impacts. These factors include safety, environmental concerns, traffic flow, and economic feasibility as outlined in Table 2.6

Table 2.6 Summary of Factors Considered in the Alignment Proposals		
S/No	**Factors**	**Consideration**
1.	Alignment Options:	Engineers evaluate multiple alignment options, considering factors like terrain, existing infrastructure, land use, and community impact. Common alignment types include straight alignments, curves, tangents, and intersections.
2.	Traffic Flow and Safety:	Engineers analyze traffic patterns, volume, and safety requirements. They consider factors like sight distance, turning radii, and vehicle speeds. Alignments that enhance traffic flow, reduce congestion, and improve safety are prioritized.
3.	Cost-Benefit Analysis:	Economic feasibility plays a crucial role. Engineers compare the costs of construction, maintenance, and operation for each alignment. Benefits include reduced travel time, improved connectivity, and economic development.
4.	Geotechnical Considerations:	Soil conditions impact pavement performance. Engineers assess soil stability, bearing capacity, and settlement potential. Rigid pavement requires a strong foundation. Soil tests guide decisions on subbase and subgrade preparation.
5.	Alignment Optimization:	Iterative optimization involves adjusting alignment parameters (curvature, slope, etc.) to minimize impacts. Trade-offs occur—for example, a steeper curve may reduce environmental impact but increase construction costs.
6.	Public Participation and Stakeholder Engagement:	Community input matters. Public meetings, consultations, and feedback help shape alignment decisions. Balancing stakeholder interests ensures a more just and acceptable outcome.
7.	Final Alignment Selection:	Based on the analysis, engineers recommend the alignment that best balances safety, environmental impact, cost-effectiveness, and community needs. Rigid pavement design specifics (thickness, reinforcement, joint spacing) are then tailored to the chosen alignment.

2. **Alternative Design/Technology/Structural Alternatives**:

Exploring various engineering designs and construction methods. This could involve assessing sustainable materials, innovative road layouts, or eco-friendly features.

Structural alternatives pertain to the Project's design, layout, and configuration. Variations in road alignment, bridge designs, tunnels, and interchanges could affect infrastructure projects like highways. Evaluating structural alternatives helps identify the most efficient, cost-effective, and environmentally sound options. Trade-offs between different designs are considered, balancing benefits and drawbacks.

3. **Feasibility and Impact Assessment**:

Feasibility is a key criterion for alternative selection. An alternative must fulfill the Project's purpose while minimizing adverse impacts. The ESIA process estimates the extent and scope of assessment required for each alternative. Recommendations are made regarding whether a full ESIA study is necessary. Time frames and resource requirements are also considered.

4. **Incremental Alternatives**:

These emerge during the ESIA process as responses to identified impacts.
Incremental alternatives address specific issues and are closely tied to mitigation measures.
They may involve project components, operational practices, or construction phasing adjustments.
The goal is to minimize negative effects and enhance positive outcomes.

5. **Engineering Alternatives**

a. **Road Engineering**:

Road engineering focuses on designing, constructing, and maintaining roads and pavements. Engineers aim to create durable, safe, and efficient vehicular and pedestrian traffic routes. Key considerations include selecting the right materials, layer thicknesses, and pavement types.

b. **Types of Pavements in Road Construction**:

Pavements are the part of the road that carries traffic. There are two main types of road surfaces:

- Rigid Pavement:
  - Consists of a single layer (e.g., Portland cement concrete).
  - Provides high durability and strength.
  - It is commonly used for highways and major roads.
- Flexible Pavement:
  - They are typically made up of multiple layers (e.g., asphalt).
  - Distributes loads effectively.
  - Suitable for various traffic volumes and soil conditions.
- Other road surface materials include artificial stone, flagstone, cobblestone, bricks, tiles, and timber.

c. **Construction Alternatives**:

Beyond pavement types, engineers consider various construction alternatives:

- White topping Roads: Using concrete overlays on existing asphalt surfaces.
- Polymer Fiber Reinforced Concrete Roads: Enhancing concrete durability with polymer fibers.
- Bituminous Roads: Traditional asphalt roads.
- Composite Solutions: Combining different materials for optimal performance.
- Recycling Techniques: Reusing materials for sustainable construction.

d. **Designing for Strength and Longevity**:

Engineers measure road strength based on the number of vehicles they can support. Specifications include material choices, layer thickness, and pavement type. The goal is to create serviceable roads that withstand traffic and last their design life.

e. **Concrete Pavement Design**:

The Lagos-Calabar Coastal Highway's first phase comprises a 47.47-kilometer dual carriageway. It is constructed using 11-inch-thick concrete roads with 20-millimeter reinforcement.
This innovative design improves local cement manufacturing and boosts steel production from Ajaokuta.

1. The Chosen Engineering Option -Rigid Pavement

As shown above, the proposed project requires road engineering, a multifaceted field that involves careful planning, design, and construction. It encompasses a range of disciplines, from material selection to pavement design. By considering alternatives and optimising construction methods, durable, cost-effective, and sustainable road networks can be built.

Based on the different types of engineering considered, the choice of rigid pavement reflects a commitment to building a robust, enduring highway that will serve future generations. This choice is not just a technical detail but a strategic decision crucial in achieving the project's durability, safety, and long-term performance goals. We value your input and understand that this decision affects not just us but also the community. We believe that by choosing rigid pavement, we are making a decision that aligns with our shared goals of sustainability and long-term value. This should reassure you about the quality of our chosen engineering option and the transparency of our decision-making process.

Rigid pavement, in stark contrast to flexible pavement (asphalt), is a road surface constructed using rigid materials such as concrete. It does not just offer durability, load-bearing capacity, and resistance to deformation, but it excels in these aspects. Unlike flexible pavement, which distributes loads through the entire structure, rigid pavement relies on the inherent strength of the concrete slab itself, ensuring a superior performance. This superiority instill confidence in the quality of the chosen engineering option.

2. Cement and Asphalt

Cement and asphalt are both commonly used materials for paving surfaces, but they have different climate impacts. It is well known that darker surfaces get hotter in sunlight than lighter ones. Climate scientists use a metric called 'albedo' to help describe this phenomenon. **Box 2.3 comprehensively compares cement and asphalt materials for paving surfaces and climate impacts**, clearly understanding why the rigid payment was a significant factor in the decision. T**he proposed project is based on using Cement for the rigid pavement, which is considered superior to asphalt.** This choice ensures a durable road and contributes to a more sustainable environment, keeping you well-informed and engaged in the project's positive climate impact.

Table 2.7 shows a comparison of cement and asphalt materials for paving surfaces and climate impacts

Albedo is a measure of surface reflectivity. Surfaces with low albedo absorb lighter and tend to be darker, while high-albedo surfaces are brighter and reflect more light. Albedo is a central factor in cool pavements. Cement and asphalt are both commonly used materials for paving surfaces, but they have different climate impacts.

It is well-known that darker surfaces get hotter in sunlight than lighter ones. Climate scientists use a metric called "albedo" to help describe this phenomenon. Typical paving surfaces, like conventional asphalt, possess a low albedo and absorb more radiation and emit more heat. In contrast, cool pavements have brighter materials that reflect more than three times as much radiation and, consequently, re-emit far less heat (Logan, A (2021: Countering climate change with cool pavements, MIT Concrete Sustainability Hub).

Box 2.4: Cement and asphalt Materials with Climate impacts

Table 2.7: Comparison of Cement and Asphalt Materials for paving surfaces and Climate impacts

s/No	Element	Asphalt:	Concrete:
1	Heat Absorption and Emission:	Conventional asphalt has a low albedo (reflectivity) and absorbs more solar radiation. As a result, it emits more heat, contributing to the urban heat island effect. In hot climates, asphalt can soften and even melt, causing bumps and ruts on the surface.	Concrete pavements, especially reflective concrete, have higher albedo and reflect more solar radiation. They emit less heat, helping mitigate the urban heat island effect. In some cases, concrete performs better than asphalt due to its rigidity at high temperatures, which minimizes vehicle fuel consumption.
2	Greenhouse Gas Emissions:	Asphalt: The production of asphalt involves energy-intensive processes and emits greenhouse gases. Additionally, asphalt surfaces contribute to the urban heat island effect, indirectly affecting climate change.	Concrete: While concrete production also emits greenhouse gases, it has the potential to reduce emissions if carbon reduction strategies are implemented. Research suggests that emissions for pavements and buildings could fall dramatically with optimized concrete use.
3	Implementation Considerations:	replacing conventional asphalt with cool options (such as reflective	concrete pavements (whether reflective or not) perform better

Table 2.7: Comparison of Cement and Asphalt Materials for paving surfaces and Climate impacts

s/No	Element	Asphalt:	Concrete:
	Location: The choice between asphalt and concrete depends on the local climate.	asphalt) is preferred due to its impact on reducing heat and emissions.	because of their rigidity at high temperatures.
4	Traffic Configurations:	conventional asphalt with cool options has impact on reducing heat and emissions.	Cool pavement strategies should be selected based on neighbourhood-specific factors like traffic patterns

2.12 Conclusions

Overall, the Lagos-Calabar Coastal Highway, beyond being just a road, it is a testament to collaboration, foresight, and commitment. The Lagos-Calabar Coastal Highway project (Section 1) stands on solid ground, supported by multiple pillars of assurance as outlined below:

- Social and Cultural Acceptance:
    - The project aligns with societal norms and cultural values.
    - Communities find it appropriate and acceptable.
- Technical Soundness:
    - Rigorous engineering design ensures technical feasibility.
    - The highway’s construction and operation are sustainable.
- Environmental Considerations:
    - Environmental impact assessments have been thorough.
    - Mitigation measures are in place to minimize harm.
- Economic Viability:
    - Leveraging private sector resources and funding.
    - The project’s financial sustainability is assured.
- Government Commitment:
    - Key ministries (Federal Ministry of Works, Federal Ministry of Environment, and Federal Ministry of Finance) champion the project.
    - Regulatory frameworks and flexible financing instruments are actively implemented.

CHAPTER THREE
PROJECT DESCRIPTION

3.1 Background Information

This chapter mainly focuses on Section 1 of the proposed Lagos Coastal Highway. It provides a concise overview of the project activities, facilities, equipment, operations, personnel, and the implementation schedule.

3.1.1 Overview of the Overall Lagos-Calabar Coastal Project

The Lagos Coastal Road is a roadway project that aims to improve road connectivity along the coastline. It will run parallel to the coast, connecting various cities and towns, including Lagos, and other coastal areas. The road will primarily serve motor vehicles, including cars, buses, and trucks. It aims to reduce travel time, enhance trade, and improve access to coastal regions.
The Lagos-Calabar Coastal Highway Project is a monumental infrastructure initiative in Nigeria. The project involves constructing a modern road spanning approximately 700 kilometers.
It will connect Lagos (Nigeria's economic hub) to Calabar (a major coastal city).

Beyond Lagos and Calabar, the highway will link other major urban centers, industrial hubs, and seaports along the southern coast. By bridging key regions, the highway aims to enhance national connectivity. Access to major seaports and industrial centers will promote economic growth and development. The project promises to uplift living standards in the region.
The project goes beyond roads. It includes plans to incorporate rail lines within the median strips of the main roads. These integrated rail lines will provide seamless intermodal transport, allowing passengers and freight to transition smoothly between road and rail modes.
The ambitious highway project will revolutionize Nigeria's road network by connecting several major roads across the country: Lagos-Badagry Expressway Superhighway, Proposed Fourth Mainland Bridge, Lekki Deep Sea Port Road and Ogoja-Ikom Road (linking to points in Northern Nigeria). Table below shows Key Details of the Project Information.

Table 3.1 Key Details of the Project Information

S/No	Aspect*	Details
1.	Project Length	• Approximately 700 kilometers
2.	Rail Integration	• Rail lines within median strips of highways
3.	Number of Section of the Road	• 9
4.	Start and End of Section 1	• The first phase of the highway covers a 47.5kilometer section starting from Victoria Island in Lagos.
5.	Economic Impact of the coastal Road	• Boosting trade, industry, and livelihoods
6.	National Importance	• Enhancing Nigeria's coastal connectivity

7.	Construction and Features:	• It features five lanes on each side of the dual carriageway, with a train track running through the middle.
8.	Alignment Considerations:	• Eko Atlantic's Ahmadu Bello Road: The alignment starts here, running parallel to the coastline • Cross-State Connection: Extends across Ogun, Ondo, Delta, Bayelsa, Rivers, and Akwa Ibom States, terminating in Calabar, Cross River State. • Trans West African Highway Connection: Links with the Lagos-Benin-Enugu-Abakiliki-Ikom-Cameroon-Mombasa route.
9.	Ecological Considerations:	• Deflection to Avoid Sensitive Areas: The alignment avoids ecologically sensitive zones, such as mangrove swamps and turtle nesting areas.
10	Existing Infrastructure/Utilities Considerations	• Avoidance of infrastructures/utilities like Telecommunication corridor (marine cables) that are existing along the proposed corridor. • Oil Pipelines: Existing pipelines influence the alignment in certain segments.

3.1.2 Proposed Project Location

a. The Entire Proposed Project Alignment

The road starts from Lagos, near the Lekki Deep Seaport, and runs through several states: Lagos, Ogun, Ondo, Delta, Bayelsa, Rivers, Akwa Ibom and ends in Cross River State. The Lagos-Calabar. The project will be implemented in stages, allowing for incremental opening of completed segments for public use. Thus, the project will start with Section 1 which is the focus of this report.

Figure 3.1 Nigeria Map showing the Coastal States of Project

b. Proposed Alignment (Section 1) of the Project

The alignment begins at **Eko Atlantic's Ahmadu Bello Road (0.0km)** and terminates at Eleko (47.5km) for the Section 1, all within Lagos, Nigeria.

The initial phase spans **47.5 kilometers**. It commences from **Victoria Island** and extends to **Eleko**. **Victoria Island**, a bustling commercial hub in Lagos, serves as the starting point. The highway then winds its way through the coastal landscape, connecting various regions. The journey culminates at **Eleko**, a strategic location known for its economic potential and development prospects.

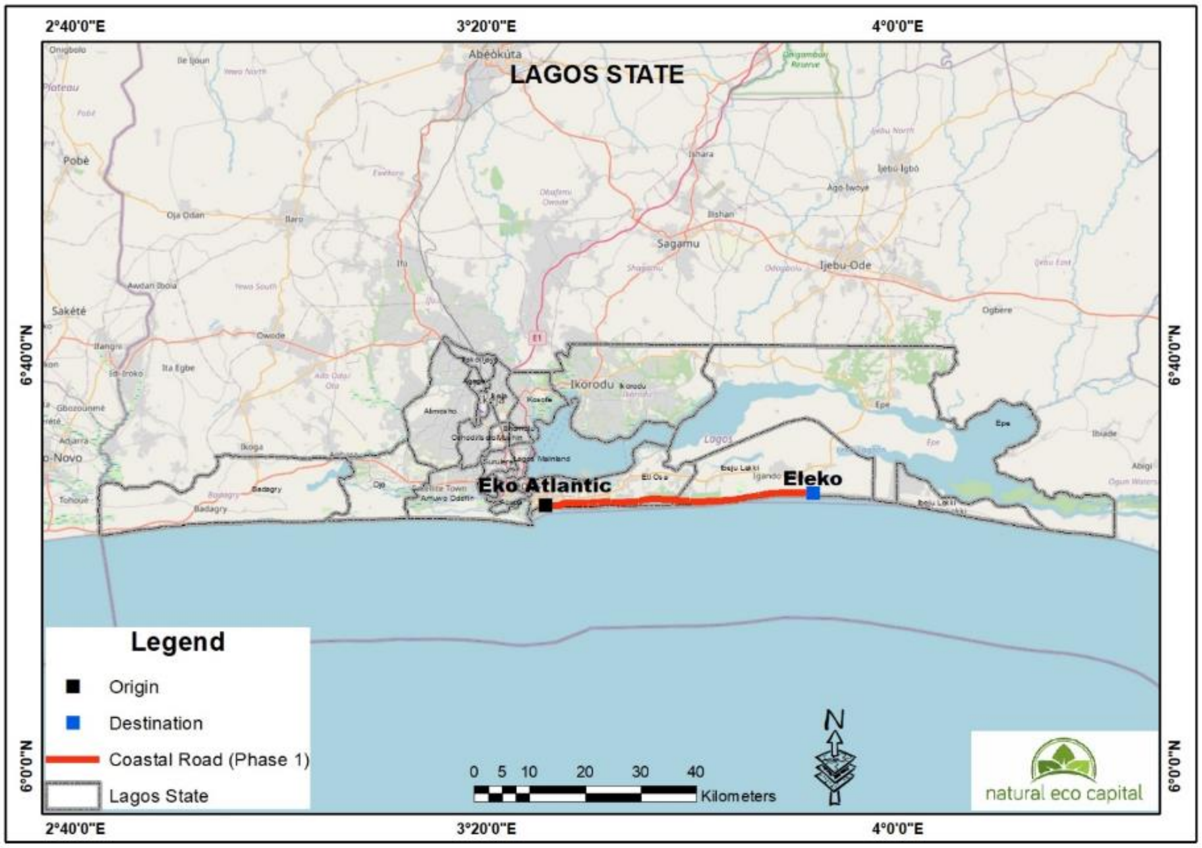


Figure 3.2 Proposed Project alignment for Section 1

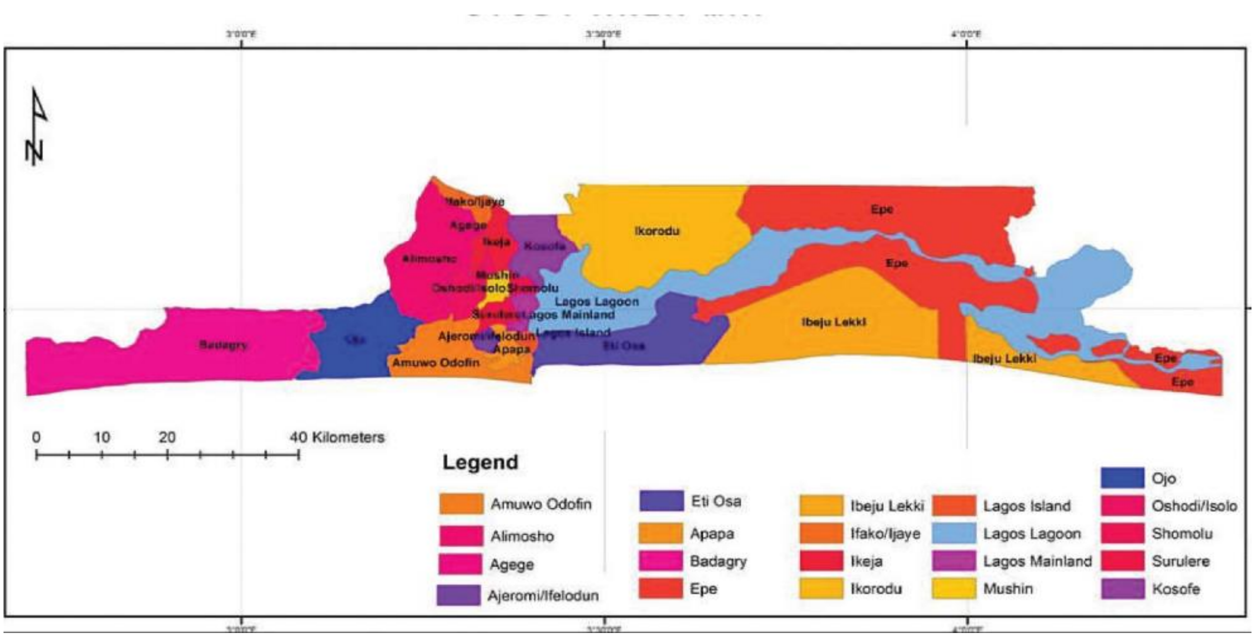


Figure 3.3 Map of Lagos showing the Local Government Areas. Source: Ministry of Physical Planning.

Project Components and Ancillary Facilities

The Project components would include the following:

- Road surface (paved or graded).

- Road reserve (“hard shoulder”).
- Crossings (e.g. bridges, culverts).
- Drainage and erosion control structures.
- Safety and security measures (e.g. barriers and fencing).
- Other elements (e.g. signage).

The ancillary facilities will include the following:

- Lay-bys or service areas.
- Temporary construction facilities (e.g. workshops, laydown areas, working corridors outside the road reserve, workers’ accommodation, and borrow pits)
- Security posts.
- Access roads within and between temporary facilities and the road being developed.
- Landscaping features, etc.

Construction activities

The following are the tasks involved in road construction:

- Establish temporary access to work areas and create clearance zones while controlling access.
- Construct temporary diversions for roads that need upgrading to manage existing traffic.
- Clear and level the corridor and perform major earthworks such as cuttings and embankments.
- Locate and develop borrow pits and quarries, and import materials like gravel, clay, and bitumen as needed.
- Source and establish a water supply from surface and/or groundwater. - Improve existing drainage and introduce new road drainage, including culverts if necessary.
- Surface and seal the carriageway, including using bitumen mixing plants where applicable.
- Build water crossings such as bridges and culverts, including concrete batching for structures.
- Establish or improve safety arrangements such as modifying camber, barriers, and sight lines.
- Perform landscaping as needed.

Other tasks include:

- Set out, reference, and take cross sections
- Clear the site and remove topsoil
- Perform earthworks.
- Construct drainage structures such as box and pipe culverts, including protection works
- Construct the pavement, which includes bitumen surfacing, cement-stabilized base, and improved material sub-base
- Ensure the safe and convenient passage of traffic through works
- Provide road furniture such as signs, guardrails, marker posts, wire fencing, etc.
- Perform ancillary operations such as constructing offices, laboratories, and staff housing, accommodation works, diversion of services, operations in quarries and borrow areas, providing water supply, and diverting existing services.

Engineering/Geometric Design

Functional, safe and contextually appropriate roadways are created by integrating geometric designs. The proposed project considered the following objectives and considerations while designing. Geometric design shapes road for drivers, vehicles and traffic behavior. It balances safety, convenience and efficiency for road users. The geometric considerations for road design were based on the following:

1. **Location** - best route considering physical constraints and terrain.
2. **Alignment -** horizontal and vertical alignment of the road.
    - **Horizontal Alignment**:
        - Determines the road's lateral position.
        - Balances safety, comfort, and efficiency for drivers.
        - Considers curves, tangents, and transitions.
    - **Vertical Alignment**:
        - Defines the road's vertical profile (elevation changes).
        - Ensures smooth transitions between different grades.
        - Considers hills, valleys, and crests.
3. **Cross Section** - width of the road, lanes, shoulders, and medians.
    - Describes the road's width, lanes, shoulders, medians, and slopes.
    - Influences safety, drainage, and aesthetics.
4. **Intersections -** safe and efficient design.
5. **Highway Types** - function of the road (urban, rural, expressway, etc.).
6. **Simplicity**: Strive for straightforward geometry within physical limitations.
7. **Safety Margin**: Ensure consistent safety margins at expected operating speeds.
8. **Adequacy and Convenience**: Provide a facility that meets user needs under anticipated traffic conditions.
9. **Stability and Sustainability**: Design for long-term stability and minimal environmental impact.
10. **Harmony with Community**: Preserve natural and cultural resources while integrating with the community.
11. **Economic Returns**: Balance costs and benefits for an economically viable project.
12. **Context-Sensitive Design (CSD)**:
    - Collaborative approach involving all stakeholders.
    - Develops transportation facilities that fit their physical settings.
    - Preserves scenic, aesthetic, historic, and environmental resources.
    - Balances safety, mobility, and community needs.

3.1.3 Road Design and Structural Standards

Methodologies and Standards

Methodologies used in pavement design, earthworks, drainage and structures are in conformity with the latest international techniques to ensure economical use of available materials and a balance between capital and maintenance costs

Standards to traffic conditions:

1. **High Traffic Volumes**:

For roads with heavy traffic, higher design standards are necessary. These standards include:

- Wider Carriageways: To accommodate more vehicles.
- Gentle Curves: Easier for vehicles to navigate.
- Flatter Vertical Gradient: Reduces steep slopes.
- Full Overtaking Distances: Allows safe passing.

2. **Low Traffic**:

Roads with lower traffic volumes can have more modest design standards. These may include narrower lanes, simpler curves, and less extensive infrastructure.

Adapting Design to terrain

1. **Flat Terrain**:
    - Contours: 0-10 five-meter contours per kilometer.
    - Characteristics: Minimal elevation changes, suitable for straightforward road alignment.
2. **Rolling Terrain**:
    - Contours: 11-25 five-meter contours per kilometer.
    - Characteristics: Gentle slopes, moderate elevation changes.
    - Design considerations: Curves and transitions to accommodate rolling landscape.
3. **Mountainous Terrain**:
    - Contours: Above 25 five-meter contours per kilometer.
    - Characteristics: Steep slopes, significant elevation variations.
    - Design challenges: Address sharp curves, steep grades, and stability.

Functional classification

Adopted it the Federal Republic of Nigeria Highway Manual guidelines for existing and future road classification as outlined below which was adopted:

1. **Road Function**:
    - Relates to the primary purpose of the road.
    - Considers travel types, trips, and service characteristics.
    - Balances mobility (speed) and land access (low speeds).
2. **Design Criteria Alignment**:
    - Once the road's function is established, appropriate design criteria can be applied.
    - These criteria encourage the intended use of the road.
3. **Design Features for Classification**:
    - **Width of Roadway**: Reflects the road's capacity and intended use.
    - **Alignment Continuity**: Consistent alignment enhances safety.
    - **Intersection Spacing**: Varies based on road function.
    - **Access Points Frequency**: Influences mobility and convenience.
    - **Building Setbacks**: Considered for safety and aesthetics.
    - **Alignment and Grade Standards**: Tailored to road function.
    - **Traffic Controls**: Reflect road hierarchy and function.

Geotechnical Design Criteria

This section presents the design basis for the foundations of various proposed road structures, pavements, site class, subsurface concrete and evaluation of liquefaction potential of top-soil layers. The **geotechnical design criteria** play a crucial role in ensuring the stability and longevity of the Lagos-Calabar Coastal superhighway.

1. **Foundation Design**:
    - Geotechnical criteria guide the design of foundations for road structures.
    - Proper foundation design ensures stability and load-bearing capacity.
2. **Pavement Design**:
    - Geotechnical considerations impact pavement thickness and material selection.
    - Adequate pavement design prevents premature deterioration.
3. **Site Class and Liquefaction Evaluation**:
    - Site classification helps assess soil behavior and seismic risks.
    - Evaluating liquefaction potential ensures safety during earthquakes.

Design Hydrology and Design Return Periods

1. **Hydrological Study**:

The purpose of the hydrological study was to compute and evaluate **peak discharges** for watercourse crossings. Key steps involved:

- **Site Observations**: Gathering data from the project site.
- **Condition Survey**: Assessing existing conditions.
- **Drainage Design Procedures**: Following guidelines from the design manual.
- **Peak Discharge Calculation**: Determining the required hydraulic opening sizes and waterway structure types.

2. **Preliminary Determination**:

Based on hydrological/hydraulic investigation and other relevant factors (such as geometric and subsurface soil properties), the **opening size** and **span** of drainage structures were preliminarily determined.

3. **Major Drainage Design**:
   - **Bridge Opening Size:**

The hydrologist's recommendation guided the determination of the bridge opening size.

- The span size was also determined based on hydrologic/hydraulic requirements.

   - **Free Board**:
     - The free board (vertical clearance above the water level) for bridge structures adheres to the Nigerian drainage design manual.

Sand Filling

The filling shall be determined based on the coastal road quantities and alignment profiling as outline in table 2.2 and Figure 2.2 – 2.5

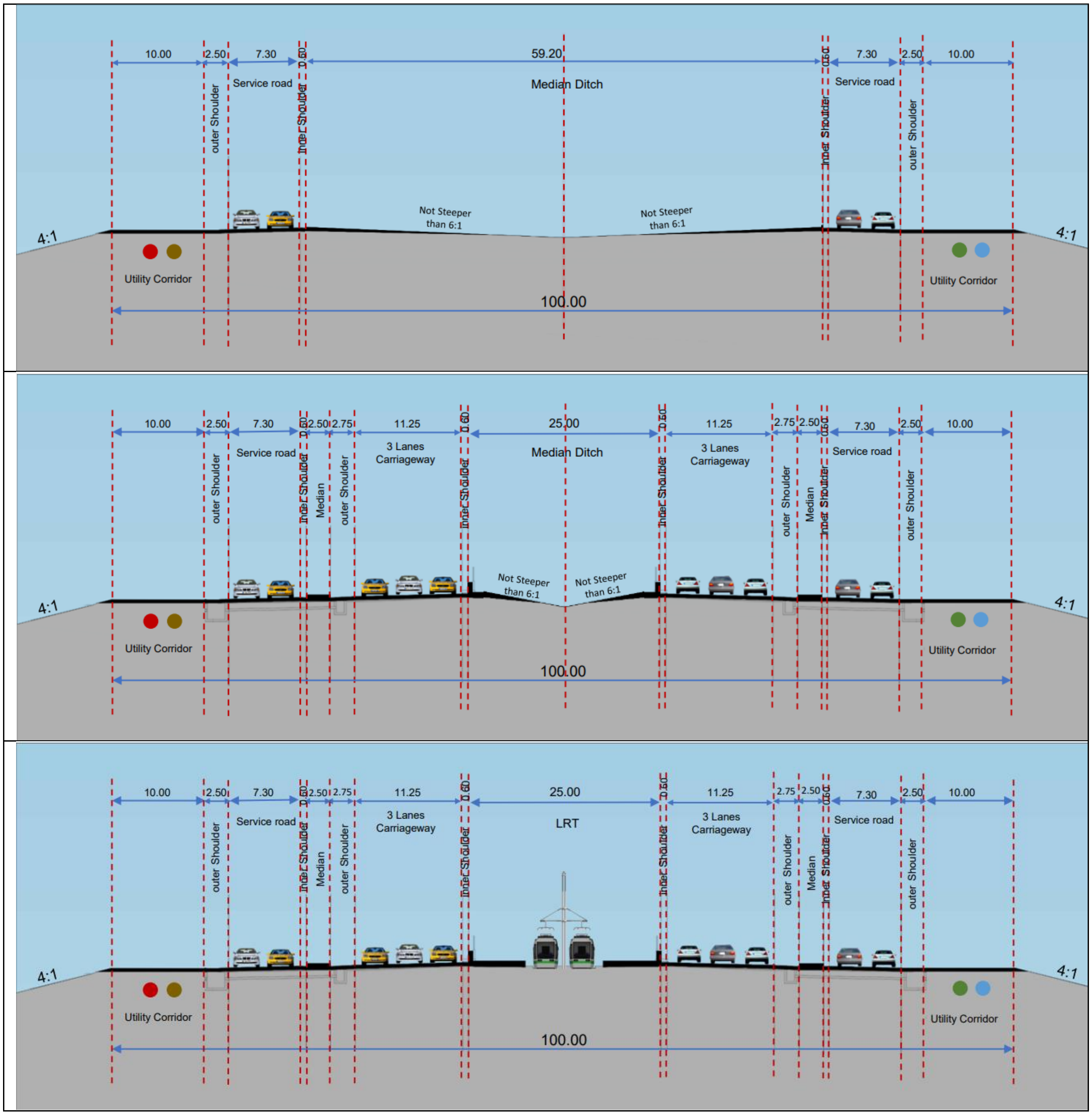
Table 3.1 Proposed Coastal Road quantities

ITEM	Unit	Quantity	NOTES
Cut	m3	4,002,058	
Fill	m3	Up to 17 million	
CRCP Service Lanes (Phase 1)	m3	290,400	2 lanes for each direction for main road (Shoulders are not paved)
Base &Subbase (Phase 1)	m3	441,600	including shoulders
CRCP Main Carriageways (Phase 2)	m3	390,000	3 lanes for each direction for main road + 2 lanes for service road (Shoulders are not paved)
Base &Subbase (Phase 2)	m3	656,640	including shoulders
Number of Streetlight	Number	2,377	
Interchanges	Number	4	

Profile and Sections

These are provided in the Figures below

Cross-Section Elements



Typical Cross Sections

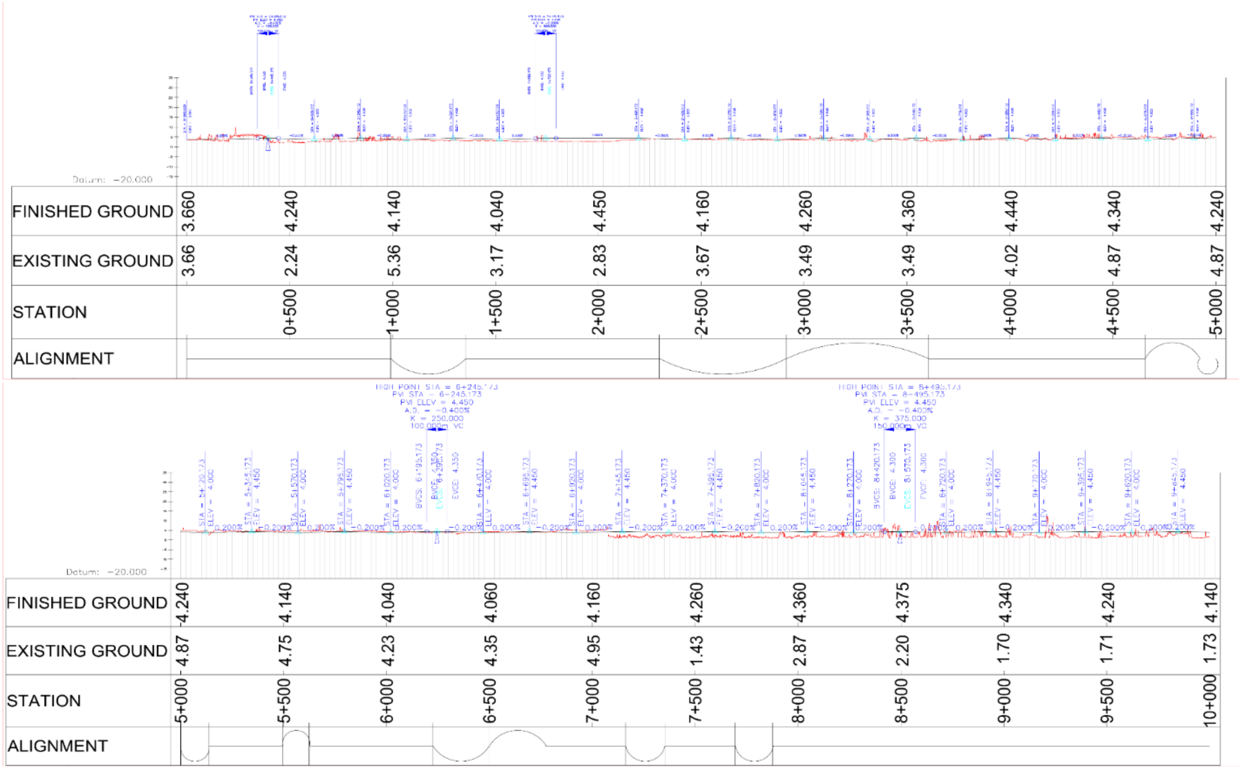


Figure 3.4: Alignment Profiling of the Proposed Coastal Road (0+500 to 10+000)

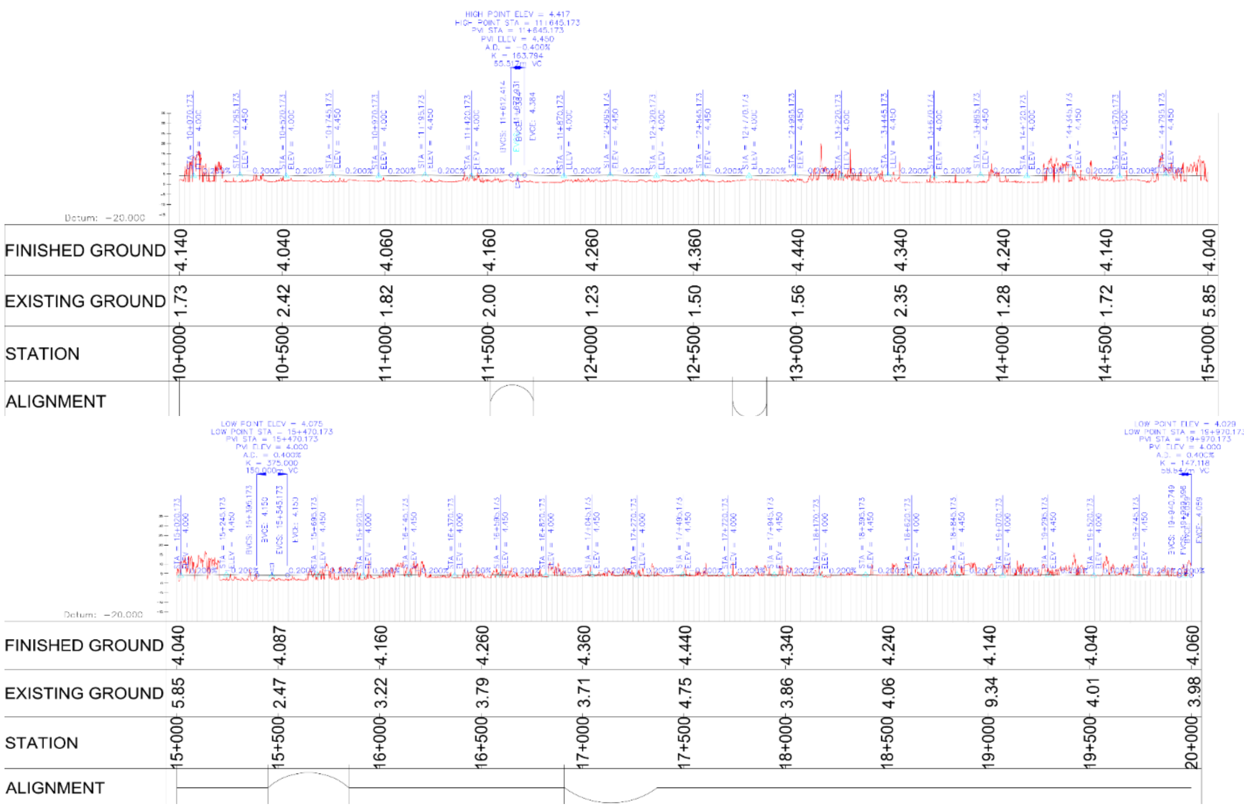


Figure 3.5: Alignment Profiling of the Proposed Coastal Road (10+000 to 20+000)

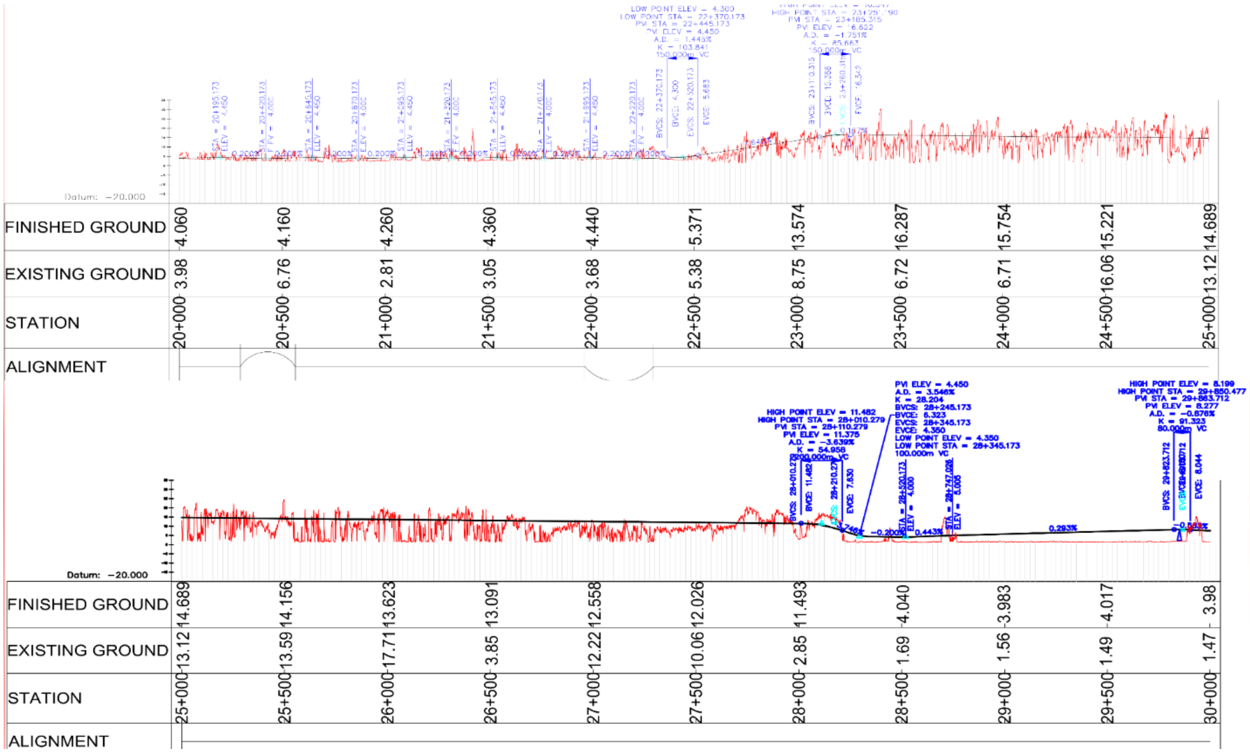


Figure 3.6: Alignment Profiling of the Proposed Coastal Road (20+000 to 30+000)

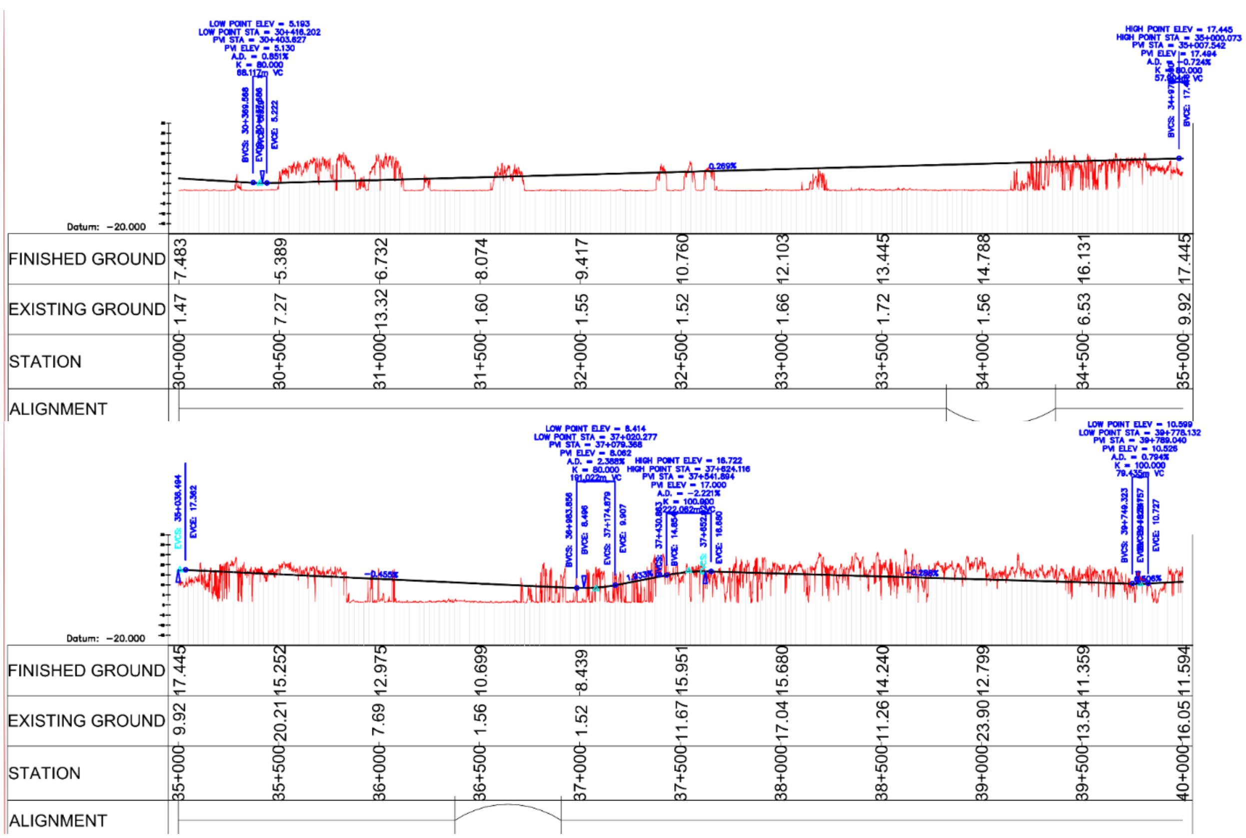


Figure 3.7: Alignment Profiling of the Proposed Coastal Road (30+000 to 40+000)

3.2.1 Description of the Coastal Road and Rail System Design Factors

Coastal rail station design

Coastal rail station design involves a delicate balance between aesthetics, functionality, and resilience. By addressing these considerations, designers create stations that enhance both travel experiences and coastal landscapes. When designing coastal rail stations, several crucial considerations come into play.

Design factors for the rail:

1. **Passenger Experience and Human-Centric Design**:

Experiential Focus: Modern rail stations prioritize passenger experience. Designers aim to create spaces that are more relaxed, cleaner, and simpler.

Efficiency and Flow: Efficient passenger flow is essential. Curved corners and clear wayfinding help travelers move comfortably without bumping into others.

2. **Transparency and Connection**:

Transparency: Coastal rail stations benefit from transparent elements like glass walls or ceilings. These allow natural light, views of the coastline, and a sense of openness.

Urban Connectivity: Stations should seamlessly connect with urban areas, integrating with other modes of transportation (buses, ferries, etc.) and nearby attractions.

3. **Thermal Comfort and Inclusiveness**:

Tropical Environment: designers must consider thermal comfort. Proper ventilation, shading, and materials play a role.

Inclusiveness: Design-for-all principles ensure that stations accommodate passengers of all abilities, including those with disabilities.

4. **Environmental Factors**:

Coastal Adaptation: Stations near the coast face unique challenges such as saltwater exposure, high winds, and potential flooding. Resilient design is crucial.

Wave Energy Dissipation: Coastal structures should dissipate wave energy to prevent erosion and damage.

Environmental Impact Assessment: Assessing the station's impact on the local ecosystem is essential.

5. **Structural Design and Geotechnical Aspects**:

Foundation Stability: Coastal soil conditions may vary. Proper geotechnical investigations ensure stable foundations.

Structural Resilience: Stations must withstand coastal weather conditions, including storms and saltwater corrosion.

6. **Maintenance and Monitoring**:

Regular Inspections: Coastal stations require frequent inspections due to exposure to salt, humidity, and wind.

Corrosion Protection: Materials and coatings should resist corrosion.

Emergency Preparedness: Coastal stations need contingency plans for extreme weather events.

3.2.2 Project Installation Details

The activities for the Installation of the Lagos-Calabar Highway shall include the following components:

3.2.2Pre Works Activities

Earthworks shall include the following:

A. SITE CLEARING

Clearing and grubbing

B. Excavation

C. Soil filling and backfilling

D. Subgrade construction

Removal Or Realignment of Obstruction and Utilities

The Project Contractor shall remove wholly or in part and dispose of all obstructions, buildings, fences, abandoned pipelines and others, as indicated on drawings or as directed by the Engineer. In some alignment on the path of the Project, and were indicated on the Drawings, utilities are to be realigned or salvaged as directed by the Engineer.

Excavation of topsoil and materials shall be a key activity.

In some cases, depending on the findings on the path, the excavation shall be for land-grading or for ground preparation as appropriate. The Excavation may be rock excavation or road excavation. The excavation operations shall be accompanied by utilization where possible or proper disposal of the excavated materials.

The above shall be followed by

ROADWORKS which shall include in this order

A. Granular subbase and base courses and subsurface drainage blanket system
B. Bituminous layers
C. Curbs, gutters, sidewalks and paved medians
D. Road signages
E. Pavement markings for traffic
F. Steel guardrail and concrete safety barrier
G. Concrete block pavement

WET UTILITIES for the Project and some general requirements to be installed shall include

A. Pipes, fittings and accessories
B. Bedding, surround, haunching, encasement and thrust blocks
C. Manholes, chambers inlets and gullies

CONCRETE AND STEEL WORKS are the major component of the Lagos- Calabar Project works to be executed and shall include:

A. Concrete and concrete mixes and testing
B. Concrete handling, placing and curing
C. Steel reinforcement and fixing
D. Forms, formwork and falsework building
E. Plain and reinforced concrete structures installation
F. Prestressed concrete construction
G. Concrete bridges & erection procedures
H. Reinforced concrete box culverts installation

Proposed Engineering Works

Pavements

Pavements are the backbone of any road infrastructure, and their design is critical to ensure durability and cost-effectiveness. To achieve this objective, the proposed project adheres to the following principles:

- Objective of Pavement Design: Our primary goal is to select an economical pavement thickness and quality of materials, limit stresses in the subgrade due to anticipated traffic loads and ensure that pavement layers remain serviceable throughout the design period.
- Design Inputs: To accomplish the objective of pavement design, we must consider the following inputs: - Design Subgrade Strength: Determines the load-bearing capacity of the subgrade. - Design Traffic Class: Considers the expected traffic volume and type. - Material Availability: Sufficient construction materials are essential.
- Pavement Thickness Design: To design the pavement thickness, we follow the Nigerian Federal Highway Manual Part 1 (2013) guidelines. We also consider the traffic catalogue (Tn) and subgrade strength catalogue (Sn). The manual accounts for experience and current country conditions. By following these principles, we can ensure that the pavement is durable, cost-effective, and can withstand the anticipated traffic loads.

Hydraulic

The hydraulic concept for the project is designed to ensure the road benefit the users and the environment. The hydraulic design of any road project is a critical aspect that needs to be carefully considered. This involves evaluating the existing hydraulic structures, such as bridges and culverts, and assessing their adequacy, economy, and sustainability. It is important to consider site conditions and design discharge to ensure that the project is effective and sustainable. When it comes to waterway design, the size of openings for drainage structures must be determined to handle flood runoff and the volume of runoff passing through watercourse crossings.

The selection of drainage structures is based on site-specific needs, taking into account factors like flow rate, water volume, and environmental impact.

Engineering Design and Nigerian Content

- **Options Selection and Project Definition Studies**:
  - These critical early-stage activities carried out entirely in Nigeria.
  - Feasibility studies, site selection, soil tests (essential for foundation design), and other preliminary data gathering conducted locally.
  - Nigerian companies will handle process study reporting, risk analysis, and preliminary engineering studies.
- **Detailed Engineering Design for General Facilities**:
  - The detailed design work for general facilities domiciled in Nigeria.
- **Fabrication**:
- **In-Country Fabrication**:
  - All fabrication work related to piles, pipe racks, and bridges (including galvanizing) will take place within Nigeria.
  - Third-party services, such as mechanical tests and certification of welding procedures and welders, will also be carried out locally.

        - The relevant Nigerian Institute, in collaboration with international accreditation bodies, will certify these tests.

- **Construction**:
    - **Site Preparation and Infrastructural Development**:
        - Nigerian companies will be responsible for site preparation and developing necessary infrastructure.
    - **Civil/Structural, Piping, and Mechanical Construction**:
        - Competent Nigerian companies (or their foreign affiliates) will handle civil/structural, piping, and mechanical construction.

- **Selection of Contractors and Vendors**:
    - The Federal Government is committed to empowering more Nigerians and Nigerian companies. Ensure services that can be effectively carried out by Nigerian vendors, either independently or in collaboration with other companies.
    - Ensure **Quality Assurance through** Bids maximizing local content without compromising job quality will be prioritized.
    - Give **Financial Consideration** for Bids within 1% of the best commercial qualifying bid will receive special attention.
- **Fabrication of Structural Fittings**:
    - **Local Service Companies and Mills**:
        - Leveraging existing local resources, 45% of pipe spools will be sourced from within Nigeria.

3.2.3 Outdoor and Road Lighting Installations

The proposed project will ensure proper planning, design, and execution of critical components that include electricity. Designing a solar road lighting system involves several critical components and considerations. A well-designed solar road lighting system can significantly reduce energy costs, enhance safety, and contribute to sustainable infrastructure

The following key aspects have been taken into consideration:

1. **Outdoor and Road Lighting Installations**:
    - This includes the installation of luminaires (light fixtures) along the roadways and outdoor areas.
    - Luminaires are essential for providing visibility and safety during nighttime or low-light conditions.
    - Proper placement and design of these fixtures are crucial to ensure effective illumination.
2. **Earthing**:
    - Earthing (also known as grounding) involves connecting electrical systems to the ground to prevent electrical hazards.
    - It ensures safety by dissipating fault currents and preventing electric shock.
    - Proper earthing is essential for road lighting systems to protect against lightning strikes and other electrical faults.
3. **Builder's Works**:

- Builder's works refer to the construction activities necessary for the successful implementation of the project.
- In this context, it includes tasks such as:
  - Column foundations: Constructing stable foundations for lighting columns.
  - Cable pits: Excavating and installing pits for cable management.
  - Cable trenches: Creating pathways for electrical cables.
  - Ductwork: Installing conduits or ducts for cable routing.

4. **Testing and Additional Requirements**:
   - Rigorous testing and commissioning are essential to ensure that the lighting system operates as intended.
   - Compliance with safety standards and regulations is crucial.
   - Additional requirements may include specific performance criteria, energy efficiency, and maintenance guidelines.
5. **Electrical Installation Equipment Data**:
   - This involves documenting details about the electrical equipment used, including specifications, ratings, and installation locations.
   - Proper record-keeping facilitates maintenance and future upgrades.
6. **Rehabilitation of Existing Utilities**:
   - If there are existing electrical and telecom utilities along the Lagos-Calabar Superhighway, they may need relocation or removal.
   - This ensures that the new lighting system can be seamlessly integrated without disrupting existing infrastructure.
7. **Road Crossing Ducts/Service Ducts**:
   - These ducts are designed for future expansion of the electrical and telecom network.
   - The specified dimensions (4x160mm for electrical and 4x110mm for telecom) indicate the size of the ducts.
   - They allow for the installation of additional cables or fiber optics as needed.
8. **LED Luminaires**:
   - LED luminaires are energy-efficient light fixtures that use light-emitting diodes (LEDs) as the light source.
   - Compliance with standards such as BS EN62722-1, BS-EN62722-2-1, BS EN13032-4, and IEC60598 ensures quality and performance.
   - LED luminaires offer benefits like longer lifespan, reduced energy consumption, and better color rendering.
9. **Photovoltaic (PV) Panel/Modules and Mounting Structure**:
   - PV panels (solar panels) capture sunlight and convert it into electricity.
   - Proper mounting structures ensure optimal positioning for maximum solar energy absorption.
   - The panels should withstand environmental conditions, including UV exposure and temperature variations.
10. **Charge Controller**:
    - The charge controller regulates the charging and discharging of batteries connected to the PV panels.
    - It prevents overcharging and ensures efficient battery management.

11. **Converter (Inverter)**:
    - The converter (inverter) converts the direct current (DC) generated by the PV panels into alternating current (AC) for powering the LED luminaires.
    - It must be reliable and efficient.
12. **Batteries and Enclosures**:
    - Batteries store excess energy generated during the day for nighttime operation.
    - Enclosures protect batteries from environmental factors and ensure safety.
13. **Interconnecting Wires and Cables**:
    - High-quality wires and cables connect all components, including PV panels, charge controllers, batteries, and luminaires.
    - Proper sizing and insulation are crucial for minimizing energy losses.
14. **Lighting Columns**:
    - Concrete columns with double brackets provide structural support for mounting LED luminaires.
    - The design should consider wind loads, aesthetics, and ease of maintenance.
15. **Environmental Conditions**:
    - The system must withstand high temperatures (up to 40°C) and humidity (100%) during direct sunlight exposure.
    - UV resistance is essential due to the high content of ultraviolet rays.
16. **Qualified Installation**:
    - Qualified personnel would handle the installation to ensure safety and compliance.
    - Integration with other works (such as road construction) is crucial for seamless operation.
17. **Local Codes and Regulations**:
    - Adherence to local codes of practice, power authority regulations, and international standards is essential.
    - Confirm system earthing requirements with the local power authority.

3.2.4 EARTHING SYSTEM

Proper earthing and bonding are critical for electrical safety. Compliance with local codes, regulations, and international standards is essential. The essential aspects of earthing and equipotential bonding in electrical installations:

1. **Main Earthing Terminals or Bars**:
    - These serve as central points for connecting all earthing conductors.
    - The main earthing terminal (MET) or earthing bar provides a low-resistance path to the ground.
    - It ensures that fault currents are safely directed away from electrical equipment and structures.
2. **Exposed Conductive Parts of Electrical Equipment**:
    - Exposed conductive parts include metal enclosures, frames, and other components of electrical equipment.
    - These parts must be effectively earthed to prevent electric shock hazards.
    - Proper earthing ensures that any fault current flows directly to the ground, minimizing the risk to users.
3. **Extraneous Conductive Parts**:

   - Extraneous conductive parts refer to metallic elements that are not part of the electrical system but can become energized during faults.
   - Examples include metal pipes, ducts, and structural elements.
   - Bonding these parts to the earth ensures that they remain at the same potential as the equipment, reducing the risk of electric shock.
4. **TN-S System Arrangement**:
   - The TN-S system is a common earthing arrangement.
   - In this system:
     - "T" stands for "terre" (earth), indicating that the neutral (N) and earth (E) are separate.
     - "N" is the neutral conductor.
     - "S" represents the protective earth (ground) conductor.
   - The TN-S system ensures that the neutral and earth are distinct, enhancing safety.

Construction Method and Materials (new placement)

- **Design Considerations**:
  - The project aims to utilize all available technology and resources.
  - Key factors include **simple techniques**, readily available construction materials, and efficient labor input.
- **Structural Materials**:
  - **Reinforced Concrete (RC)**:
    - All superstructural and substructural elements will be constructed using reinforced concrete.
  - **Reinforcement Steel**:
    - Grade 60 reinforcement steel for bars with a diameter equal to or greater than 20mm.
    - Grade 40 steel for bars with a diameter less than 20mm.
    - Minimum yield strength: 420MPa for grade 60 and 300MPa for grade 40.
    - Minimum clear cover for reinforcing bars will be as recommended and shown on drawings.

- **Concrete**:
  - **Superstructure**:
    - Design parameters for C-30 concrete will be used in structural computations.
    - Compressive strength: 30MPa for 150mm cube samples and 25MPa for 150mm cylindrical samples.
  - **Substructure (Plain Concrete Leveling)**:
    - C-15 class of concrete will be used.
    - Compressive strength: 15MPa for 200mm cube samples and 10MPa for 150mm cylindrical samples.
    - These parameters are specified in design drawings and technical specifications for attainment during the construction stage.
- **Resistance Factors**:
  - To account for imperfections in production, resistance factors are recommended.

- Appropriate factors for shear and bending moment of structural components were considered during the design phase.

Independent Verification and Certification

By involving independent experts, the project aims for excellence, safety, and adherence to standards. The commitment to **independent verification and certification** is crucial for ensuring the quality and compliance of the Lagos coastal road project.

1. **Third-Party Experts**:
    - The **Federal Ministry of Works** will engage independent third-party experts.
    - Their role is to **witness, audit, and participate** in all project aspects.
    - These experts will verify that the engineering work aligns with relevant **international and national codes and standards**.
2. **Scope of Verification**:
    - The verification process covers various stages:
        - **Design**: Ensuring the project design meets quality standards.
        - **Fabrication**: Verifying the quality of materials and components.
        - **Installation**: Checking proper installation procedures.
        - **Pre-commissioning**: Ensuring readiness for operational use.
        - **Handover**: Validating compliance during project handover.
3. **Surveillance and Verification**:
    - **Manufacture, Fabrication, and Installation**:
        - Surveillance activities will monitor these critical phases.
        - A third party, in collaboration with **State Government representation**, will oversee the process.
        - This approach enhances transparency and accountability.

3.3 Project Phases

A comprehensive and well-articulated phased approach ensures a well-executed project with lasting benefits for stakeholders. Hence the articulated project phases plan is outlined below:

Mobilization or Pre-construction Phase:

The activities during this phase include:

- **Project Components Assessment**:
    - Evaluate the road design, including road surface specifications, crossings (bridges, culverts), drainage structures, and safety features.
    - Identify the road reserve ("hard shoulder") and other necessary elements (signage, lighting).
- **Ancillary Facilities Planning**:
    - Plan lay-bys or service areas for rest stops and maintenance.
    - Establish temporary construction facilities (workshops, laydown areas, workers' accommodation).
    - Determine security post locations.
    - Design access roads within and between temporary facilities and the road being developed.
    - Consider landscaping features for aesthetics and environmental impact.

- **Key Activities Include**:
  - **Planning**: Detailed project planning takes place.
  - **Feasibility Study & Engineering Design**: Assessing technical feasibility and designing the road.
  - **Procurement of Works**: Acquiring necessary materials and services.
  - **Securing Bonds & Insurances**: Ensuring financial security.
  - **Land Acquisition & Clearing**: Obtaining land rights and clearing the construction site.
  - **Worksite Organization**: Setting up camps, workshops, and schedules.
  - **Resource Allocation**: Identifying and organizing essential resources.
  - **Land Dispossession & Property Evaluation**: Addressing land ownership changes.
  - **Relocation & Compensation Arrangements**: Managing affected communities.

3.3.1 Construction Phase:

The heart of the project is where physical construction occurs. The activities during this phase include:

- **Earthworks and Clearing**:
- Clear the construction site and remove topsoil.
- Perform major earthworks, including cuttings and embankments.
- **Materials Sourcing and Import**:
- Locate and develop borrow pits and quarries.
- Import materials such as gravel, clay, and bitumen.
- **Infrastructure Installation**:
- Establish water supply from surface and/or groundwater.
- Improve existing drainage and introduce new road drainage (culverts if needed).
- Surface and seal the carriageway using bitumen mixing plants.
- Construct water crossings (bridges, culverts).
- Enhance safety arrangements (modify camber, barriers, sight lines).
- Perform landscaping as needed.
- **Monitoring and Quality Control**:
- Set out, reference, and take cross sections.
- Monitor construction progress and adherence to specifications.
- **Other Tasks Include**:
- Scarification of Failed Sections: Repairing damaged road segments.
- Stone Base Provision: Laying a stable foundation.
- Prime Coat Application: Preparing the surface for asphalt.
- Asphalt Overlay/Construction: Paving the road.
- Shoulder Reinstatement: Ensuring proper road edges.
- Concrete Lined Drains & Earth Drains Construction: Managing water flow.
- Bridge Construction & Maintenance: Building bridges along the route.
- Dredging, Excavation, De-watering, and Sand filling: Preparing the terrain.
- Crushed Stone Base Placement: Creating a solid base.
- Cement Stabilization of Base Course: Strengthening the foundation.

- **Closure of Construction Phase**:
- The final steps before operational use.
- Focus on quality roads and environmentally responsible site management.

3.3.2 Operation and Maintenance Phase:

After construction, the road becomes operational, meeting transportation needs of the communities and various stakeholders. Toll collection may begin to recoup the investment. Regular monitoring and maintenance to ensure sustainability shall be implemented. During the operation phase, road maintenance shall be prioritized to ensure safety, functionality, and longevity.
The key considerations in this phase shall include:

- **Regular Inspections**:
  - Scheduled inspections to assess road conditions, identifying areas needing attention.
  - Focus on high-traffic sections, vulnerable spots (such as bridges), and safety features (signage, barriers).
- **Emergency Repairs**:
  - Address urgent issues promptly, such as potholes, damaged guardrails, or collapsed drainage structures.
  - Emergency repairs prevent accidents and minimize disruptions.
- **Routine Maintenance**:
  - Regularly clean debris, remove vegetation, and repair minor defects.
  - Maintain road markings, signs, and lighting for visibility and safety.
- **Pavement Management**:
  - Prioritize pavement rehabilitation based on condition assessments.
  - Address cracks, rutting, and surface distress to prevent further deterioration.
- **Drainage Systems**:
  - Keep drains clear to prevent water accumulation and erosion.
  - Address clogged culverts and blocked ditches.
- **Safety Features**:
  - Ensure guardrails, crash barriers, and reflective markers are intact.
  - Repair damaged safety elements promptly.
- **Budget Allocation**:
  - Allocate funds based on critical needs and available resources.
  - Balance preventive maintenance with reactive repairs.
- **Community Feedback**:
  - Engage with road users and local communities.
  - Address reported issues promptly.
- **Performance Metrics**:
  - Monitor road performance (ride quality, skid resistance, load-bearing capacity).
  - Use data to prioritize maintenance tasks.
- **Long-Term Planning**:

Plan for major rehabilitation or reconstruction cycles.

  - Consider life-cycle costs and sustainability.

3.3.3 Decommissioning Phase:

While unlikely, if decommissioning occurs, it will involve **upgrading or rehabilitation** rather than abandonment. The focus is on **maintaining and improving** the road rather than dismantling it.

- **Specific Actions**:
  - **Temporary Facilities Decommissioning**:
    - Close down temporary facilities such as workshops, laydown areas, and workers' accommodations.
    - Ensure proper removal of equipment and materials.
  - **Restoration of Disturbed Areas**:
    - Restore any land disturbed during construction to its natural state.
    - Replant vegetation, stabilize slopes, and address erosion.
  - **Project Evaluation**:
    - Evaluate the overall success of the project.

3.3.4 Project Resources

3.3.5Mechanized Equipment and Types

The fleet of mechanical equipment required for the project and the technical specifications of the batching plant:

1. **Fleet of Mechanical Equipment**:
   - The project will utilize a range of heavy construction equipment to facilitate various tasks.
   - These equipment types include excavators, bulldozers, cranes, loaders, and more.
   - Each machine serves a specific purpose in construction, such as earthmoving, lifting, or material handling.

The list of the fleet of mechanical equipment to be used for the construction phase of the project is presented in the Table below:

Table 3.3 List of Fleet of mechanical Equipment and Usage

S/N	DESCRIPTION	TYPE	SUPPLIER	USAGE	QTY
1	CAT DOZER D6GC LGP New	CAT	CAT	*CLEARING*	3
2	Volvo Excavator 350	Volvo	Volvo	*Clearing*	7
3	Volvo Dumper A40	Volvo	Volvo	*Clearing*	2
4	Volvo Dumper A45	Volvo	Volvo	*Clearing*	5
5	Soil Compactor Roller 21t Ca 610p/Dyna	Dyna	Dyna	*Layerworks*	1
6	Soil Compactor Roller 12t/Dyna Ca25p	Dyna	Dyna	*Layerworks*	8
7	Volvo Dump Truck Water Tanker 25,000 Lt	Volvo	Volvo	*Layerworks*	8
8	Sino Water Tanker 6x4 Cng , 20,000l	Sino	Sino	*Layerworks*	6
9	Sino Tractor 6x4 Cng	Sino	Sino	*Steel Supply*	14
10	Flatbed 3 Axle 50t	Sino	Sino	*Steel Supply*	13

11	Sino Transit Mixers Cimc 9cub Cng	Sino	Sino	*Kerbing And Barrires*	24
12	GRADER SDLG 9290-23t/20.5x25	SDLG	SDLG	*LAYERWORKS*	4
13	Pneumatic Roller 24t/Dyna Cp275	Dyna	Dyna	*Layerworks*	3
14	Wirtgen Wr 240	Wirtgen	Wirtgen	*Crcp*	2
15	Wirtgen Sp25	Wirtgen	Wirtgen	*Barrier And Kerb*	3
16	Wirtgen Paver Sp124	Wirtgen	Wirtgen	*Crcp*	2
17	Wirtgen Tcm 180	Wirtgen	Wirtgen	*Crcp*	2
18	Wirtgen Concrete Placer Wsp 102	Wirtgen	Wirtgen	*Crcp*	2
19	Writgen Darin Mold	Wirtgen	Wirtgen	*Crcp*	
20	Writgen Jersey Mold	Wirtgen	Wirtgen	*Barrier*	2
21	Writgen Curb Mold	Wirtgen	Wirtgen	*Curb*	2
22	Writgen Insert Mold	Wirtgen	Wirtgen	*Insert*	1
23	MAN Truck 6x6 Cement Spreader	MAN	MAN	*LAYERWORKS*	2
24	Sino Tipper 8x4 21 Cub Cng	Sino	Sino	*Layerworks*	40
25	Xcmg Crane 30 Tones Rough Terrain	Xcmg	Xcmg	*Steel Lifting*	2
26	Hi-Up 15t 6x4 Sino/ Xcmg /Cng	Sino	Sino	*Transport Steel*	1
27	Sino Tar Boiler 10,000ltrs	Sino	Sino	*Prime Layer*	1
28	Bobcat Skidteer	Bobcat	Bobcat	*Prime Layer*	4
29	Bobcat Angle Broom 173cm	Bobcat	Bobcat	*Brooming Prime Layer*	4
30	MOBILE BATCH PLANT SPANOS 135m3	SPANOS	SPANOS	*SUPPLY OF CONCRETE*	4
31	Mobile Horizontal Silos 80t	SPANOS	SPANOS	*SUPPLY OF CONCRETE*	12
32	Volvo Payloaders L120gz	Volvo	Volvo	*Supply Of Stone To Batch Plant*	4
33	Jcb/Tlb	Volvo	Volvo	*Backfilling*	4
34	Mikasa Walkbehind Roller	Mikasa	Mikasa	*Backfilling*	2
35	Pick Up Toyota Hilux	Toyota	Toyota	*Transport*	8
36	Sino 4x2 Diesel Tanker 15,000 Ltrs	Sino	Sino	*Layerworks*	1
37	Diesel Tanker Bowsers	Sino	Sino	*Supply Of Diesel On Site*	1
38	Volvo Fm4x2 Complete Mobile Workshop	Sino	Sino	*Maintenance Machines On Site*	1
38	Light Truck	Tata	Tata	*Transport Goods*	2

39	Low Bed	Sino	Sino	*Transport Heavy Machinery*	1
40	Generator 250 Kva Night Shift	Cat	Cat	*Batchplant Supply And Offices*	3
46	Tower Lights	Cat	Cat	*Temporary Lighting*	6

2. **Technical Specifications of the Batching Plant**:
    - The batching plant is a critical component for concrete production.

The specific technical details for the batching plant are presented below:

1. ***equipment using this table below (remove what is irrelevant)***

S/N	DESCRIPTION	TYPE	SUPPLIER	USAGE	QTY
1	Batching Plant 135 M3/H	SPANOS	SPANOS	CONCRETE	4
2	Batching Plant Aggregate Pre-Feeding Belts (Radial Type)	PAYLOADER	VOLVO	SUPPLY AGGREGATE	4
3	Batching Plant Silos	SPANOS	SPANOS	CONCRETE	12
4	Water Chiller System: Icw180 For Batching Plant - 15 M3/Hour				
5	Cement Air Compressor Electrical (Offloading From Bulk Truck)				

2. **Specific technical details for the batching plant:**
    i. Model: ……SPANOS 135 M3………………………………………………….
    ii. Capacity ………1080 M3 PER DAY…………………………………………….
    iii. Mixer Type: ……DRUM TYPE ………………………………………………….
    iv. Mixer Capacity (Compacted Concrete) …3 M3……cubic meters per cycle
    v. Mixer Power: ……300………kW
    vi. Aggregate Hoisting Machine: ………………………………………………….
    vii. Belt Conveyor: ……………………………………………………….
    viii. Water Pump: …TEMPAX…………………………………………………….
    ix. Cement Weighing Capacity:2000 KG…………….
    x. Water Weighing Capacity: 1000 LITERS……………………………………….
    xi. Additive Weighing Capacity: …105 LITERS…………………
    xii. Cement Screw Conveyor: …………………………………………………….

Materials Management

Managing material acquisition efficiently is crucial for construction projects. In fact, efficient material acquisition and storage contribute to smooth project execution and cost-effectiveness. The type of materials and volumes of materials required for project briefly described below:

1. **Storage and Usage**:
    - Materials will be stored at the **General Support Yard** until they are used for both **concrete production** and **construction site activities**.
    - This approach ensures proper inventory management and timely availability.

2. **Local Sourcing**:
    - The materials will be **locally sourced** from different quarries and suppliers in the region.
    - Local procurement reduces transportation costs and supports the regional economy.
3. **Volume Estimates**:
    - The table below provides an overview of the estimated volumes of materials required for the project.
    - These materials include aggregates, cement, water, and other essential components.

Table 3.4 Volumes of materials required

Materials	Quantity (tons)	Volume (m^3)	Supplier	Supplier Location
Pipes 600 Dia	80218	No	Hitech	Eko Atlantic Eko Ekete
Pipes 900 Dia	2250	No	Hitech	Eko Atlantic Eko Ekete
Steel Reinforcement	58459	Tons	African Foundaries	Ibadan
Cement (Bulk)	463,766.61	Tons	Dangote	Ibadan
Cement (Bags)				
Granite	622,542.93	Tons	Ratcon	Ibadan
Sand (for Concrete)	451,035.20	m^3	Local Suppliers	Epe
Sand (for Stabilized Filling)	488,838.42	m^3	Local Suppliers	Epe
Sand (Filling)	15,919,683.73	m^3	Local Suppliers	Epe
Stone Base	488,838	m^3	Ratcon	Ibadan

Table 2 Material transport

Material Transported	Location (from where to where	Tons	Average Truck/Vessel capacity	Frequency
Concrete	Eko Akete to site	2479464.00 tons	40 ton	4 times per day
Reinforcement Steel -	African Foundries	58459 tons	30 ton	3 times per day
Sand and stone base for filling –	Eko Akete	31839367.00 tons	40 ton	5 times per day
Bulk Cement Delivery Supplier	Dangote	463,766.61 tons	30 ton	1 per day
Stone Base – Quarry X to General Storage Yard	Ratcon	1173211.00 ton	45 ton	1 per day
Diesel		9,337,885.97	30000 liters	1 per day

		Liters		
Offshore	Dredging International	26000.00 tons	26 000 ton	4 times per day
Please, provide				

3.3.6 Traffic Management

During the construction period, managing project traffic is crucial to ensure safety, efficiency, and minimal disruption. Some key aspects related to project traffic management include:

1. **Delivery and Removal of Mechanized Fleet**:
    - The movement of mechanized equipment (such as excavators, cranes, and bulldozers) to and from the project location is essential.
    - Proper coordination ensures timely delivery and efficient removal.
2. **Operation of Mechanized Fleet Along the Alignment**:
    - While construction is ongoing, the mechanized fleet operates within and along the alignment.
    - Traffic control measures are necessary to prevent conflicts with other vehicles and pedestrians.
3. **Raw Material Delivery to Batching Plant and Construction Site**:
    - Raw materials (such as aggregates, cement, and water) are delivered from supplier sources to the **batching plant**.
    - Upon concrete production, these materials are transported to the **construction site**.
4. **Dredging of Sand from the Sea for Alignment Filling**:
    - Dredging involves extracting sand from the sea to fill the alignment.
    - Proper traffic management ensures safe movement of dredging equipment and trucks.
5. **Material Supply Vehicles**:
    - Heavy motor vehicles (dump trucks, cement trucks, water tankers, flatbeds, barges, and tugboats) are used for material supply.
    - These vehicles traverse between material sources and points of use (such as batching plants and construction sites).
6. **Onshore and Offshore Material Supply Traffic**:
    - The primary material supply traffic occurs between **ancillary sites** (support yards) and the **construction site**.
    - Both onshore and offshore transportation routes are considered.

In summary, effective traffic management shall be ensured to minimizes disruptions, ensures safety, and supports smooth project operations.

3.3.7 Raw Materials and Hazardous Materials

Raw Materials

These include:

- **Fine-grained soil**: Used for roadbed preparation and stabilization.
- **Gravel**: Essential for road base layers and drainage.
- **Blocks**: Used in structures like retaining walls and bridges.
- **Laterite**: A locally available material used for road construction.

These raw materials form the **building blocks** of the road.

The sand for filling shall be **sourced from the Atlantic Ocean/sea**. Proper sourcing and utilization of these materials contribute to efficient and sustainable construction.

Table 3.5 Estimated Quantities of Materials

ITEM	Unit	Quantity	NOTES
Cut	m3	4,002,058	
Fill	m3	Up to 17 million	
CRCP Service Lanes (Phase 1)	m3	290,400	2 lanes for each direction for main road (Shoulders are not paved)
Base &Subbase (Phase 1)	m3	441,600	icluding shoulders
CRCP Main Carriageways (Phase 2)	m3	390,000	3 lanes for each direction for main road + 2 lanes for service road (Shoulders are not paved)
Base &Subbase (Phase 2)	m3	656,640	including shoulders
Number of Streetlight	Number	2,377	
Interchanges	Number	4	

Hazardous Materials

The storage and management of fuel and lubricants during the construction and operation phases of the project would include:

1. **Fuel and Lubricant Storage**:
    - The operation of mechanized equipment requires the use of **fuel (diesel and petrol)** and **lubricants (oils and greases)**.
    - These materials will be stored in the **General Support Yard**.
    - Specifically:
        - **Oils and Greases**: These will be supplied by an oil distributor in drums and stored in a designated container.
        - **Refueling Tanker**: The refueling tanker will be refilled at a tank located in the General Support Yard.
        - The installation of this tank meets the supplier's criteria, including **retention tank** requirements for fire safety.

3.3.8 Materials Supply -Local Content and Sourcing

Local content and sourcing for the project are considered essential for achieving the project outcomes. Integrating local resources and suppliers contributes to sustainable development and community engagement.

1. **Local Content**:
- Utilizing local resources, expertise, and labor fosters community involvement and economic development.
- When local communities participate in the project, it creates jobs and supports livelihoods.
- Local suppliers play a crucial role by providing materials and services.
- Overall, promoting local content strengthens the regional economy.

2. **Local Sourcing**:
- The project prioritizes sourcing materials locally within Nigeria.
- While local sourcing is emphasized, trans-state movement may occur based on specific material needs.
- Materials like crushed rock, gravel, sand, and clay are essential for road construction.

- By sourcing locally, the project reduces transportation costs and supports local industries.

3.3.9 Water Management and Supply

Water is vital for various construction activities, including:

- Concrete preparation: Water is a key ingredient in concrete mixing.
- Dust control: Water helps suppress dust during construction, improving air quality.
- Cooling machinery: Water is used to cool equipment and prevent overheating.

Water supply and management is crucial for the construction project, especially in Lagos with varying water availability.

Outline below are the potential water needs/uses of the project

1. **Sources of Water Supply:**
    - **Boreholes**: Boreholes will be drilled at the **General Support Yard** to meet the project's water needs.
    - **Storage**: Pumped water will be stored in dedicated tanks.
    - **Quality Assurance**: Water analysis campaigns will ensure its **potability** and suitability for concrete manufacturing.
    - **Monitoring**: Groundwater levels and quality will be monitored at abstraction points.
2. **Drinking Water**:
    - The daily demand for **drinking water** at the support yard and sites is 5000 **liters** for the workforce.
    - Water treatment plants, including **sedimentation**, **rapid sand filters**, and **disinfection stages**, will ensure water quality and supply for the workforce.

The water demand for various project activities:

1. **Concrete Batching Plant**:
    - The concrete batching plant requires 200,000 **cubic meters per day** for mixing concrete.
    - Water is essential for the hydration process during concrete production.
2. **Batching Plant Cleaning and Maintenance**:
    - Cleaning and maintaining the batching plant consume 100,000 **cubic meters per day**.
    - Proper cleaning ensures efficient operation and prevents material buildup.
3. **Workforce Facilities and Offices**:
    - The workforce facilities and offices need 3492 **cubic meters per day** for drinking, sanitation, and other purposes.
    - Providing clean water for personnel is essential for their well-being.
4. **Site Activities (Sand Compaction, Cleaning Rig, and Concrete Curing)**:
    - Sand compaction, rig cleaning, and concrete curing activities require **1,230 cubic meters per day**.
    - These processes contribute to construction quality and safety.
5. **Water Usage Estimate**:
    - Based on a total of **site workers**, the estimated water supply is **20952 cubic meters per day**.
    - **Sewage generation** is estimated at **2 %**, approximately **1,880 cubic meters per day**.

The project's water management plan will ensure sustainable practices, efficient water use, and environmental responsibility.

Energy Supply

In Lagos, Nigeria, electricity supply can be **unreliable**, characterized by frequent power outages and fluctuations. The national grid, operated by the government-owned **Transmission Company of Nigeria (TCN)**, faces challenges in meeting the high-capacity energy demands of Lagos, Africa's largest city.

Some key points regarding the electricity situation in Lagos which are have been considered in the project:

1. **Power Grid Challenges**:
    - The national power grid experiences frequent **grid collapses**, leading to blackouts.
    - In July 2022, the grid collapsed for the sixth time in seven months, resulting in significant power disruptions in Lagos[1].
2. **Energy Poverty**:
    - Lagos, with its population boom, faces **energy poverty** due to inadequate power supply.
    - Even well-off neighborhoods experience power reductions during maintenance or grid failures.
3. **Privatization Challenges**:
    - The 2013 privatization of the electricity market did not yield the desired results.
    - Consumers complain about paying high electricity bills while receiving insufficient power[1].
4. **Backup Diesel Generators**:
    - Given the unreliable grid supply, having **backup diesel generators** for Ancillary Sites is crucial.
    - These generators ensure uninterrupted operations, especially during critical construction activities.

Table 3 Characteristics of diesel generators

Location	Diesel Generator				
	Capacity	Type	age	duration to run/month	Other information please add
Support Yard/ Lay down Yard	400kVA	4		953days	

Workforce and Subcontractors Management

Managing the project workforce efficiently is crucial for successful project execution. The breakdown of the workforce requirements and skill levels for the proposed project are outlined below:

1. **Direct Labor**:
    - The project aims to employ a total of **1000 people** for direct labor.
    - This includes:

  - **300 Specialists**: Highly skilled professionals with expertise in specific areas.
  - **400 Tradesmen**: Skilled workers in various trades (e.g., carpenters, electricians, plumbers).
  - **300 Unskilled**: Workers for manual tasks such as digging, carrying, and basic construction.

2. **Indirect Labor**:
   - Indirect labor involves **400 people**, including subcontractors, suppliers, and transporters.
   - These individuals play supporting roles in the project.
3. **Expatriate Personnel**:
   - The project will have **50 expatriate personnel** who bring specialized knowledge and experience.
4. **Specific Roles and Skill Levels**:
   - Key roles and their required skill levels:
     - **Project Director, Project Manager, E&S Manager, Chief Accountant, Human Resources Manager, Procurement Manager, Health and Safety Manager**: All require **skilled** expertise.
     - **Nurse**: Skilled healthcare professional.
     - **Lab Attendant, Office Assistant (Administrative)**: Semi-skilled roles.
     - **Accountant, Purchasing Officer**: Skilled positions.
     - **Environmental Officer**: Semi-skilled with expertise in environmental matters.
     - **Community Liaison Officer**: Skilled in community engagement.
     - **Batching Plant Manager, Batching Plant Operators**: Skilled roles related to concrete batching.
     - **Project Security Manager, Security Staff**: Skilled security personnel.
5. **Waste Collection Staff**:
   - The exact number of waste collection staff will be determined by the **Waste Subcontractor**.
6. **Workforce Categories**:
   - **Unskilled Labor**: Basic manual tasks.
   - **Semi-Skilled Labor**: Specialized skills (e.g., masons, carpenters).
   - **Skilled Labor**: Engineers, surveyors, equipment operators, and project managers.

Security Management

The security arrangements for the project would ensure safety and monitoring on-site activities for successful project execution,

1. **Security Coverage**:
   - Security personnel will be available **24/7** through numerous shifts.
   - Coverage includes both the **construction site** in the port regions and the **yards**.
2. **Internal Security Management**:
   - Security services are provided **internally** by the **HR department** rather than subcontracted.
   - This approach allows direct control and coordination of security measures.
3. **Collaboration with Regional Police**:

- A **relationship** is established with the **regional police station**.
- Their support will be available in case of emergencies or critical situations.

4. **Non-Armed Security Personnel**:
    - On-site security personnel are **not armed**.
    - Their role is to **monitor** and **control** situations to prevent rapid escalation.

Subcontractors Management

Subcontractors play a crucial role in construction projects, and their engagement requires careful management. The key aspects related to subcontractors are:

1. **Mobilization of Subcontractors**:
    - Subcontractors will be **mobilized** to perform various works within the project.
    - Their expertise and specialized services contribute to efficient project execution.
2. **Contractual Agreements**:
    - The **contractor** will enter into **contractual agreements** with these subcontractors.
    - These agreements outline responsibilities, deliverables, timelines, and compliance with project policies.
3. **Supervision and Compliance**:
    - The contractor will **supervise** subcontractors' activities throughout the project.
    - This supervision ensures that subcontractors adhere to **project requirements** and **industry standards**.

Effective collaboration with subcontractors contributes to successful project outcomes.

3.4 Environmental Releases of Emissions, Discharges and Wastes

3.4.1 Air Quality

Managing emissions during construction is crucial for minimizing environmental impact and protecting human health. During the construction phase, various activities contribute to greenhouse gas (GHG) emissions as outlined below:

1. **Vehicle Movement**:
    - Dust generated by vehicles traveling on unpaved surfaces can release **particulate matter** and contribute to air pollution.
    - These emissions occur due to vehicle movement during construction.
2. **Material Handling**:
    - Construction materials and stockpiles can also emit dust.
    - Activities like material handling contribute to **particulate emissions**.
3. **Power Generators**:
    - The project would use power generators. Their collective input in terms of air pollutant emissions could be significant
4. **Additional Emissions during Construction**:
    - Beyond the mentioned sources, other activities during construction contribute to emissions:
        - **Dredging of sand from the sea**
        - **Concrete Batching Plant Operations**: These can release dust and particulate matter.
        - **Demolition of Existing structures**: Dust emissions may occur during this process.
        - **Backfilling**: Another potential source of dust.

- **Execution of Rear Barrette and Bored Piles**: Heavy machinery emitting exhaust fumes adds to air emissions.
- **Installation of other Facilities**: Machinery involved in this process also contributes.

5. **Health and Environmental Impacts**:
   - The total suspended particulate component can result in **nuisance dust**, particularly affecting receptors immediately adjacent to the construction site.
   - The finer particulate component (PM10 and PM2.5) poses **health risks** to receptors, even those located at some distance from the emission source.
   - Diesel generators and machinery are significant sources of air pollutants, including **particulate matter**, **nitrogen oxides (NOx)**, **sulfur dioxide (SO2)**, and **carbon monoxide (CO)**, which can have environmental and health impacts.

Greenhouse gas (GHG) Emissions

Managing GHG emissions during construction and ensuring sustainable practices for long-term operation are critical for minimizing environmental impact.

1. **GHG Emissions during Construction**

The specific GHGs emitted during construction include:

- **NOx (Nitrogen Oxides)**: Released by vehicle combustion.
- **CO (Carbon Monoxide)**: Produced during fuel burning.
- **SOx (Sulfur Oxides)**: Emitted from fuel combustion.
- **PM10 and PM2.5**: Fine particulates generated by vehicles

The standard seven greenhouse gases usually considered include: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

Units	capacity	Number	Emission Factor (kg CO2e/hr/unit)	Maximum Days of Operation	Estimated Emissions (tons CO2e)	Remarks
Crane	24.5/ hour	4	3129.92	351	3306.3	
Excavator	24.5	8	6279.84	351	6612.7	
Dredgers	625 / h	6	2306.88	351		
Pneumatic Road Roller	12L/hr	6	2306.88	351	2204.2	
Grader	16L/h	6	3075.84	351	3238.9	
Soil compactor	12/L	6	2306.88	351	2429.1	
Wheeled loader	12L/hr	6	2306.88	351	2429.1	
Other						
Power Generators	18L/hr	4	1409.76	351	1484.5	
Dumper	15L/hr	4	2204.2	351	2024.3	
Wirtgen						

Water/diesel tankers	35L/62mile	8 (Diesel 6, water -2)	13008	351	37651	
Others, add, please and specify						
Total	10955412				t85897.3COe	

2. **GHG Emissions during Operation**

Once operational, the highway will facilitate movement of goods, services, and people along the coast. Despite the direct and indirect emissions, the highway's positive impact on transportation and economic development remains significant. It will enhance connectivity along the coast, benefiting businesses, communities, and regional trade. During this phase, the project is fully operational, and various factors come into play. Emissions are a consideration in the following regard during operation:

1. **Direct Emissions from Vehicles**:
   - During the operational phase, the primary direct emissions to the air will come from **maintenance vehicles and equipment**.
   - These vehicles and equipment used for upkeep and repairs will release pollutants into the atmosphere.
   - These emissions include pollutants such as **nitrogen oxides (NOx)**, **carbon monoxide (CO)**, and **particulate matter (PM)**.
2. **Indirect Emissions**:

Beyond direct emissions (such as those from maintenance vehicles), roads contribute indirectly to increased emissions. These **indirect emissions** are related to several factors:

- **Fuel Consumption**: As more vehicles travel along the road, their fuel consumption adds to emissions.
- **Vehicle Maintenance**: Regular vehicle maintenance (including engine tuning, tire changes, etc.) also contributes indirectly.
- **Infrastructure Provision**: The construction and maintenance of road infrastructure (e.g., roads, petrol stations) play a role in emissions.

2. Managing GHG Emission

Sustainable practices during construction and operation shall take the following into consideration:

- **Green Construction Practices**: Using eco-friendly materials and minimizing emissions during construction.
- **Public Transportation Integration**: Encouraging use of public transport to reduce individual vehicle emissions.
- **Monitoring and Compliance**: Regular monitoring of emissions and adherence to environmental regulations.

Noise

The expected activities that will generate noise emissions during the construction phase of the Lagos-Calabar Coastal Highway project:

1. **Demolition of Existing structures**:
   - Demolition work typically produces significant noise as structures are dismantled.
2. **Formwork for Capping Beams**:
   - Formwork construction involves assembling molds for concrete structures. This activity can generate noise.
3. **Backfilling Behind**:
   - Backfilling operations involve moving soil or other materials, which can result in noise emissions.
4. **Execution of Rear Barrette and Bored Piles**:
   - The execution of these foundation elements often requires heavy machinery, contributing to noise levels.
5. **Installation of Guide Walls**:
   - The process of installing guide walls can create noise due to construction equipment and machinery.
6. **Installation of various Facilities**:
   - As facilities are constructed, noise from equipment and construction activities is expected.
7. **Operation of Diesel Generators**:
   - Diesel generators, used for power supply during construction, emit noise.
8. **Operation of Batching Plants**:
   - Batching plants, where concrete is mixed, also contribute to noise emissions.
9. **Traffic by All Vehicles and Heavy Machinery**:
   - Movement of vehicles and heavy machinery on-site generates continuous noise.
10. **Underwater Noise to the Marine Environment**:
    - Activities related to dredging operations and offshore transportation can introduce underwater noise.
    - This underwater noise affects marine ecosystems and organisms.

3.4.2 Water/Wastewater

Effective wastewater treatment and responsible construction practices are crucial for safeguarding both surface water and underground water quality during the project. The wastewater management and potential risks associated with construction activities:

1. **Wastewater Treatment in Construction**:
   - All wastewater generated by the project will be stored in **septic tanks**, which are underground structures providing **primary treatment**.
   - Specifically, wastewater from the batching plant and yard facility will be directed into the septic tank.
   - The septic tank allows **heavy solid waste** to settle down from the wastewater.
   - The designed tank should have a capacity to retain **1,000 liters** of wastewater and a depth of approximately **3 meters**.
   - The septic tank treatment removes disease-causing organisms, organic matter, and most nutrients (except nitrogen and some salts).
   - The partially cleaned wastewater then either moves to the groundwater or evaporates from the soil[1].
2. **Surface Water Contamination Risks**:

- Various construction activities pose risks of contaminating **surface water**:
  - **Exposure of In-Situ Materials during Earthworks**: Disturbing natural materials can release pollutants.
  - **Hydrocarbon Spillages from Mechanized Fleet**: Fuel spills can impact nearby water bodies.
  - **Runoff from Hazardous Material Storage Areas**: Proper containment is crucial.
  - **Shoreline Construction Activities**: Land reclamation and offshore transportation introduce contaminants to water bodies.

3. **Diesel Spills and Pollutants**:
   - There is a potential for **spills of diesel** and other pollutants to pollute the soil and **underground water**.
   - Leaks or spills of hazardous chemicals used in construction (such as lubricants, solvents, or concrete additives) can also impact underground water sources.

Careful Management of all these are needed to prevent adverse impacts on the terrestrial and aquatic environment. Proper handling, containment, and monitoring are essential to minimize environmental damage.

3.4.2.1 Solid Waste Management

1. **Construction Phase Waste**:

During construction, various types of waste are generated:

- **General Waste**: This includes waste from offices, canteens, and toilets.
- **Medical Waste**: The clinic generates medical waste, which requires proper handling and disposal.
- **Maintenance and PPE Waste**: Deteriorated personal protective equipment (PPE), oil filters, and tires contribute to waste.
- **Excavation Materials**: Soil, rocks, and other materials excavated during construction.
- **Demolition Debris**: Waste resulting from demolishing existing structures.
- **Packaging Materials**: Materials used for packaging construction supplies.

Table 3.6 Estimated Waste Generation

Waste Description	**Waste Quantity**
Steel Pile Excavation Spoils –	Will not be use on this project
Concrete Pile Excavation Spoils –	N/A
Rear Barrette Excavation Spoils	N/A
Steel Reinforcement Waste –	230 cubic meter
Concrete Waste –	195000 cubic meters
Workforce Sewage Generation	28,320
Workforce Waste Generation – Average 0.15 kg/person per day	87.3kg

2. **Contractor's Waste Management Plan**:

The contractor is responsible for managing all these waste streams. A **Waste Management Plan** that outlines procedures for waste handling, segregation, recycling, and disposal would be developed. Proper waste management ensures compliance with environmental regulations and minimizes negative impacts. Thus, effective waste management practices are essential to reduce environmental impact and promote sustainability throughout the project's lifecycle. All solid and wastewater will be collected by a Nigerian LAWMA certified waste collector.

Dredging for Reclamation

Dredging from the sea plays a crucial role in the proposed project. However, it likely going to have significant environmental impacts that need careful consideration such as the following:

1. **Turbidity in the Water**:
    - Dredging stirs up sediments from the bottom of water bodies, leading to increased **turbidity** (cloudiness) in the water.
    - Elevated turbidity affects light penetration, impacting aquatic plant growth and photosynthesis.
2. **Contaminant Release**:
    - As sediments are dredged, contaminants (such as heavy metals, organic pollutants, and nutrients) can be released into the water column.
    - These contaminants may have adverse effects on water quality and aquatic organisms.
3. **Habitat Destruction**:
    - Dredging disrupts benthic habitats, including small invertebrates, shellfish, and bottom-dwelling fish.
    - Intricate biological habitats on rock formations and substrates targeted for dredging are dismantled.
4. **Water Quality Degradation**:
    - Increased turbidity reduces sunlight penetration, affecting photosynthesis by aquatic plants and phytoplankton.
    - Diminished photosynthetic activity impacts the marine food web.
5. **Air Pollutant Emissions**:
    - Dredging equipment emits **air pollutants**, including greenhouse gases.
    - These emissions contribute to environmental impact during the dredging process.
6. **Mitigation Strategies**:
    - Responsible management is essential to balance economic progress through dredging with environmental conservation.
    - Strategies include:
        - **Beneficial Reuse**: Upcycling dredged sediments for beach restoration and other purposes.
        - **Monitoring and Planning**: Regular monitoring of water quality and ecological impacts.
        - **Eco-Friendly Technologies**: Integrating sustainable practices and technologies.

3.5 Environmental, health, and safety management (EHS)

The following have been taken into consideration in the EHS Management

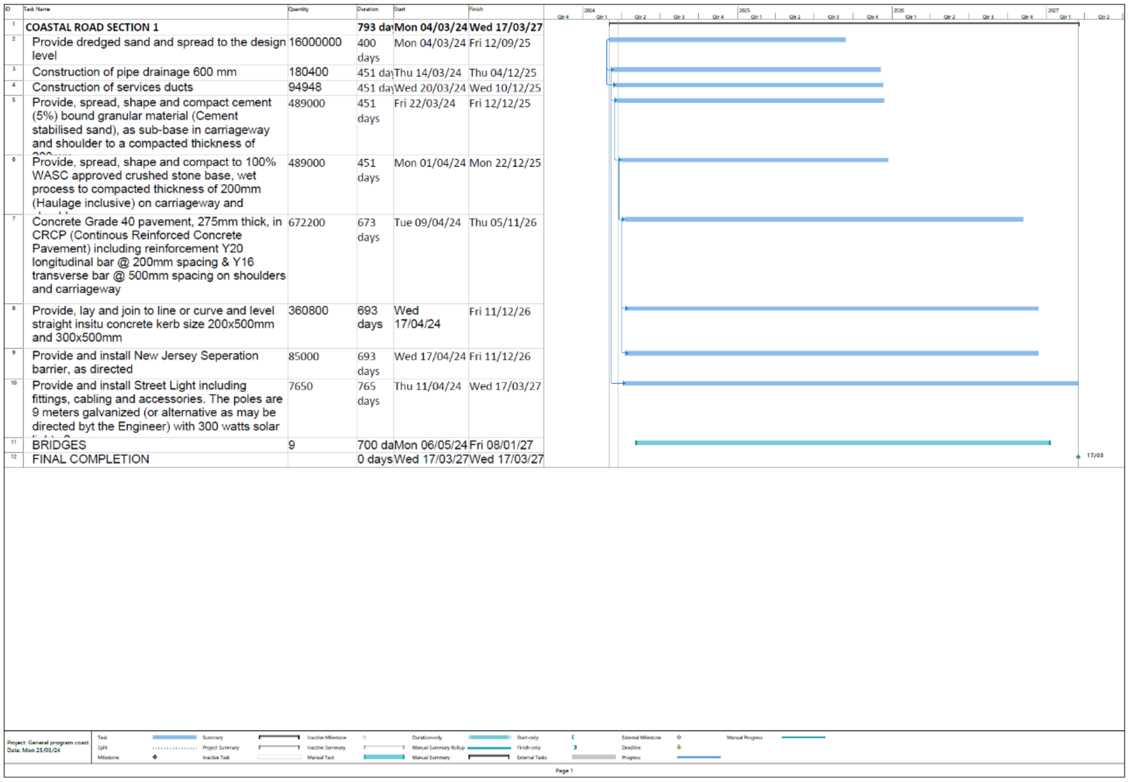
1. **Sediment and Erosion**:
    - Implement measures to prevent soil erosion and sediment runoff during construction.
    - Techniques include silt fences, sediment basins, and erosion control blankets.
2. **Runoff Control**:
    - Manage stormwater runoff to prevent pollution and soil erosion.
    - Construct proper drainage systems, retention ponds, and swales.
3. **Neighborhood Effects: Noise and Dust**:
    - Minimize noise and dust impacts on nearby communities.
    - Use noise barriers, schedule noisy activities during off-peak hours, and control dust with water sprays or dust suppressants.
4. **Landscaping and Green Cover**:
    - Enhance aesthetics and ecological balance by incorporating green spaces.
    - Plant trees, shrubs, and grass to improve air quality and provide shade.
5. **Solid Waste**:
    - Properly manage construction waste.
    - Sort and recycle materials, dispose of hazardous waste safely, and maintain clean work areas.

3.6 Project Implementation Schedule (Estimated)

The proposed project is expected to be completed in 36 months,

Table 3.7 The conceptual project schedule for the project

S/N	**Activity**	**2024**		**2025**				**2026**				**2027**			
		Q3	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
1	Appointment of Consultants to prepare EIA														
2.	EIA Preparation & Certification Process														
2	Completion of preliminary engineering design and tender preparation														
3	Preparation of site														
4	Construction														
5	Commissioning														



ID	Task Name	Quantity	Duration	Start	Finish
1	**COASTAL ROAD SECTION 1**		**793 da**	**Mon 04/03/24**	**Wed 17/03/27**
2	Provide dredged sand and spread to the design level	16000000	400 days	Mon 04/03/24	Fri 12/09/25
3	Construction of pipe drainage 600 mm	180400	451 da	Thu 14/03/24	Thu 04/12/25
4	Construction of services ducts	94948	451 da	Wed 20/03/24	Wed 10/12/25
5	Provide, spread, shape and compact cement (5%) bound granular material (Cement stabilised sand), as sub-base in carriageway and shoulder to a compacted thickness of	489000	451 days	Fri 22/03/24	Fri 12/12/25
6	Provide, spread, shape and compact to 100% WASC approved crushed stone base, wet process to compacted thickness of 200mm (Haulage inclusive) on carriageway and	489000	451 days	Mon 01/04/24	Mon 22/12/25
7	Concrete Grade 40 pavement, 275mm thick, in CRCP (Continous Reinforced Concrete Pavement) including reinforcement Y20 longitudinal bar @ 200mm spacing & Y16 transverse bar @ 500mm spacing on shoulders and carriageway	672200	673 days	Tue 09/04/24	Thu 05/11/26
8	Provide, lay and join to line or curve and level straight insitu concrete kerb size 200x500mm and 300x500mm	360800	693 days	Wed 17/04/24	Fri 11/12/26
9	Provide and install New Jersey Seperation barrier, as directed	85000	693 days	Wed 17/04/24	Fri 11/12/26
10	Provide and install Street Light including fittings, cabling and accessories. The poles are 9 meters galvanized (or alternative as may be directed byt the Engineer) with 300 watts solar	7650	765 days	Thu 11/04/24	Wed 17/03/27
11	BRIDGES	9	700 da	Mon 06/05/24	Fri 08/01/27
12	FINAL COMPLETION		0 days	Wed 17/03/27	Wed 17/03/27

1. **Summary of Project Area Description**:
   - **Section Details**:
     - The initial phase spans **47.5 kilometers**.
     - It starts from **Victoria Island** and extends to **Ibeju-Lekki**.
   - **Geographical Context**:
     - **Victoria Island**, a bustling commercial hub in Lagos, serves as the starting point.
     - The highway then winds its way through the coastal landscape, connecting various regions.
   - **Termination Point**:
     - The journey culminates at **Ibeju-Lekki**, a strategic location known for its economic potential and development prospects.
2. **Summary of Activities in Project Phases**

A. **Construction Phase**:
   - Tasks Involved in Road Construction:
     - Establish temporary access to work areas and create clearance zones while controlling access.
     - Construct temporary diversions for roads that need upgrading to manage existing traffic.

- Clear and level the corridor, perform major earthworks (cuttings, embankments).
- Locate and develop borrow pits and quarries, import materials (gravel, clay, bitumen).
- Source and establish a water supply from surface and/or groundwater.
- Improve existing drainage and introduce new road drainage (including culverts if necessary).
- Surface and seal the carriageway (using bitumen mixing plants where applicable).
- Build water crossings such as bridges and culverts, including concrete batching for structures.
- Establish or improve safety arrangements (modify camber, barriers, sight lines).
- Perform landscaping as needed.

B. **Operation Phase**:

- The road becomes operational, serving transportation needs.
- Regular maintenance, monitoring, and safety checks are essential.

C. **Demobilization Phase**:

- Decommission temporary facilities (workshops, laydown areas, etc.).
- Restore any disturbed areas to their natural state.
- Evaluate the project’s success and lessons learned.

CHAPTER FOUR
DESCRIPTION OF BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

4.1 Introduction

This Chapter presents the physical, biological, socio-economic, and cultural conditions of the proposed project area. It establishes a detailed profile of the area as derived from the baseline data collection which includes literature review, field investigations, and laboratory analyses. The chapter also informs impact assessments as presented in the Chapter 5 , which could aid informed decision-making for sustainable transport corridor development that benefit the environment, local communities and the economy at large

4.2 The Area of Influence and Relevant Environmental Components

The consideration of the Area of Influence (AOI) was deemed pivotal in evaluating the potential environmental repercussions of the proposed Lagos-Calabar Coastal Highway project. The AOI encompasses the geographical expanse where direct, indirect, and cumulative effects of the project might manifest or are anticipated. This area extends beyond the immediate project pathway to include adjacent areas where project-related activities could induce environmental and societal alterations. Within this scope, specialists conducted a thorough examination of the environmental and social parameters to establish baseline conditions. The Baseline Study furnishes vital insights into the pre-existing environmental and societal state in proximity to the proposed highway and its environs. Comprehending these spatial boundaries enabled the execution of environmental impact studies and the formulation of risk mitigation approaches in the subsequent chapters to this Chapter 4.

4.3 Study Approach/Data Acquisition Methods

4.3.1 Study Area Delineation

The first section of the project spans 47.5 kilometers starting from (CH 0 + 000m) the intersection of Ahmadu Bello Way and Adetokunbo Ademola Street in Victoria Island Annex) up to (CH 47 + 474m) Eleko village area in Ibeju-Lekki) as shown on the annotated google earth image in **Plate 4.1**. **.** The stretch of the road within the map of Lagos State is shown in **Figure 4.1**.

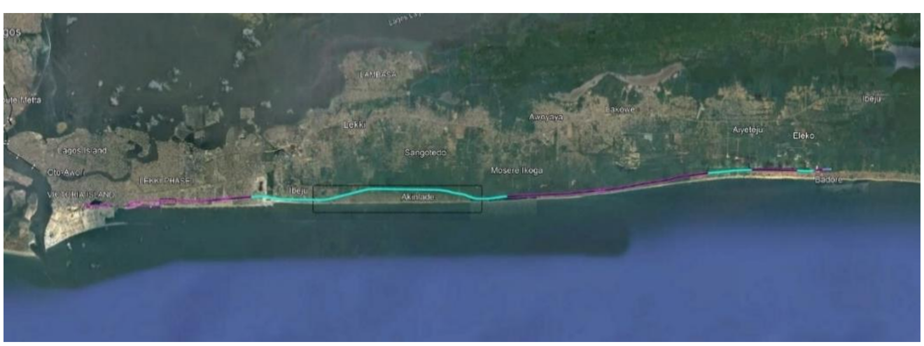


Figure 4.1: Annotated Google Earth Image Showing the Project Location.
Source: Natural Eco Capital Fieldwork April, 2024

The project corridor zone of influence extends 500 to 1000 meters from the middle of the road, but the actual road width for the proposed section one (47.5k) of LCCH depends on the following specific road design:

- **Northward Land:** area which extends toward the Lekki-Epe Express way, some locations here have building structures and communities directly within this zone.
- **Southward Sea Area:** this reaches toward the Atlantic shoreline and has direct intersection of building structures and communities with the corridor at certain locations.

4.3.2: Sampling Locations

The graphical presentation of the data and samples collection points along the proposed corridor and adjacent areas are presented in Figure 4.2 and Table 4.1.

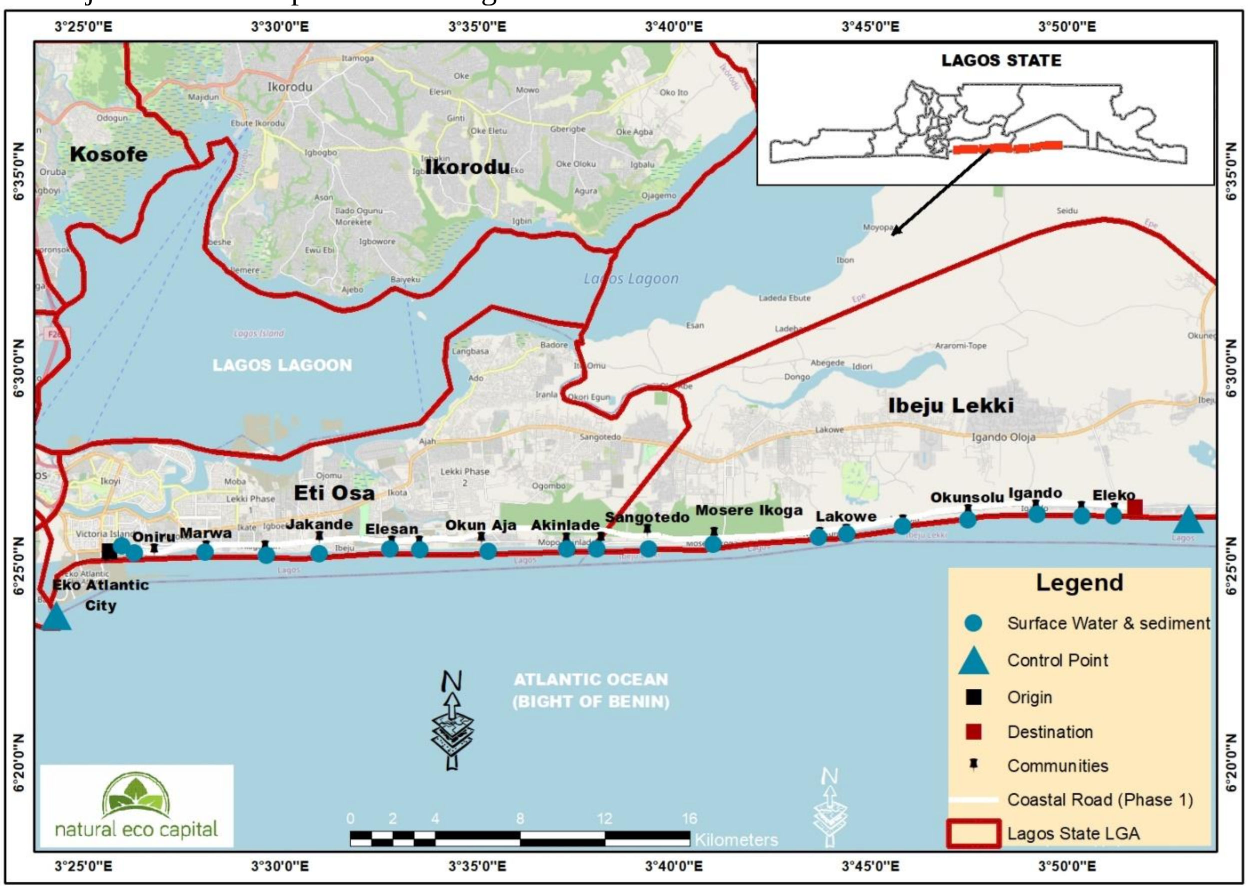


Figure 4.2 Points Sampled along the Proposed Alignment

Table 4.1: Sampling Points and their Coordinates

S/N	Communities	Lat.	Long.
1	Eko Atlantic	6.419877	3.426037
2	Oniru	6.422716	3.446513
3	Marwa	6.424273	3.468469
4	Elegushi	6.4241s18	3.493347
5	Jakande	6.428088	3.516501
6	Elesan	6.426124	3.547175
7	Lafiaji	6.426026	3.558781
8	Okun Aja	6.427751	3.585086
9	Akinlade	6.427651	3.620911
10	Mopo Ijebu	6.427817	3.63556
11	Sangotedo	6.43116	3.65526
12	MosereIkoga	6.429814	3.683681
13	Iwereku	6.429687	3.728184
14	Lakowe	6.431308	3.739767
15	Iwesolu	6.435072	3.763529
16	Okunsolu	6.439422	3.791136
17	Igando	6.441356	3.819811
18	Badore	6.440752	3.83922
19	Eleko	6.4402	3.853224
Control Points			
1	Eko Atlantic	6.395502	3.404908
2	Eleko	6.436591	3.884671

Source: Natural Eco Capital Fieldwork April, 2024

4.3.3 Relevant Environmental Components

Baseline information was established across a number of environmental indices in the Areas of Interest (AOIs). Essentially, the environmental indices included: air quality, noise flooding and hydrology. flora and fauna, shoreline changes, dredging and soil placement. land cover loss and land use changes.

Samples of environmental indices or components of relevance to project impacts and project affected communities within the area of interest were obtained as presented in Table 4.2.

Table 4.2: Relevant Environmental Components Sampled and Communities

S/N	Communities	Air quality & Noise	Soil	Ground Water	Surface Water
1	Eko Atlantic	X			X
2	Oniru	X		X	X
3	Marwa	X	X	X	X
4	Elegushi	X	X	X	X
5	Jakande	X	X	X	X
6	Lafiaji	X	X	X	X
7	Okun Aja	X	X	X	X
8	Mopo Ijebu	X		X	X
9	Sangotedo	X			X
10	Igando	X	X	X	X
11	Badore	X	X	X	X
12	Eleko	X	X	X	X
13	Oguntimehin	X	X	X	
14	Solu Alade	X	X	X	
15	Solu Orunmija	X	X	X	
16	Debojo	X	X	X	
17	Eko Akete	X			
18	Idado	X			
19	Lakowe				X
20	Iwesolu				X
21	Okunsolu				X
22	MosereIkoga				X
23	Iwereku				X
24	Akinlade				X
25	Elesan				X
		18 Stations	12 samples	14 samples	19 Samples

Source: *Natural Eco Capital Fieldwork April, 2024*

a. **Soil Sampling**

Systematic sampling design (systematic line transect) was employed to collect soil by establishing plots across the sampled area. Soil samples were collected from each of the stations with the aid of a Dutch Hand Auger, Hand gloves, a spool and hammer at depths of 0-15cm and 15-30cm, representing top and bottom samples. These are the soil depths at which most (>80%) of the plants feeder roots and soil micro-organisms are concentrated.

At each sampling station, three (3) samples were taken for each depth and composited to give one representative sample. All sampled points were geo-referenced in the field using the Garman Geographic Positioning System (GPS) Equipment. Furthermore, field investigations on soil morphological properties as it affects slope, drainage/flooding, presence of soil structure impediments, texture mottling, were conducted. The physical appearances of contaminants such as hydrocarbons were also examined, alongside the land use practices. All soil samples connected were analyzed in the laboratory using standard methods. The following sub-samples were taken for each depth, namely:

Samples for physico-chemical parameters which were put into polythene bags; Samples for hydrocarbon analysis which were put into glass bottles; Samples for microbiological analysis collected with McCartney bottles and stored in ice-packed coolers. Analysis of all collected samples was conducted in Bato Chemical Laboratories Ltd, Bato House. Plot A, Block 11a, Lasun Olaitan Avenue (Off Channels TV Road), Riverview Estate, Isheri North; a Federal Ministry of Environment and NESREA Accredited laboratory.

_b._ Water Quality Sampling

Surface and groundwater samples were collected along the coastal road project in Lagos for physico chemical analysis**.** Key sampling locations along rivers, streams, estuaries, and other water bodies that could be impacted by the coastal road project were identified. These locations represent various environmental conditions and potential sources of pollution, such as urban runoff, industrial discharge, and agricultural activities.

Water samples were collected using clean, sterile containers to prevent contamination. Samples were collected at a consistent depth and location within the water body, following standard protocols to ensure accuracy and reproducibility. They were then subjected to analysis for a range of physical, chemical, and biological parameters, including pH, dissolved oxygen, turbidity, nutrients (nitrogen and phosphorus), heavy metals, pesticides, and fecal coliform bacteria. These parameters provided insights into water quality, pollution levels, and ecological health

_c._ Groundwater Sampling

Ground water samples for this study were collected from 12 study locations within the study area. Table 1 below shows some of the locations where the groundwater samples were collected, their geographic coordinates and depth. The groundwater samples were collected in high density polyethylene bottles prewashed with 1 N hydrochloric acid followed by distilled water and then rinsed two to three times with the sampled water. The collected water samples were taken to Bato Chemical Laboratories Ltd for comprehensive analyses. The samples were filtered using 0.45 μg cellulose membrane before the analyses. The analytical procedures employed were as documented by the American Public Health Association (APHA, 2017).

d. Air Quality Sampling

Assessment of the sampling locations was done taking into cognizance the predominant wind direction and other requisite criteria as stipulated by the World Bank to have good representative sampling points for the locations. These criteria include:
Predominant Wind Direction; Unobstructed flow of air to equipment probe or inlet from 3 out of the 4 cardinal points (270 degrees) of the location including the predominant wind direction; Distance from trees (minimum of 10meters); Distance from nearby tall buildings – > twice the difference in elevation (of the building and inlet of the equipment); Distance from roadways to equipment probe or inlet 2-10 and 10-100 meters (depends on average daily traffic in vehicles

per day with 2-10 for micro-scale site, except for a designated traffic site, and 10-100 for middle and neighbourhood scale site with upper limit for ~40,000 – 70,000 vehicles per day).
In addition, a control sampling point is located at Folu Community in Ibeju Lekki LGA of the State. The location represents an area with baseline conditions unaffected by the proposed project but similar in environmental characteristics to the proposed project sites. Aeroqual Series 500 with the respective sensor heads was used to collect the air quality data.

e. **Shoreline Dynamic Mapping - Shoreline Dynamics in the Last 45 Years (1979-2024)**
Historic shoreline dynamics across the project area were calculated using the DSAS tool on ArcGIS. Spatial dataset used include satellite imageries acquired in different years and covering a time span of 45 years (1986). The images were sourced from the USGS Landsat online data archive (*www.glovis.org, www.earthexplorer.org*) and were carefully selected based on the conditions that little or no cloud coverage was present and the tide period was the same, e.g. low tide and small tidal range. Table 4.3 shows the characteristics of each of the dataset.

Table 4.3: Characteristics of Satellite Imagery

Date	Satellite data/Sensor	Path/row	Pixel size (M)	Coordinate system/datum	Zone
1979	Landsat-5/TM	188/57	30	UTM/WGS84	32
1991	Landsat-5/TM	188/57	30	UTM/WGS84	32
2000	Landsat-7/ETM	188/57	30	UTM/WGS84	32
2005	Landsat-7/ETM	188/57	30	UTM/WGS84	32
2014	Landsat-7/ETM	188/57	30	UTM/WGS84	32
2018	Landsat-8/OLI	188/57	30	UTM/WGS84	32
2021	Landsat-8/OLI	188/57	30	UTM/WGS84	32
2024	Landsat-8/OLI	188/57	30	UTM/WGS84	32

Source: Natural Eco Capital Fieldwork April, 2024

The image processing methodology, a crucial aspect of this study, began with a meticulous check for any defects in the images, such as band striping. We then proceeded to extract the shorelines using a semiautomatic method based on the dry/wet boundary, which approximates the high waterline (HWL). To reduce subjectivity in delineating the shoreline, we used the band ratio between the mid-infrared/shortwave infrared (band 5 [b5]/ band 6 [b6]), the near-infrared (band 4 [b4]/ band 5 [b5]) and the green (band 2 [b2]/ band 3 [b3]) for the Landsat images. This band ratio computation was implemented using the band math's model in the ENVI software (Formular1) b2/b4 * b2/b5 >1 formula 1. After the image processing, the resulting image with ratio values between 0 and 3 was classified into two classes. This classification was done using the ISOCLUST unsupervised classification tool in ENVI, a tool that plays a crucial role in our image classification process. The resulting binary image had values less than 1 classified as water and values greater than 1 classified as land. The land class was then converted from raster to vector and exported as shape files for overlay in ArcMap where the shorelines were extracted.
Shoreline dynamics in the project area were measured by creating perpendicular transects for measurement locations across multiple shorelines. The transect lines were made perpendicular to the baseline and drawn to intersect all the extracted shorelines. The intersected points were spatially joined to the baseline to create a field that calculated the shortest perpendicular distance

from each end to the baseline. The transect-shoreline intersections were therefore used to calculate various rates of movement. This study computed shoreline change rates using the Net Shoreline Movement (NSM) and End Point Rate (EPR). The NSM reports the distance between the oldest (1979) and the youngest (2024) shorelines, while the EPR converts the NSM into an annual rate of shoreline change by dividing the distance of the shoreline movement from the oldest to the most recent shorelines as the period passed.

f. Microbiology Analysis

Water and sediment samples for microbiology analysis were collected in sterile glass bottles and stored in ice packed containers before transfer to the refrigerator prior to laboratory investigation. Enumeration of heterotrophic bacteria and fungi was carried out by pour plating technique. This was done by inoculating 0.1 ml tenfold serially diluted samples onto nutrient agar (Bacterial), acidified potato Dextrose agar containing Streptomycin (1mg /100 ml) (fungal) and mineral salt Agar (MSA) (Hydrocarbon degraders). The mineral salt media of Mill *et al.*, 1978 as modified by Okpokwasili and Amanchukwu (1988) contains the following composition in gram per litre of distilled water NaCl 10g, $MgSO_4$. $7H_2O$, 0.42 g, KCl, 0.29 g, K_2HPO_4, 1.2 g, KH_2PO_4, 0.83 g, $NaNO_2$, 0.42 g, Agar –Agar, 15 g, pH 7.2 and 2ml of petrol/diesel. The inoculated nutrient Agar plates were incubated at 370C for 24 hours while the potato dextrose Agar plates were incubated at room temperature for 3-5 days. Observed colonies were counted and expressed as colony forming units per gram (cfug- 1). The bacterial and fungal isolates were characterized based on their cultural, biochemical properties and microscopic appearances as described by Cheesbrough (2005).

g. MarineWildlife Studies

An inventory of wildlife species in the study stretch was obtained through literature review, field survey and interaction with indigenous and resident fisher folks.

4.4 Physicochemical Components of Project Environment

4.4.1 General Description of the Climate and Weather Patterns of Lagos

Lagos, Nigeria, experiences a transitional tropical climate shaped by the Guinean and Sudanian variants. Key atmospheric systems such as the St. Helena anticyclone, Egypto-Lybian anticyclones, and Saharan depression influence its distinct rainy and dry seasons. Major wind patterns like harmattan, Saharan low-pressure system, and monsoons impact weather and rainfall, defining Lagos as humid tropics with two dominant air masses. They are the dry Northeasterly Tropical Continental (cT) from across the Sahara and the wet Southwesterly Tropical Maritime (mT) from across the Atlantic Ocean. The Inter Tropical Convergence Zone (ITCZ) separates these air masses, oscillating with the sun's apparent location and accounting for the dominant seasons of the area. Marginal alterations are also recorded due to landform characteristics, ocean currents, surrounding shoreline configuration, and the flat topography of the region.

Temperature: The data collected for a period of 37 years from 1986 to 2023 for Lagos State showed an average maximum temperature of 31.6°C and an average minimum temperature of 23.9°C. The average maximum temperature range is 5.5°C while minimum range is 2.3°C.

Figure 4.4 shows the average warmest temperature in Lagos is recorded in February and March, while the lowest is in June.

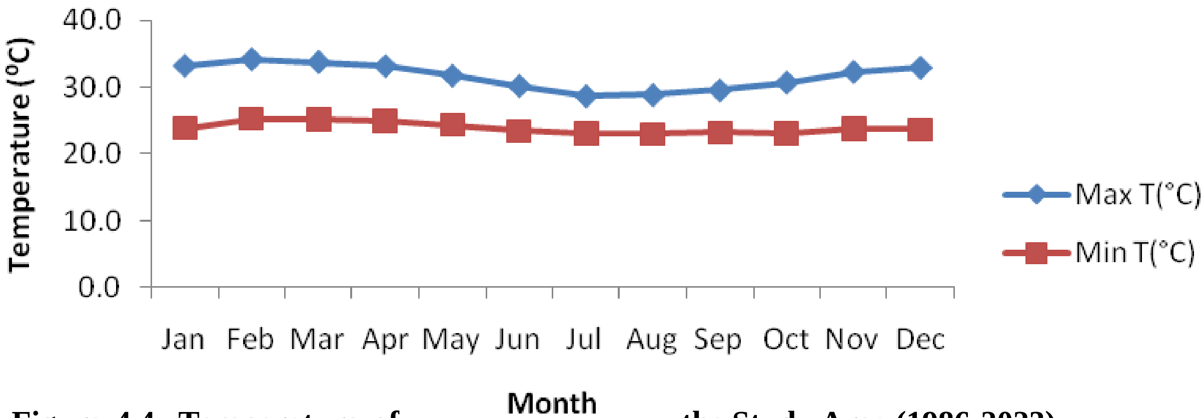


Figure 4.4: Temperature of the Study Area (1986-2023)

Extreme temperatures have been known to cause cracking and deterioration of road due to expansion and contraction the materials used. The road design must take into consideration, the temperature range of 21ºC to 34ºC.

Rainfall**:** Lagos has 2 rainfall peaks in May and June, as shown in the table and charts
Lagos experiences rainfall throughout the year. Data spanning 37 years (1986-2023) indicates June with the highest rainfall (304.2mm) and January with the lowest (typically a dry season month). The average rainfall over this period is 131.8mm, representing the expected pattern, as illustrated in Table 4.6 and Figure 4.5. Furthermore, 30 years of hourly weather model simulations and observed historical climate and weather data, confirm the period of the wet and dry season in the project area.

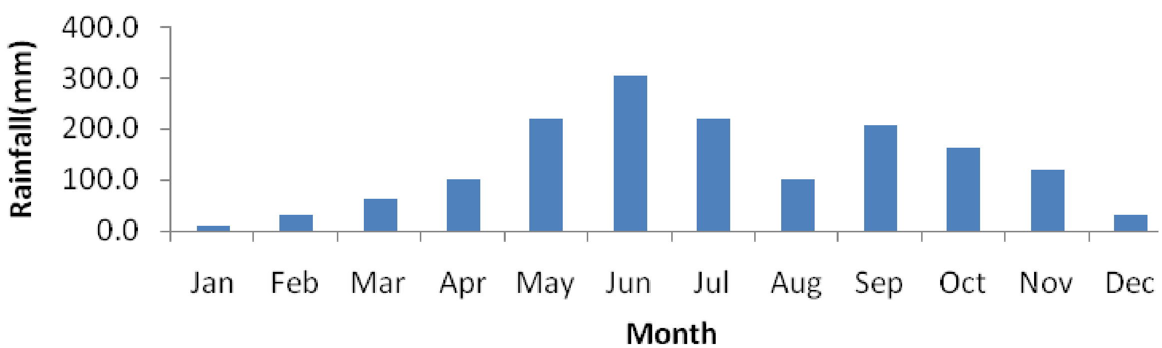


Figure 4.5: Rainfall of the Study Area (1986-2023)

Relative Humidity: Relative humidity, linked to air temperature, influences cloud formation and precipitation types. A 37-year data span (**1986-2023**) shows average yearly humidity at 82.4%, varying from 71.1% in January to 87.6% in July.

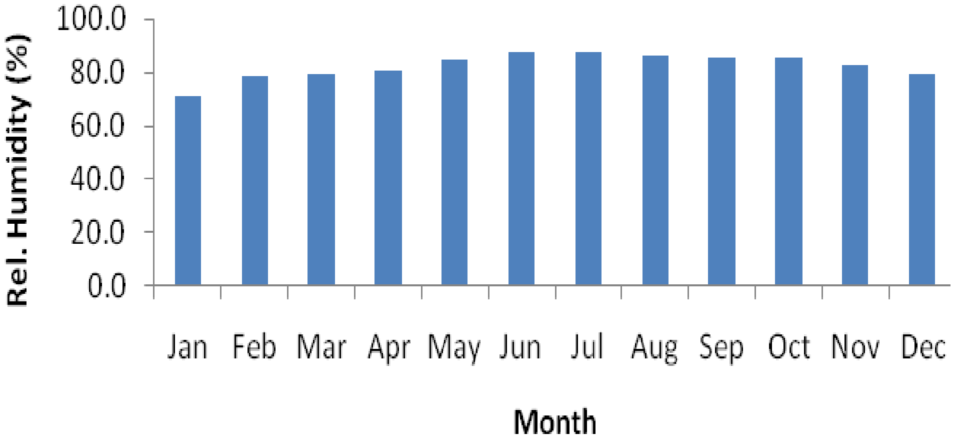


Figure 4.8: Relative Humidity of the Study Area (1986-2023)

Throughout 1986-2023, Lagos consistently maintains relative humidity above 70% monthly, irrespective of season. June and July peak at 87.3% and 87.6% respectively, correlating with the rainy season. High humidity, typical during the wet season, results from Lagos' location and near-constant rainfall. Peaks reach 78% from June to October, with February's low at 57%.

Wind Speed: The winds that prevail over Lagos State are the same with that which prevail over Nigeria, and these are the Tropical Maritime Air mass and the Tropical Continental air mass.

Strong winds pose risks like erosion, debris on roads, and visibility issues, mitigated by wind barriers and road design. Northward winds increase salt spray, corroding infrastructure, crucial in coastal road stability planning. Figure 4.9 depicts consistently high wind speeds, especially March to September, slightly lower in October/February, with prevailing southwesterly winds but northward winds at 6%, sufficient for corrosion near the ocean.

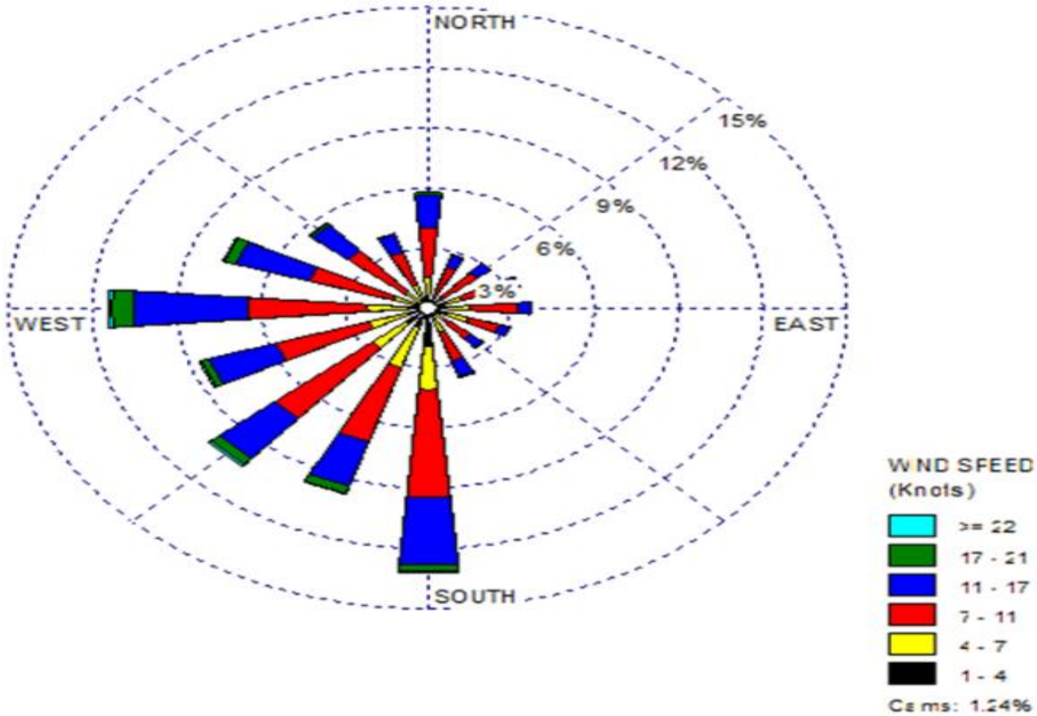


Figure 4.9: Annual Prevailing Wind Directions in the Project Area

According to the statistics available for the last ten years the prevalent wind directions is South-westerly. Often, the South-westerlies dominate the wetter period of the year in the area while North-easterlies dominate the drier season.

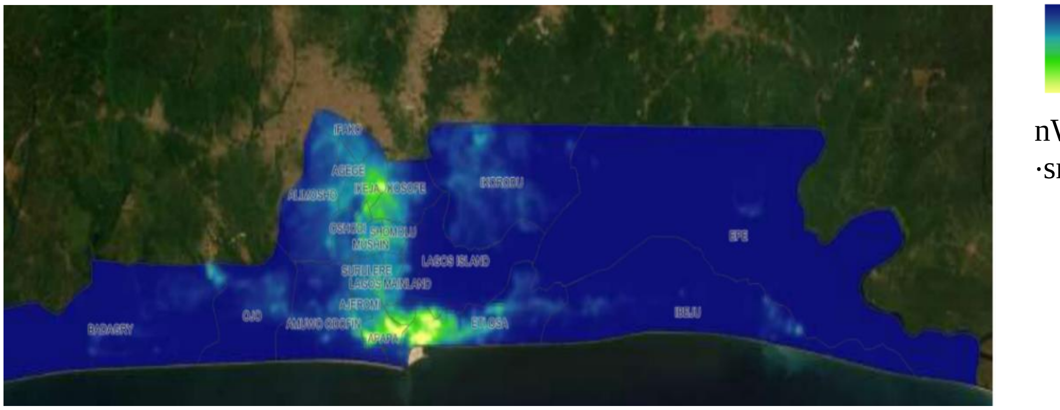
Radiance: Figure 4.4 present maps for a. Global Horizontal Irradiation (GHI), b. Direct Normal Irradiation (DNI), and c. Photovoltaic Power Potential (PVOUT)

a. b. c.

Figure 4.10*:* Solar Resource Maps of Nigeria

Source*: The World Bank (2020): Global Solar Atlas 2.0, Solar resource data: Solargis*

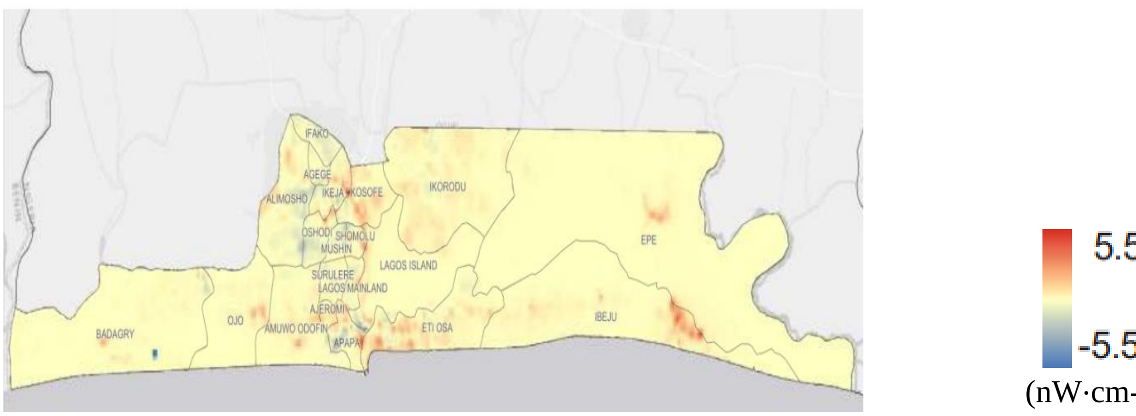
GHI map provides a summary of the estimated solar energy available for power generation and other energy applications. It represents the long-term average of yearly/daily sum of global horizontal irradiation (GHI). DNI solar resource map provides a summary of the estimated solar energy available for power generation and other energy applications. It represents the long-term average of yearly/daily sum of direct normal irradiation (DNI). The PVOUT map provides a summary of estimated solar photovoltaic (PV) power generation potential. It represents long-term average of yearly/daily potential electricity production from a 1 kW-peak grid-connected solar photovoltaic (PV) power plan.



nW·cm-2 ·sr-1

Figure 4.11: Average nighttime light radiance (2013–2019) Nanowatts cm^2 per steradian

Figure 4.11 shows the rate of change in nighttime radiance (2013–2019) Average change in nanowatts per square centimeter per steradian per month.



(nW·cm-2 ·sr-1 ·month-1)

Figure 4.12: Rate of change in nighttime radiance (2013–2019) Average change in nanowatts per square centimeter per steradian per month. ***Source:*** *World Bank, 2023, Map data from NOAA, "VIIRS Daily Mosai*

Microclimatic Data: Microclimatic data were acquired for the study area during the EIA field study. During field work survey, a weather monitoring equipment (Kestrel) was used to monitor the weather parameters essentially the temperature, wind speed, humidity, barometric pressure. The results obtained for the weather parameters are presented in Table 4.8 while the summary of values for the weather parameters is presented in Table 4.9.

Table 4.4: Weather Pattern Recorded within Study Area.

S/N	Monitoring Locations	Meteorological Parameters			
		Temp (^oC)	Humidity (%)	Wind Speed (m/s)	B. Pressure (hPa)
1.	Eko Atlantic	32.6	76.5	0.9	1013.5
2.	Solu Alade	35.3	77.4	1.6	1014.3
3.	Eko Akete	31.3	79.8	1.3	1011.0
4.	Badore	33.1	79.3	1.1	1014.3
5.	Oguntimeyin	36.3	71.4	1.6	1014.2
6.	Eleko	30.5	86.8	0.4	1013.7
7.	Shangotedo	31.8	87.1	0.5	1010.8
8.	Debojo	34.3	73.9	1.7	1014.5
9.	Oniru Private Beach	34.7	74.1	1.1	1013.6
10.	Maruwa	34.6	73.7	0.9	1013.0
11.	Solu Orunmija	36.1	77.1	1.1	1014.7
12.	Idado	37.5	67.6	1.3	1013.3
13.	Igando	34.9	75.5	1.5	1014.5
14.	Mokpo Ijebu	33.1	78.5	1.1	1011.0
15.	Okun Aja	35.9	68.9	0.4	1010.8
16.	Laraji	33.5	74.4	1.0	1011.5
17.	Elegushi	35.0	72.8	0.5	1012.4
18.	Jakande	34.3	72.9	0.9	1011.9
19.	Control (Folu, Ibeju Lekki)	32.3	88.5	1.2	1013.8

Source: Natural Eco Capital Fieldwork April 2024

Table 4.5: Summary of Results for the Weather Parameters

	Temp (^oC)	**Humidity (%)**	**Wind Speed (m/s)**	**B. Pressure (hPa)**
Minimum	30.5	67.6	0.4	1010.8
Maximum	37.5	88.5	1.7	1014.7
Average	34.1	76.6	1.1	1013.0

Source: Natural Eco Capital Fieldwork April 2024

4.4.2 Inference from the Weather Parameters Results

Study parameters in the monitored environment range from 30.5-37.5°C for temperature, 67.6-87.1% for humidity, 0.4-1.7m/s for wind speed, and 1010.8-1012.4hPa for barometric pressure. Average values are 35°C temperature, 72.8% humidity, 0.5m/s wind speed, and 1012.4hPa barometric pressure. Temperature ranges from 30.5°C to 37.5°C, showing notable variability. However, it aligns with macroclimatic data for Lagos. Maximum temperature peaks at 37.5°C as shown in Figure 4.13.

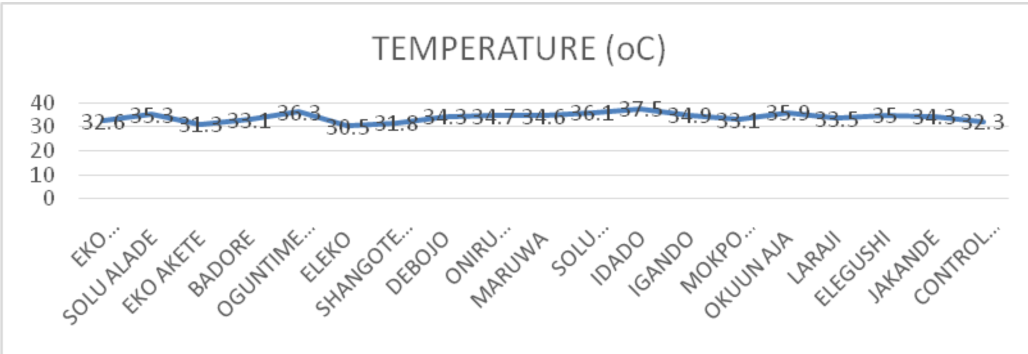


Figure 4.13: Graphical Illustration of the Temperature Recorded Within the Study Area

Humidity of the project location: The humidity data for this location indicates fluctuating moisture levels in the air, with a minimum humidity of 67.6%, a maximum of 87.1%, and an average of 72.8% as presented in Figure 4.14.

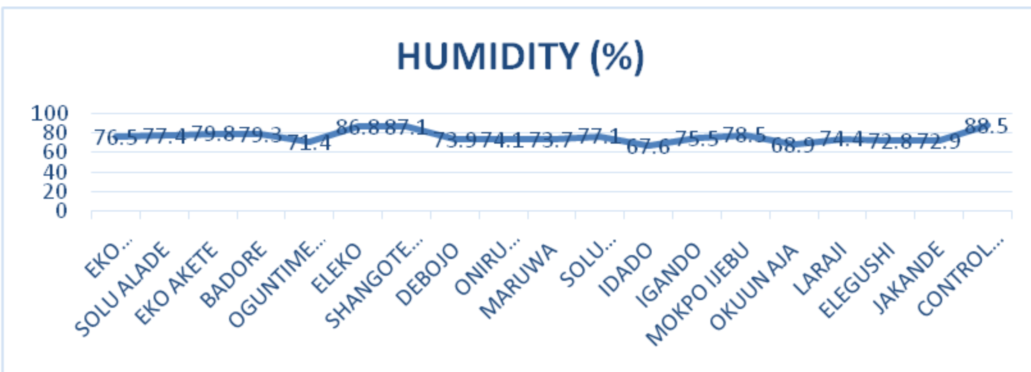


Figure 4.14: Graphical Illustration of the Humidity Recorded Within the Study Area

Wind Speed and Wind Direction: Wind speeds in the project area range from 0.5 to 1.7 m/s, averaging 0.5 m/s, suggesting calm conditions. Minimum speeds indicate light breezes or calm periods, while the modest maximum of 1.7 m/s can impact air quality dispersion and wind energy potential. Predominantly southwesterly wind direction is noted as revealed in Figure 4.15.

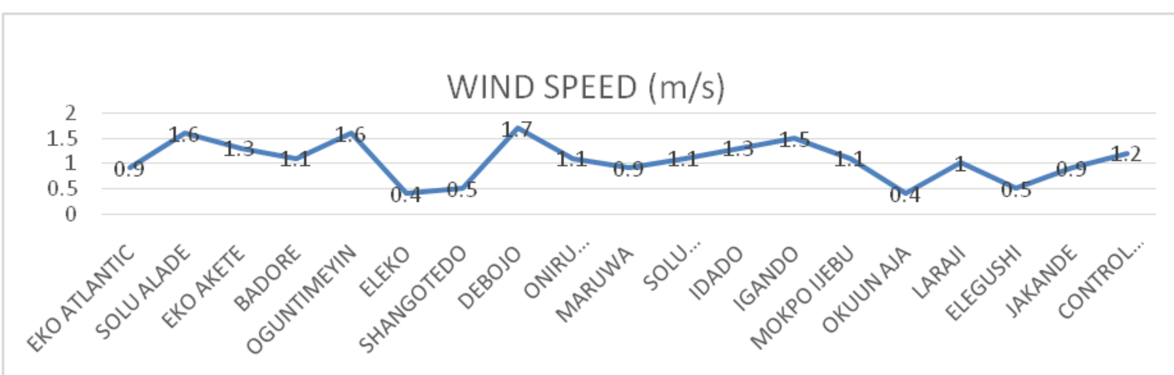


Figure 4.15: Graphical Illustration of the Wind Speed Recorded within the Study Area

Barometric Pressure*:* Barometric pressure data ranges from 1010.8 hPa to 1014.7 hPa, averaging 1012.4 hPa, influencing weather patterns. Higher readings near 1014.7 hPa indicate stable weather with clear skies, while lower readings near 1010.8 hPa suggest unsettled conditions like clouds or precipitation. The average pressure of 1012.4 hPa indicates neutral weather as presented in Figure 4.16.

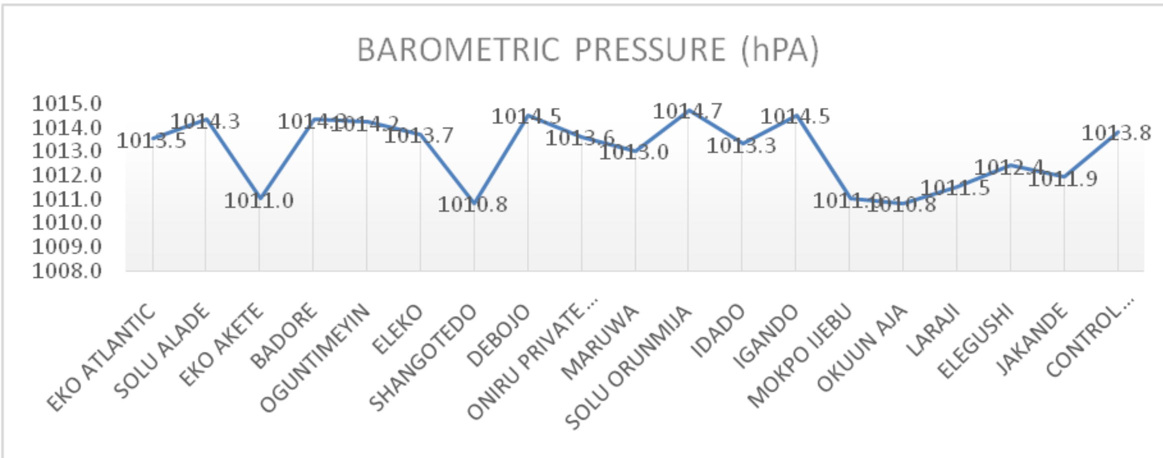


Figure 4.16: Graphical Illustration of the Barometric Pressure Recorded Within the Study Area

Table 4.6: Summary of Local Meteorological Data for the Project Area

Month	MEAN ITD position (°N)	Wind Direction	Mean Wind Speed (Kts)	Mean Min. Temp. (°C)	Mean Max. Temp. (°C)	R.fall (mm)	Surf. Pres. st. Helena hPa
July	18.9	South westerly	10kts	26.1	31.8	250.2	1024
August	19.9	South westerly	18kts	25.5	31.2	10.4	1036
Septem ber	18.0	South westerly	22kts	23.4	31.5	184.5	1028

4.5 Climate Projections

Considering the projected changes, planners and engineers must incorporate climate resilience measures into the design, construction, and maintenance of the coastal road project to ensure its long-term viability and adaptability to future climate conditions. This may include implementing coastal protection measures, improving drainage infrastructure, using climate-resistant materials, and considering future sea level rise in design standards. Box 4.1 outlines projected changes that could affect the coastal road project in Lagos in the future.

- **Increased Temperatures:** Climate models indicate a general trend of rising temperatures due to global warming. This could lead to higher temperatures along the coast, impacting the performance of road surfaces and infrastructure materials.
- **Changes in Precipitation Patterns:** While projections vary, some models suggest alterations in precipitation patterns for Lagos, potentially resulting in more intense rainfall events during the wet season and longer dry spells during the dry season. This could increase the risk of flooding and droughts, respectively, affecting the road's stability and drainage systems.
- **Sea Level Rise:** Climate models consistently predict sea level rise due to melting ice caps and thermal expansion of seawater. This poses a significant threat to the coastal road project, as higher sea levels can lead to coastal erosion, saltwater intrusion into freshwater sources, and increased vulnerability to storm surges.
- **Increased Frequency and Intensity of Extreme Weather Events:** Climate models suggest that extreme weather events such as storms, hurricanes, and heatwaves may become more frequent and intense in the future. These events can cause significant damage to infrastructure along the coastal road and disrupt transportation networks.
- **Impacts on Ecosystems and Biodiversity:** Climate change could also affect the coastal ecosystems and biodiversity along the road project, influencing vegetation patterns, habitat suitability for wildlife, and shoreline stability.

Table 4.7: The Quarterly Projection of Maximum Temperature for 100 years in Lagos

Units:°C	2020-2039				2040-2059				2060-2079				2080-2099			
Scenario	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**
SSP1-1.9	33.31 (32.41, 34.12)	33.51 (32.68, 34.24)	31.2 (30.5, 31.75)	31.86 (31.35, 32.52)	33.53 (32.27, 34.47)	33.74 (32.86, 34.64)	31.44 (30.71, 32.11)	32.03 (31.49, 32.74)	33.44 (32.34, 34.22)	33.66 (32.84, 34.45)	31.35 (30.65, 31.95)	31.99 (31.41, 32.67)	33.33 (32.42, 34.1)	33.55 (32.78, 34.35)	31.25 (30.53, 31.87)	31.85 (31.37, 32.48)
SSP1-2.6	33.56 (32.54, 34.35)	33.67 (32.87, 34.35)	31.34 (30.58, 31.9)	32.06 (31.54, 32.72)	33.82 (32.29, 34.9)	34.05 (33.16, 35.1)	31.71 (30.92, 32.36)	32.18 (31.57, 32.88)	33.99 (32.28, 34.9)	34.08 (33.1, 35.12)	31.85 (30.94, 32.51)	32.52 (31.61, 33.34)	33.86 (32.49, 34.9)	34.05 (33.08, 35.32)	31.94 (30.88, 32.76)	32.39 (31.62, 33.42)
SSP2-4.5	33.42 (32.56, 34.18)	33.54 (32.79, 34.24)	31.26 (30.64, 31.78)	31.99 (31.52, 32.64)	34.03 (32.99, 34.91)	34.07 (33.4, 35.03)	31.93 (31.15, 32.76)	32.49 (31.89, 33.3)	34.32 (32.86, 35.47)	34.49 (33.82, 35.61)	32.37 (31.58, 33.23)	32.88 (32.13, 33.98)	34.72 (33.49, 36.03)	34.91 (33.85, 36.35)	32.9 (31.51, 33.79)	33.25 (32.26, 34.33)
SSP3-7.0	33.25 (32.11, 34.22)	33.59 (32.43, 34.31)	31.26 (30.54, 32)	31.8 (31.19, 32.52)	33.95 (32.22, 35.41)	34.21 (32.54, 35.5)	31.88 (31.11, 32.74)	32.52 (31.87, 33.54)	34.69 (32.37, 35.95)	34.92 (32.93, 36.35)	32.83 (31.5, 33.74)	33.2 (32.26, 34.67)	35.54 (32.86, 37.1)	35.58 (33.63, 37.1)	33.72 (32.26, 35.17)	33.85 (32.68, 35.22)

https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-projection

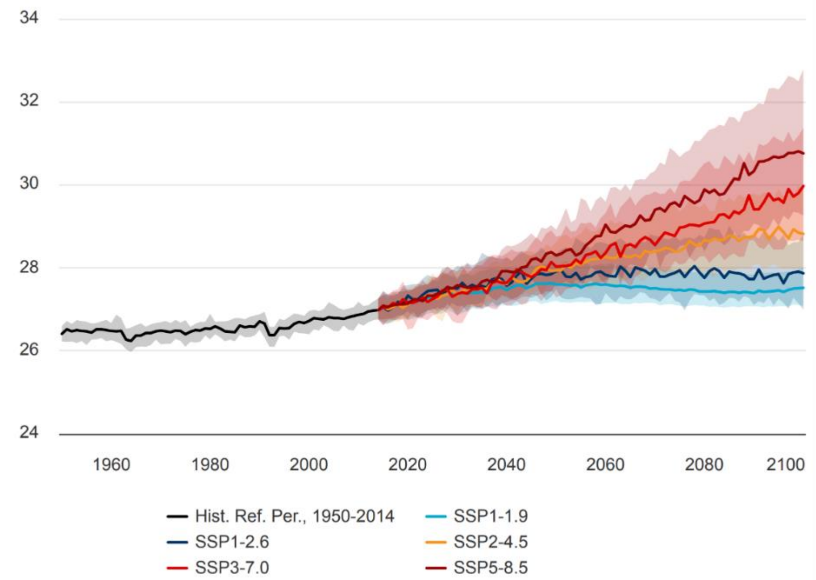


Figure 4.17: Projected Average Mean Surface Air Temperature Lagos, Nigeria; (Ref. Period: 1995-2014), Multi-Model Ensemble

The chart in Figure 4.18 is the quarterly projection of maximum temperatures around Lagos for the next 100 years

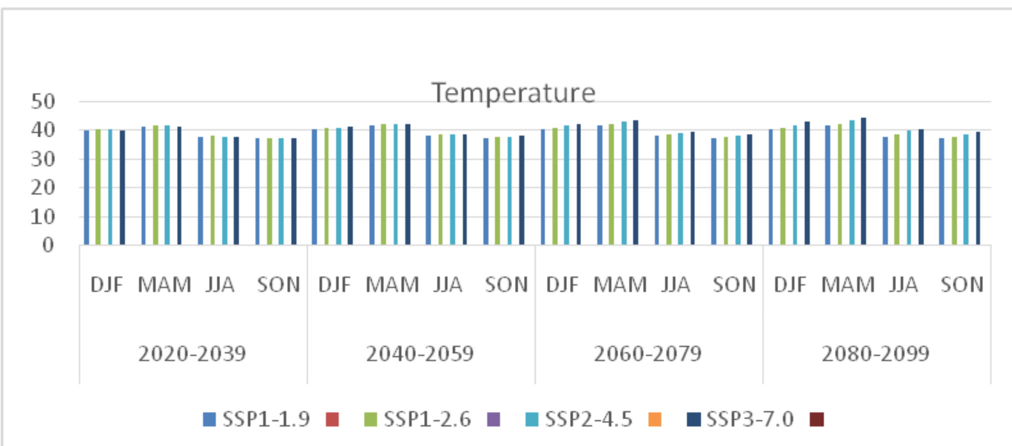


Figure 4.18: Projected maximum temperatures around Lagos for the next 100 years

Projected Change in Seasonal Precipitation as Percentage - Projected percent change in total precipitation for the data aggregation period, shown below by season. This is a useful indicator for contextualizing projected precipitation anomalies, or changes. Percent change should be compared with precipitation anomalies to understand absolute values of precipitation (mm) to gain a more complete understanding of projected changes in precipitation dynamics. The identified sub-national units with the highest and lowest values reflect the projected time period, 2040-2059.

Units:%	**2020-2039**					**2040-2059**				**2060-2079**				**2080-2099**		
Scenario	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**
SSP1-1.9	99.26 (77.8, 119.7)	98 (87.59, 110.67)	100.39 (90.53, 110.91)	102.39 (90.45, 115.73)	97.81 (75.58, 118.94)	96.69 (85.87, 107.98)	99.49 (89.21, 110.54)	101.6 (89.38, 116.39)	97.6 (77.94, 116.81)	97.33 (87.43, 107.04)	98.82 (90.1, 109.88)	100.46 (89.5, 114.79)	97.94 (80.47, 115.82)	97.62 (88.13, 107.64)	98.72 (89.95, 108.64)	100.06 (88.94, 112.25)
SSP1-2.6	102.62 (75.73, 125.65)	98.47 (87.66, 111.51)	100.11 (91.36, 110.76)	103.06 (89.87, 113.19)	99.96 (76.96, 120.38)	96.53 (85, 109.8)	101.19 (88, 112.86)	103.76 (88.34, 118.92)	100.08 (73.19, 119.86)	98.36 (87.25, 110.71)	102.28 (91.12, 114.75)	103.24 (89.88, 121.59)	98.51 (77.45, 122.67)	96.6 (86.89, 112.2)	101.16 (90.86, 114.36)	103.1 (87.56, 118.95)
SSP2-4.5	99.04 (77.62, 118.56)	98.34 (89.02, 109.42)	100.43 (90.51, 111.16)	103.94 (90.63, 118.33)	96.7 (70.3, 118.93)	95.19 (82.09, 108.58)	99.18 (88.54, 111.45)	103.59 (90.69, 118.89)	98.69 (68.53, 125.35)	94.31 (83.84, 108.51)	99.91 (91.58, 112.64)	104.41 (91.31, 130.55)	97.59 (63.9, 122)	96.26 (80.56, 110.43)	103.16 (86.47, 115.94)	105.71 (88.09, 132.26)
SSP3-7.0	98.29 (72.24, 120.33)	96.7 (84.97, 114.84)	100.53 (89.73, 113.47)	100.9 (90.72, 117.1)	96.78 (62.39, 133.29)	94.99 (82.4, 109.8)	100.92 (87.25, 115.71)	103.1 (87.48, 129.37)	96.71 (57.69, 139.99)	92.18 (76.5, 106.73)	99.44 (81.2, 123.63)	105.61 (85, 138.27)	106.66 (55.12, 147.11)	89.02 (71.08, 108.99)	97.69 (79.7, 127.23)	109.07 (84.12, 152.17)

Table 4.8: Projection for Percentage Change in Annual Rainfall over Lagos

Projected Change in the Average Largest 1-Day Precipitation - Projected anomaly, or change, in the average highest precipitation amount in a 1-day period during each month in the data period, shown below by season. This indicator can be useful in understanding potential change in large precipitation events; this should not be confused with extreme precipitation events. Average Largest 1-Day Precipitation can be compared with mean precipitation anomalies to Identify differences and changes in precipitation dynamics. The identified sub-national units with the highest and lowest values reflect the projected time period, 2040-2059.

Table 4.9: Projected Change in the Average Largest 1-Day rainfall in Lagos

Units: mm	**2020-2039**				**2040-2059**				**2060-2079**				**2080-2099**			
Scenario	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**	**DJF**	**MAM**	**JJA**	**SON**
SSP1-1.9	18.3 (12.92, 25.14)	35.01 (25.16, 51.38)	62.15 (45.3, 80.8)	47.83 (32.08, 69.67)	18.08 (12.98, 24)	34.54 (24.51, 53.09)	63.7 (45.37, 84.45)	48.23 (32.8, 72.99)	18.41 (13.22, 24.46)	35.26 (25, 53.66)	64.36 (47, 85.73)	47.97 (32.26, 73.91)	18.34 (13.5, 24.18)	35.41 (25.14, 53.19)	63.85 (46.4, 86.4)	47.53 (32.3, 73.25)
SSP1-2.6	18.74 (13.05, 26.47)	34.48 (25.04, 50.45)	59.81 (45.64, 77.74)	46.8 (33.87, 62.55)	18.04 (13.3, 23.66)	32.25 (24.9, 47)	64.75 (45.89, 83.62)	48.37 (29.62, 69.36)	18.8 (13.36, 24.72)	36.95 (25.96, 55.3)	65.46 (47.94, 80.82)	48.66 (31.91, 72.75)	17.83 (13.27, 24.13)	37.78 (26.49, 50.98)	63.52 (46.84, 80.92)	47.42 (32.11, 69.26)
SSP2-4.5	18.57 (12.99, 24.14)	35.23 (24.96, 48.64)	60.75 (44.08, 76.25)	47.62 (31.84, 68.62)	17.54 (12.69, 23.07)	36.74 (25.14, 55.82)	61.23 (42.47, 78.62)	49.54 (35.85, 73.09)	18.17 (12.31, 24.47)	36.85 (25.67, 52.63)	64.33 (47.09, 84.05)	48.95 (35.45, 71.88)	17.31 (12.45, 23.82)	36.16 (26.55, 48.72)	65.31 (47.9, 84.15)	52.64 (36.49, 75.82)
SSP3-7.0	17.54 (12.33, 25.33)	35.78 (25.7, 55.47)	64.87 (44.61, 84.48)	47.94 (27.87, 74.77)	17.74 (11.9, 23.75)	33.22 (22.5, 56.43)	63.93 (45.18, 85.3)	50 (33.29, 75.15)	18.15 (11.01, 26.18)	35.28 (24.63, 53.32)	66.63 (46.76, 85)	51.62 (32.59, 82.44)	19.5 (12.16, 25.74)	37.48 (23.69, 61.19)	67.97 (42.85, 92.07)	54.45 (33.01, 83.67)

https://climateknowledgeportal.worldbank.org/country/nigeria/climate-data-projections

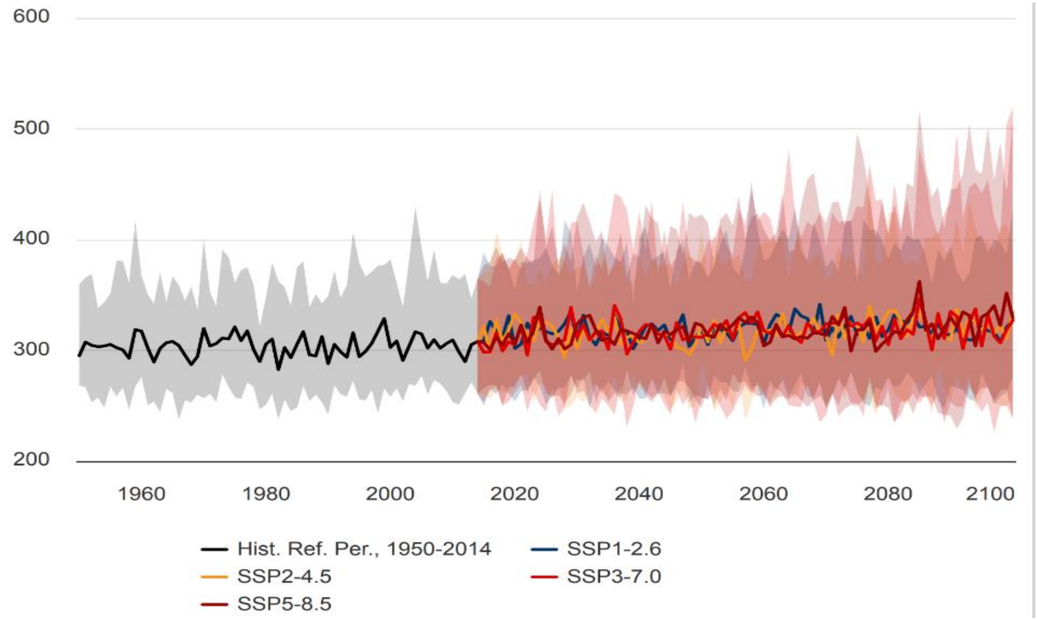


Figure 4.19: Projected Average Largest Monthly Cumulative Precipitation Lagos, Nigeria; (Ref. Period: 1995-2014), Multi-Model Ensemble

The projected annual amount of rainfall during wettest days Anomaly for 2080-2099 in Nigeria is presented in Figure 4.20.

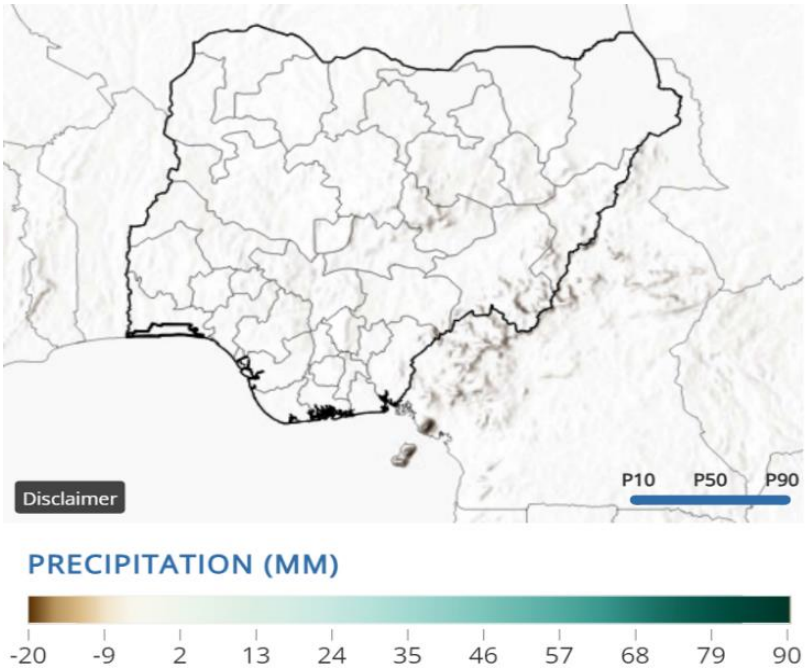


Figure 4.20: The projected anomaly for annual amount of rainfall during wettest days for 2080-2099. (Ref. Period: 1995-2014), SSP5-8.5, Multi-Model Ensemble

4.5.1 Topography and Geology

Geology of Lagos

Lagos, Nigeria, sits on diverse topography, ranging from coastal plains to marshlands. Geomorphologically, it features a mix of low-lying areas, elevated plateaus, and scattered hills. Understanding its topography, geomorphology, and geology is crucial for urban planning, infrastructure development, and mitigating natural hazards, ensuring sustainable growth in one of Africa's largest and most dynamic metropolitan areas.

The geology of Lagos includes Alluvium, Coastal Plain Sands, Ilaro Formation, and Oshoshun Formation: The proposed Lagos-Calabar Road is situated on Alluvium, which consists of loose, unconsolidated soil and sediment deposited by rivers and other water sources. The presence of Alluvium has significant implications for construction. Alluvial soils are typically soft, highly compressible, and can be prone to settling and shifting, which may lead to instability in the road foundation. The loose sedimentary material deposited by water can settle over time, leading to uneven road surfaces and potential vehicle damage. Moreover, it is prone to erosion during heavy rainfall or flooding, which can undermine the roadbed and cause structural issues. Sedimentation on the road surface is another concern, reducing road capacity and creating hazardous driving conditions. Additionally, alluvial soils may be unstable, posing risks of landslides or subsidence, especially in areas with steep slopes or seismic activity. The map below is the geology of Lagos. The map reveals that the section one and two of the proposed corridors will be located on alluvium deposit

Consequently, construction on Alluvium requires thorough geotechnical investigations to determine soil properties and appropriate engineering measures. These measures might include soil stabilization, deep foundations, or piling to ensure the road's stability and durability. Proper planning and engineering can mitigate the challenges posed by Alluvium, ensuring the proposed road remains safe and functional.

Stabilization techniques such as soil compaction, reinforcement with geosynthetics, or retaining structures can improve the engineering properties of the alluvial soil. Effective drainage systems, including culverts and erosion control measures, are necessary to manage surface water runoff and prevent erosion and sedimentation. Structural design considerations must accommodate settlement and ground movements, using flexible pavement materials and appropriate thicknesses. Regular monitoring and maintenance are vital to address any issues promptly and prevent further deterioration. Environmental compliance is essential

Terrain: The digital elevation and contour lines at 20-meter interval for Lagos is presented in **Figures** 4.21 and 4.22 respectively.

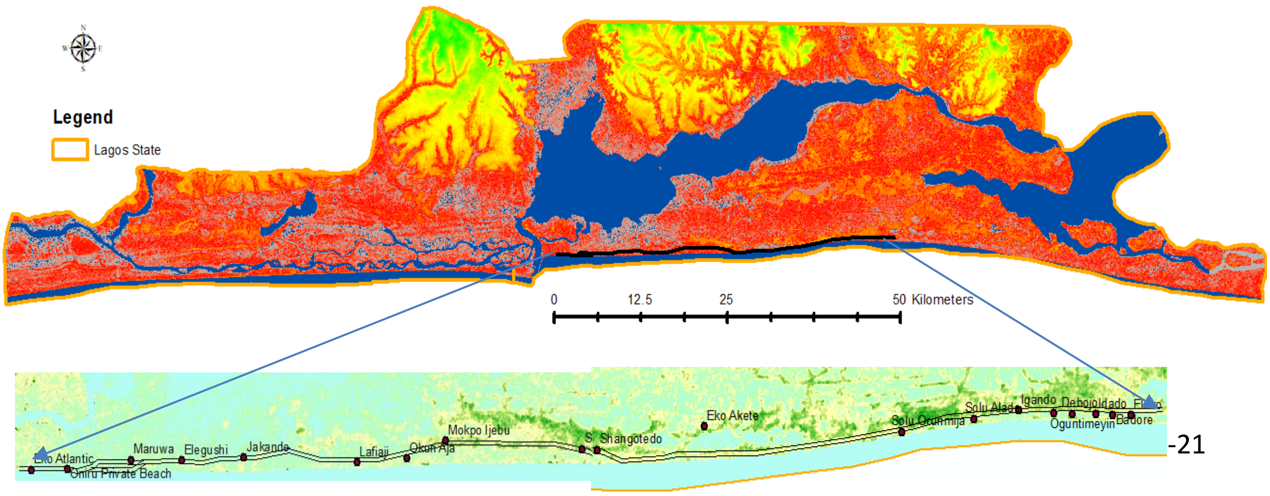


Figure 4.21: Contour/Isolines of Lagos

The contour lines show that the southern end of Lagos, particularly the south eastern portion, shows large invariance in the topography. Most of the locations fall between 0 and 5 meters above mean sea level.

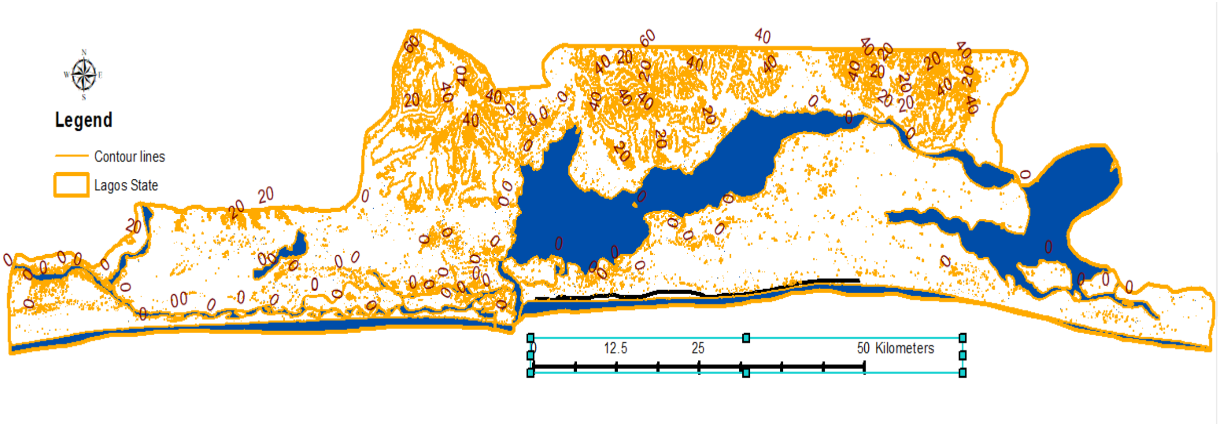


Figure 4.22: Contour/Isolines of Lagos

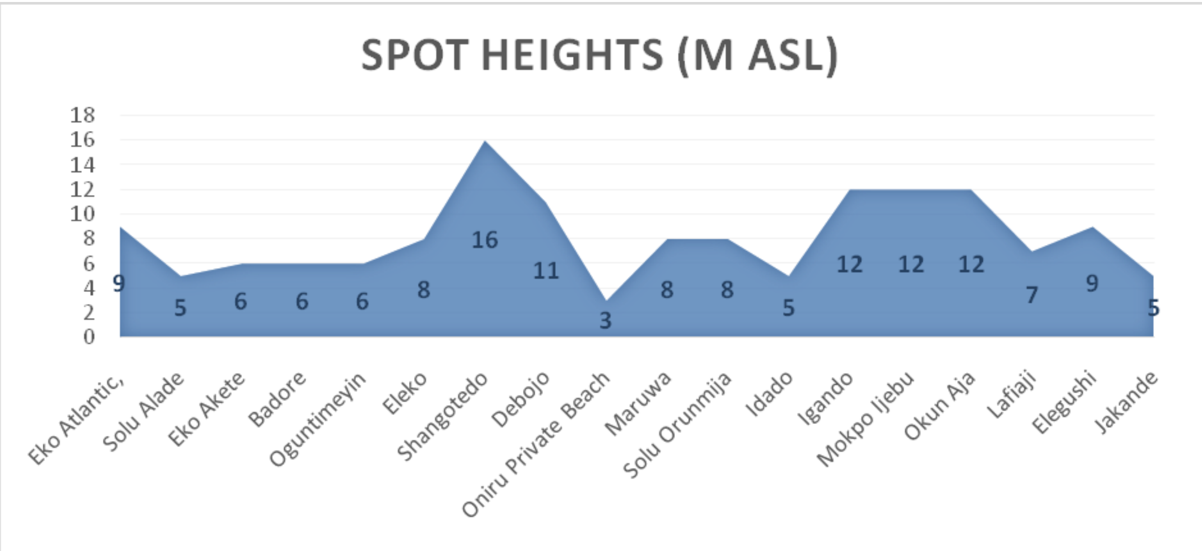


Figure 4.23: Spot heights of the sampling locations

Conducting topographic surveys and analyzing elevation, slopes, and contours, engineers and planners can make informed decisions about road design, alignment, and infrastructure placement to ensure the safety and efficiency of the coastal road project in Lagos.

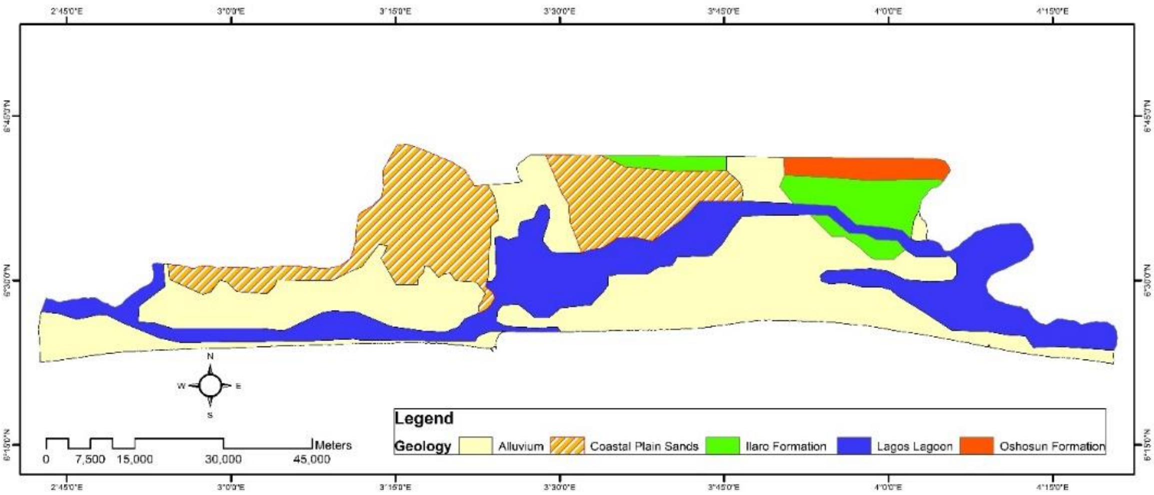


Figure 4.24: Geology Map of Lagos

4.5.3 Hydrology

Understanding Drainage Systems: The area upon which water, falls and the network through which it travels to an outlet are referred to as a drainage system. The flow of water through a drainage system is only a subset of what is commonly referred to as the hydrologic cycle, which also includes precipitation, evapo-transpiration, and groundwater flow. The hydrology tools focus on the movement of water across a surface.

A drainage basin is therefore an area that drains water and other substances to a common outlet. Other common terms for a drainage basin are watershed, basin, catchment, or contributing area. This area is normally defined as the total area flowing to a given outlet, or pour point. A pour point is the point at which water flows out of an area. This is usually the lowest point along the boundary of the drainage basin. The boundary between two basins is referred to as a drainage divide or watershed boundary.

Having provided some explanation on the operation of groundwater flow and the drainage system, the following aspects of hydrology are important for this project: Drainage order, Basin, Flow Accumulation, Flow Direction, Flow Length, Sink, Snap Pour Point and Watershed.

Drainage Order: This drainage network of section 1 as shown below was derived from the DEM extracted from the SRTM data as presented in **Figure 4.25.**

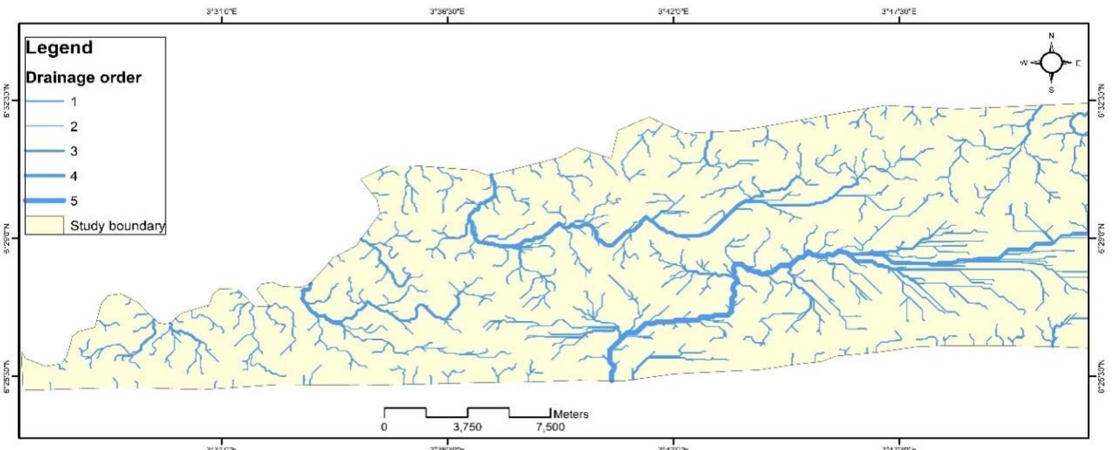


Figure 4.25: Drainage Network of Section One in the Project Area

The map shows that the project area has five drainage orders as shown in the map. The implication is that the neural drainage networkshave to be connected by canals that runs parallel to the road which can then drain into the ocean by one major channel as shown in the map as presented in Figure 4.26.

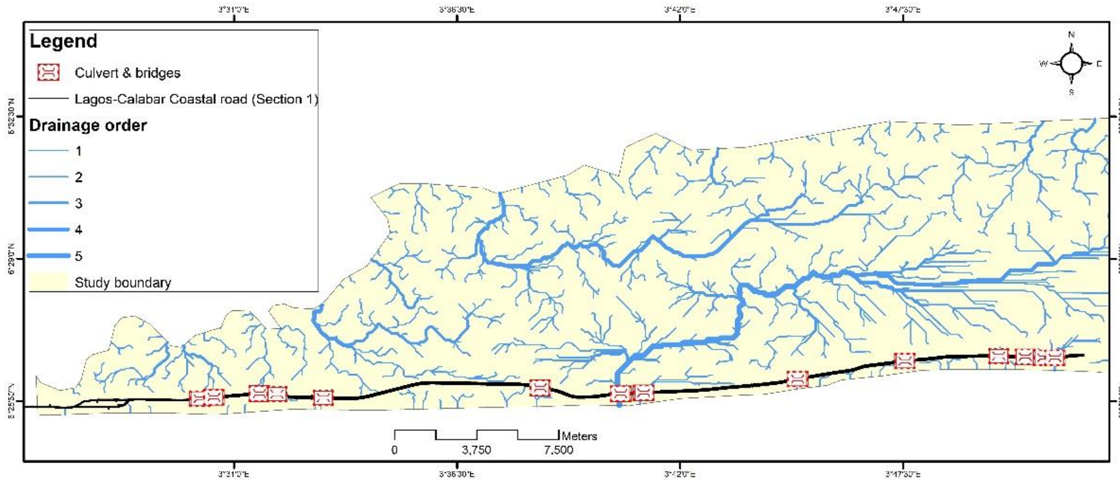


Figure 4.26: The drainage network with the coastal road and location that may require culverts and bridges

The construction of the road without a parallel drainage channel will lead to collection of water at various points by the road side. This collection of water at specific locations along the road would create some negative environmental effects including water borne disease such as serving as breeding sites for mosquitoes in the surrounding settlements. The impounded water could also threaten the integrity of the road. The map above shows locations that will require culverts and bridges for the purpose of creating an effective drainage system along the corridor. The plate below shows the proximities of communities and buildings to the proposed road

Plate 4.2: Satellite image of the proximity of buildings to the proposed road at Eleko vilage

The above satellite image provides a synoptic view of the villages to the right of way of the proposed corridor at Eleko in Ibeju Lekki. The impacts of the construction activities such as noise and dust from vehicular movements namely, heavy duty machines and trucks will be felt by the communities. Beyond these, is the flow of groundwater and surface runoffs during the raining season. The Table 4.14 also shows the coordinates of the points suggested for such culverts and bridges.

Table 4.10: Coordinates Locations for Suggested Culverts and Bridges

S/N	Longitudes (^{0}E)	Latitudes (^{0}N)
1	3.50844	6.42652
2	3.52715	6.42802
3	3.53434	6.42777
4	3.55342	6.42627
5	3.64254	6.43038
6	3.6756	6.42796
7	3.68509	6.42835
8	3.7483	6.43395
9	3.79239	6.44135
10	3.83095	6.44338
11	3.8418	6.44309
12	3.84947	6.44269
13	3.85399	6.44271

Source: Natural Eco Capital Fieldwork April, 2024

Watershed: It is clear from the map that there are 7 distinct basins in the northern portion of the State and all draining into the Lagoon and the ocean as shown in Figure 4.27.

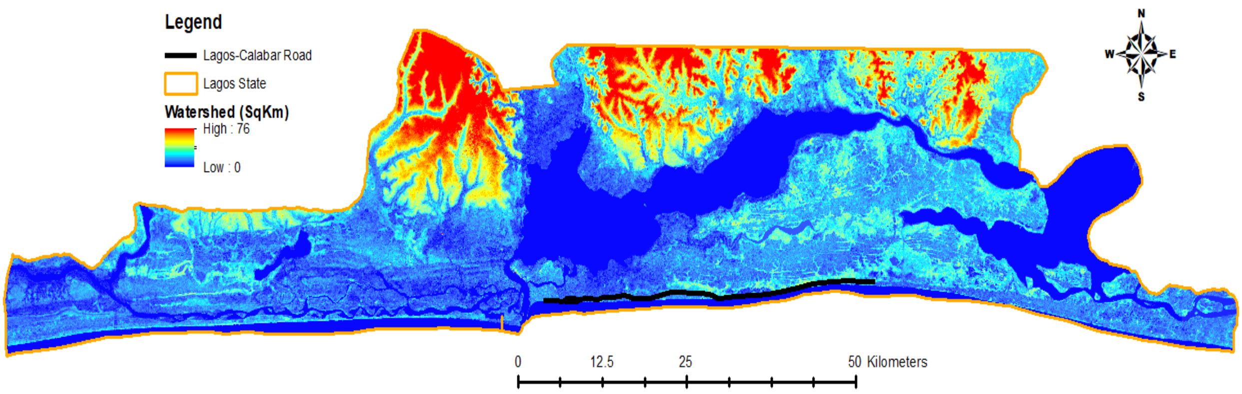


Figure 4.27: The Map of Watershed in Lagos State

A cursory look at the image also suggests that the coastal areas where the proposed road project is located also have moderately high watershed of up to 50 percent of the ones from the north. The drainage basin or catchment area, where all the water, including runoff, drains into common outlet at the southern part of the state is not pronounced because of the topography between 0 to 15 meters ASL. This merely suggests that the flow rate is not as fast as it is in the upper basins, hence the pronounced swamps and marishes at the south. Road compaction could further arrest the rate of flow thereby constituting in more stagnation and creation of ponds along the northern side of the corridor and also at locations on the southern side of the road where, nested settlements form obstructions to run offs.

***Flow Direction*:** These maps are essential in hydrological modeling, aiding the simulation of surface water movement across landscapes. They determine drainage patterns, contribute to flow accumulation calculations, and assist in terrain analysis by identifying watershed boundaries and slope characteristics. Crucial for flood modeling and erosion prediction, these maps help understand water behavior in ecosystems. They are fundamental tools for studying and managing watersheds, guiding decisions related to water resource management and environmental conservation. Generally, a southwesterly direction is prevalent. Incidentally, the flow direction reveals that water will not collect along the corridor. This is particularly helpful in the design of the concrete drainage channels along both sides of the proposed corridor. Most of the water accumulating in section one of the road should be channeled into a concrete drainage westward while run offs from section two of the corridor should be channeled eastwards as presented in Figure 4.28.

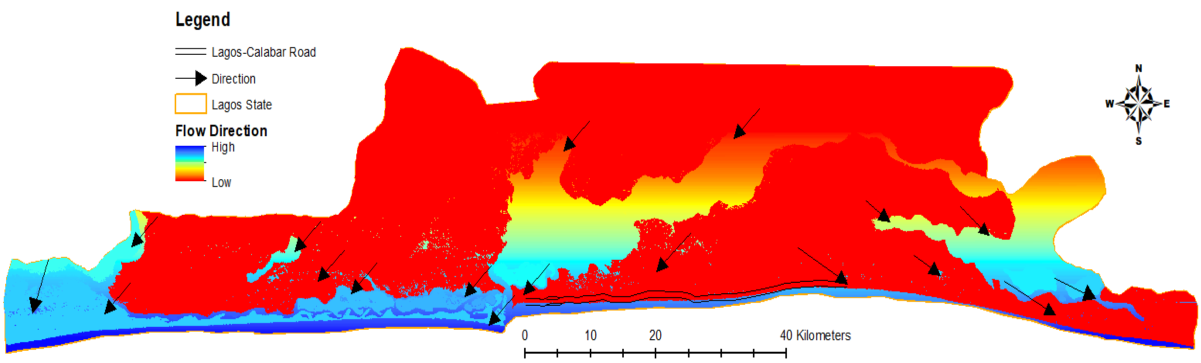


Figure 4.28: **The prevailing direction of runoff water flow**

Basin, Flow Length and Flow Accumulation: Further analysis reveals that the project areas do not have varying values in flow length, flow accumulation, and basin. This clearly suggests that the terrain lacks significant variations in slope or relief. Essentially, it indicates a relatively flat or uniform landscape where water flow is evenly distributed, without preferential pathways or concentrated drainage patterns. In hydrological terms, this may imply a gentle or uniform terrain where water movement is relatively consistent across the entire area, with no pronounced channels or basins of accumulation.

While the uniformity of flow characteristics may simplify some aspects of road design, careful planning and consideration of various factors are still necessary to ensure the construction of a safe, resilient, and environmentally sustainable coastal road. In designing such roads several considerations should arise:

Drainage Planning: The area lacks pronounced drainage patterns, and this implies proper drainage planning is still necessary to ensure that rainwater and runoff are efficiently managed. Even in uniform landscapes, localized drainage issues can arise, so designing effective drainage systems to prevent water accumulation on and around the road is crucial.

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Erosion Control: Although the terrain appears relatively flat, erosion control measures are essential to mitigate the potential impact of rainfall and runoff on the road and surrounding areas. Strategies such as vegetative buffers, retaining walls, and erosion-resistant materials should be considered as mitigations to minimize erosion risks.

Flood Management: Even in areas with uniform flow characteristics, flooding can still occur during heavy rainfall or storm events. Incorporating flood management measures such as adequate road elevation, storm water retention ponds, and flood barriers can help minimize the risk of flooding and protect the road infrastructure.

Road Alignment*:* In uniform landscapes, road alignment may be more flexible compared to areas with complex terrain. However, considerations such as coastal erosion, sea level rise, and future development should still be considered when determining the optimal road alignment to ensure long-term resilience and sustainability.

Environmental Impact: Designing the coastal road also requires careful consideration of its environmental impact. Preservation of natural habitats, conservation of biodiversity, and minimization of disturbance to sensitive ecosystems should be prioritized to maintain the ecological integrity of the area.

Sea Dredging, and Soil Placement

The sand used for reclamation along the coastal highway is primarily dredged from the sea. This dredged sand serves as a stable foundation for soil placement during highway construction. The project aims to reclaim lost shoreline areas by dredging up to 8 meters of sand. After dredging, the excavated soil is carefully placed along the highway alignment. Suitable soil types (such as granular soils, clay soils, and lateritic soils) are used to create a durable roadbed.

The Baseline Assessment for coastal road projects, focusing on the evaluation of the existing environment and key considerations. Kindly refer to the relevant section on the following environmental component which have been considered in this same chapter. Physical environment (examining landforms, topography, and geological features, identifying coastal dynamics, erosion patterns, and sediment transport), ecological environment (assessing biodiversity, habitats (such as wetlands, mangroves, and beaches), and species distribution, understanding ecological processes and interactions), air quality (monitoring air pollutants (e.g., particulate matter, gases) in the project area. considering emissions from construction and traffic), water quality (analyzing parameters like turbidity, nutrients, ph, and contaminants, evaluating impacts on aquatic ecosystems), socio-economic factors (engaging with local communities, assessing livelihoods, cultural heritage, and economic activities)

In other words, the marine ecosystems and other relevant parameters have been captured in other aspects of this report. Kindly refer to the relevant subsections of the various environmental components

4.5.4 Water Quality

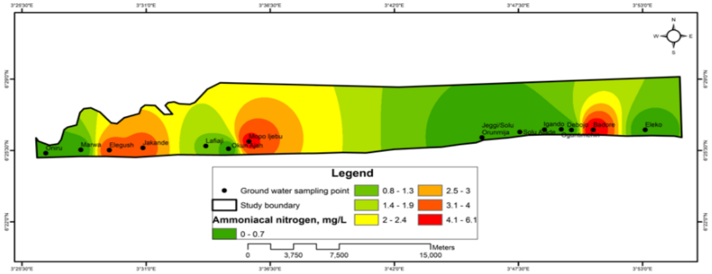
Sampling and analysis of water was done on the groundwater of the project site. The following section presents the report on the quality of the existing groundwater resource of the area.

4.5.4.1 Physico-chemical Condition of Groundwater: Groundwater quality can be affected by a number of physical characteristics of the land surrounding it. These characteristics may include land use and soil conditions at the surface as well as the deeper bedrock geology (lithology, mineralogy, chemical composition, and structure) of the principal aquifers from which water is drawn. How contamination influences the quality of water groundwater may also be related to soil thickness and topographic position of locations in relation to contaminant sources

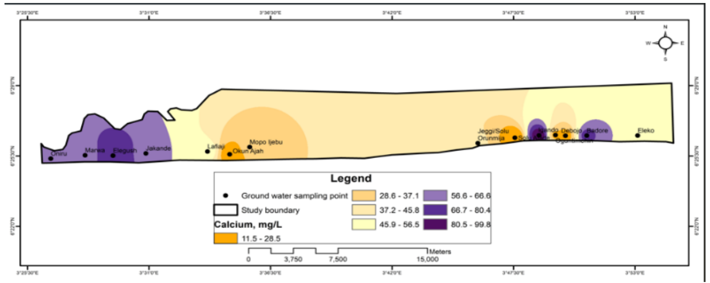
Road effects on groundwater are important considerations in determining the overall impact a transportation system imparts on the hydrologic function of a watershed. Information concerning road effects on groundwater is needed for ecological, watershed, fish habitat, and buffer strip analyses and is necessary input for optimizing transportation system development activities from an ecosystem management standpoint. This study was designed to assist in measuring and assessing the likely impacts of Lagos-Calabar roads on groundwater and to provide a foundation for developing the ability to predict effects of road prisms on groundwater, developing methods of identifying and treating or mitigating effects, accounting for groundwater concerns during construction, operations, maintenance, and closure.

The overall physico-chemical condition of the groundwater samples recorded in this investigation is presented in Appendix 4.1**.** The Electrical conductivity value in the analyzed groundwater samples ranges from 162.0 to 1857.0 $uScm^{-1}$ with mean value of 530.1 $uScm^{-1}$. Turbidity varied from 0 to 8.1 NTU, and mean value recorded was 7.48 NTU. pH ranged between 5.4 and 8.2, and observed mean value was 7.0. Total Dissolved solids varied from 131.0 to 1392.7 mg/L with mean value of 401.85 mg/L.

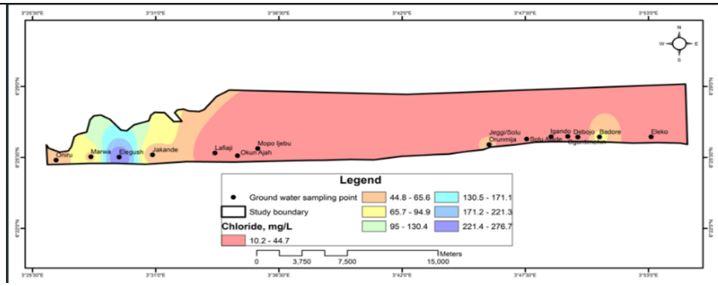
4.5.4.2 Maps of groundwater quality parameters*:* The maps below are the variability distribution of physicochemical parameters of the groundwater sampled along the proposed corridor. Areas with higher and lower concentrations of the parameters have been distinguished by the variation in colors as indicated on the maps. For instance, the map used the deeper color tones to represent higher concentrations as can be seen in the spatial distribution of ammoniacal nitrogen, calcium, chloride, copper, and the rest parameters in the maps are revealed in Figures 4.29.



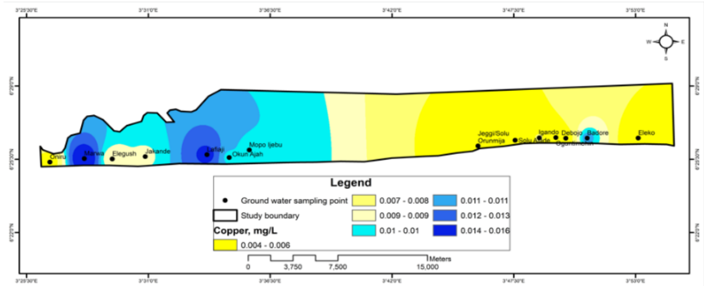
(a)Amino Nitrogen



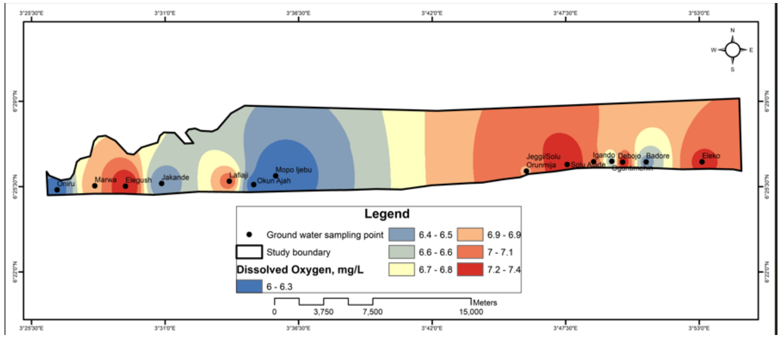
(b) Calcium



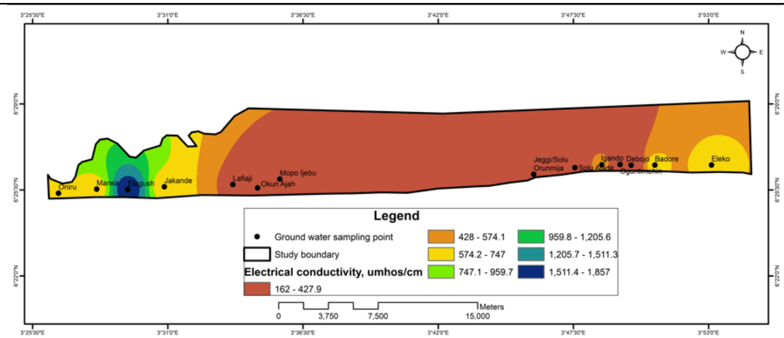
(c) Chloride



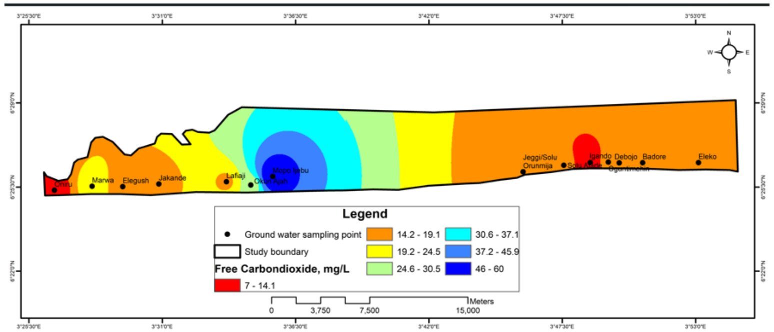
(d) Copper



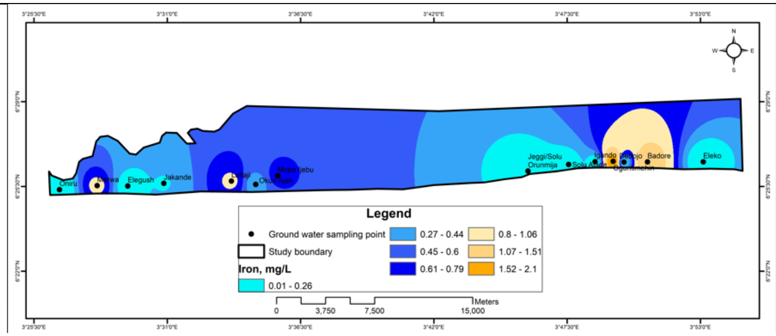
(e) Dissolved Oxygen



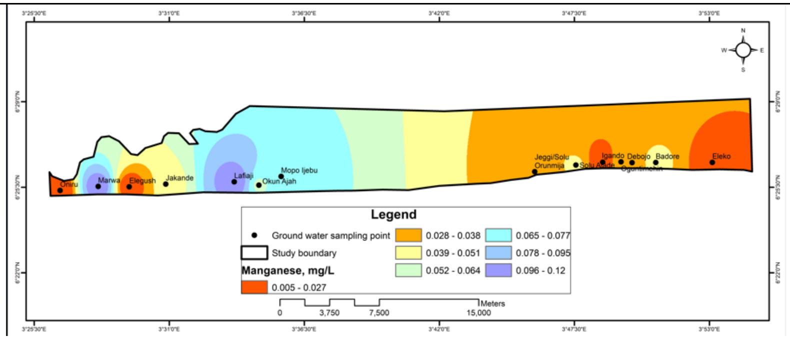
(f) EC



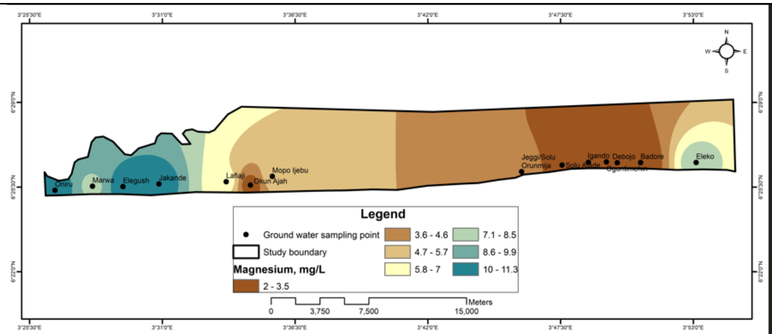
(g) Free Carbon



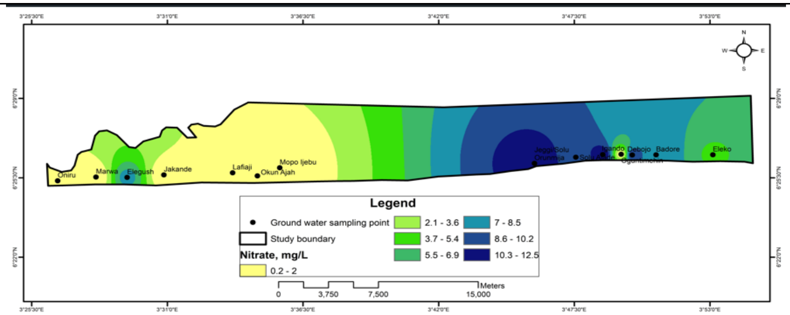
(h) Iron



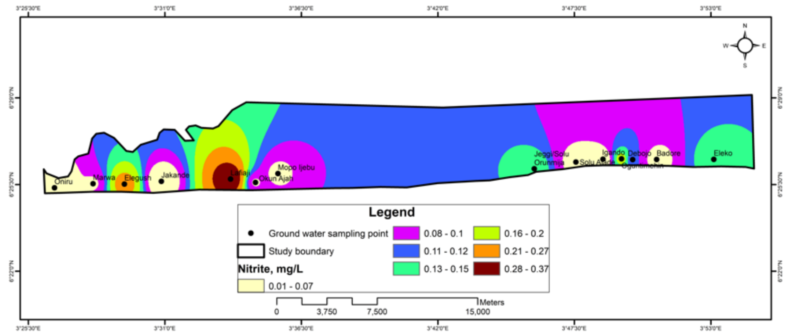
(i) Manganese



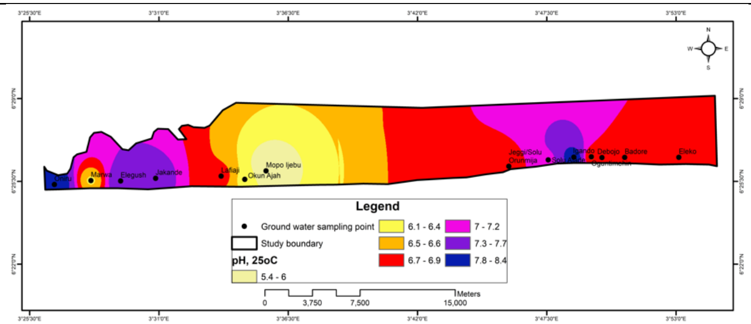
(j) Magnesium

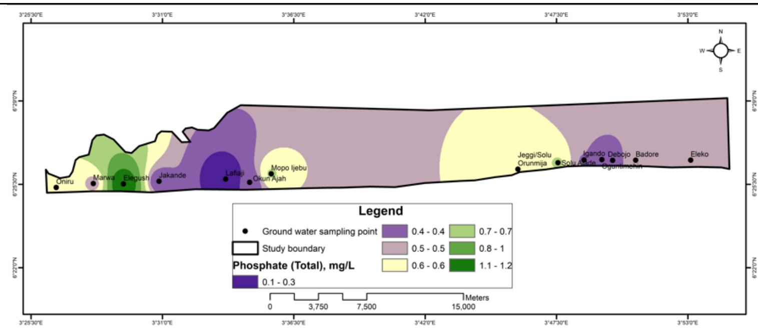


(k) Nitrate

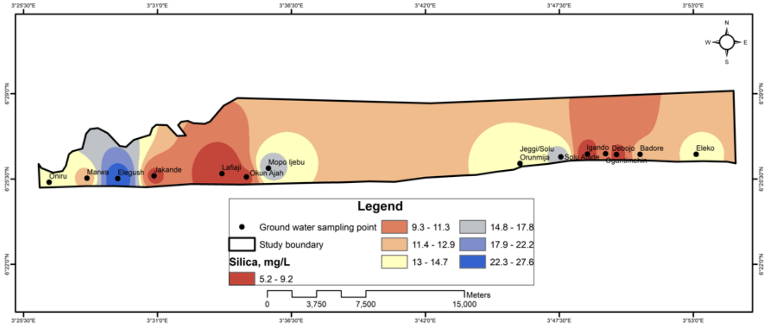


(l) Nitrite



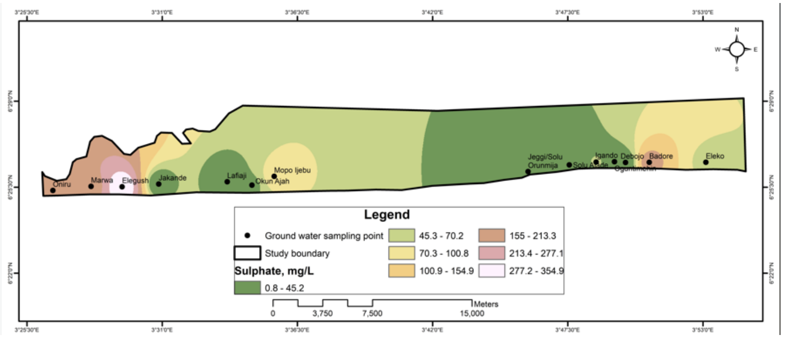


(b) pH

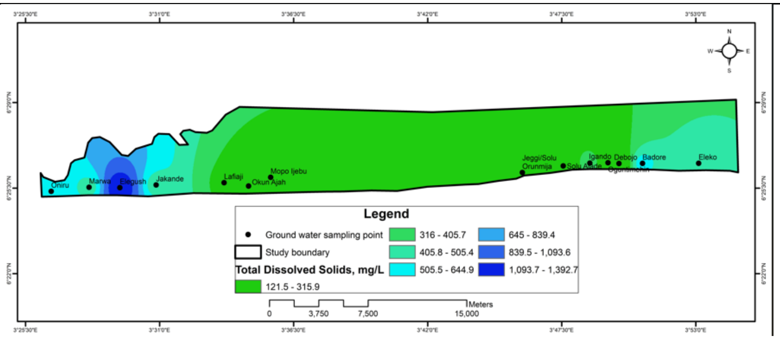


(b) Silica

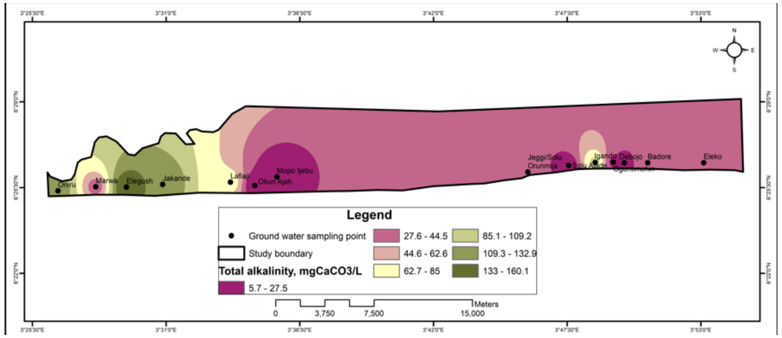
(b) Phosphate



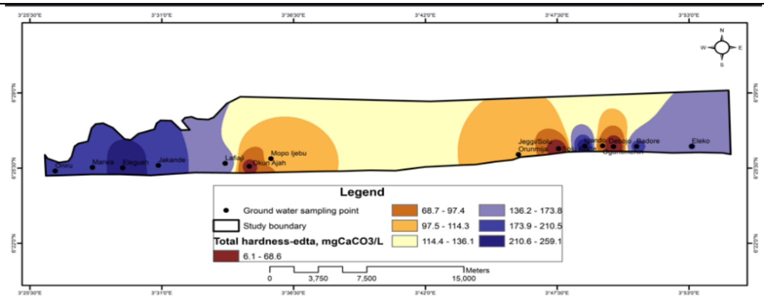
(b) Sulphate



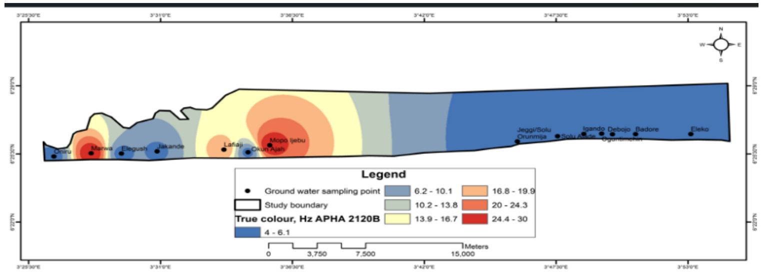
(m) TDS



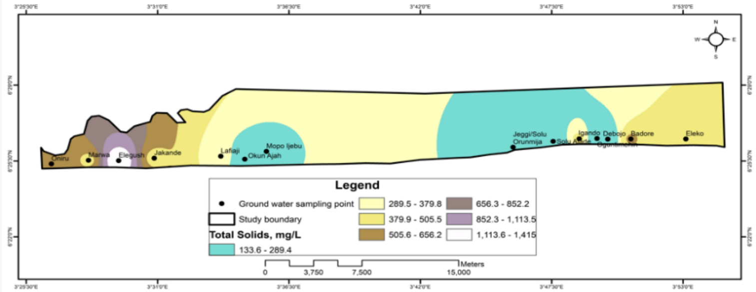
(n) Total Alkalinity



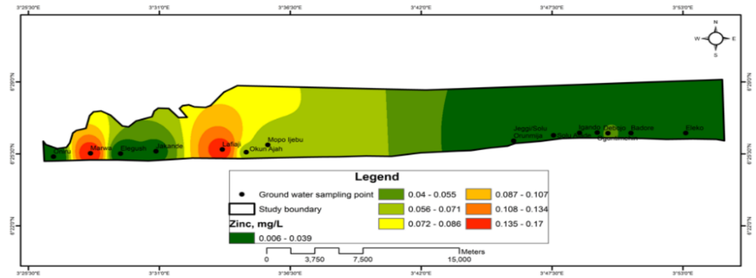
(o) Total Hardness



(p) True Colour



(q) TS



(r) Zinc

Figures 4.29 (a-r): Variability distribution of physicochemical parameters of groundwater in the project area.

4.5.4.3 Physico-chemical Condition of Surface water

Physico-chemical Characteristics of Seawater

Coastal area is the most dynamic and productive ecosystem, and are also focus of human settlements, industry and tourism. Anthropogenic pressures and climate changes have made the coastal environment increasingly susceptible. As coastal waters are dynamic and unstable, monitoring physico-chemical parameters is essential and plays a vital role in identifying pollution sources and understanding the variations in water quality. It is useful to stakeholders in making policies and establishing standards to ensure adequate protection of the aquatic environment. The quality of surface water within a region is influenced by both natural processes and anthropogenic activities. The physico-chemical characteristics of any aquatic ecosystem determine the productivity and diversity of the biota. The nature and distribution of the flora and fauna in the aquatic system are mainly controlled by the fluctuations in the physical and chemical characteristic of the water body. Several physico-chemical parameters of surface were investigated in this study to determine water quality status of the area, and the results obtained are presented in Tables 6.3, 6.4 and 6.5.

The temperature of water influences chemical reactions, water density, solubility of gases, and the buoyancy mechanism of plankton. Surface water temperatures observed in this study ranged from 28.89 to 30.59 ^{0}C, with an average temperature of 29.42^{0}C. Dissolved Oxygen (DO) can be described as the amount of gaseous oxygen dissolved in an aqueous solution. Oxygen is required for aerobic processes in the aquatic system. The concentration of DO varies daily and seasonally and it is dependent on the species of phytoplankton present, microbial activities, nutrient availability, temperature, water movement, partial pressure of atmospheric oxygen in contact with the water and bio-depletion rates (Mann, 2000; UNEP, 1978; GESAMP, 1988). This recorded DO values of range 4.0 to 9.34 mg/L for surface water, with a mean of 6.3 mg/L.

The salinity of the study area is controlled by the Gulf of Guinea's less saline thin surface layer of warm tropical waters overlying more saline subtropical waters from the North Atlantic. The salinity of the study area ranged from 26.1 to 29.7 ppt, with a mean value of 28.3 ppt. Conductivity accounts for the measure of the total ionic composition of water. The conductivity of the surface water ranged from 36,88 to 51700 µs/cm, with a mean of 45748 µs/cm. pH of seawater is a measure of the hydrogen ion concentration, and it is affected natural and anthropogenic processes taking place in the water. The pH of surface waters at the study locations ranged from 6.9 – .7.9, with a mean value of 7.5.

Total suspended solids (TSS) are made up of allochthonus and autochthonus organic and inorganic fractions. One hazard associated with elevated levels of TSS is the possibility of these suspended materials clogging the gills of fishes which could lead to their death or retard their growth rates. Total suspended solids also reduce light penetration, and this could have a profound impact on the algal community as their ability to produce food and oxygen is reduced. The concentration of TSS ranged from 3.0 to 13.35 mg/L with a mean value of 8.2 for surface water. Turbidity of seawater can be increased due to increase in waste discharge, urban run-off, and activities of bioturbators that stir up sediments, waves and current actions. The turbidity recorded in the study area was low.

Within the study area, nitrate levels for surface waters ranged from 1.5 to 5.91 mg/L with a mean of 3.6 mgL, while phosphate ranged from 0.02 to 9.12 mg/L with a mean value of 1.5.

Table 4.11 Summary of results of physicochemical parameters of surface water in the study area

Parameter	Unit of Measurement	Min	Max	Mean
Temperature	^{O}C	28.89 – 30.59	29.42	
pH		6.9	7.86	7.5
Electrical conductivity	(µs/cm)	36,800.0	51700.00	45,748.0
Salinity	ppt	26.1	29.7	28.3
TDS	(mg/L)	18,900.0	30274.62	25,967.9
TSS	(mg/L)	3.0	13.35	8.2
Turbidity	(NTU)	2.4	2.38	2.4
DO	(mg/L)	4.0	9.34	6.3
BOD	(mg/L)	0.8	2.57	1.5
COD	(mg/L)	5.3	8.6	7.0
Sodium	(mg/L)	7,396.5	11242.68	9,253.7
Magnesium	(mg/L)	43.4	3771.34	1,604.1
Potassium	(mg/L)	381.1	775.83	552.5
Calcium	(mg/L)	297.7	576.70	414.2
Sulphate	(mg/L)	27.8	19783.40	6,176.8
Phosphate	(mg/L)	0.02	9.12	1.5
Nitrate	(mg/L)	1.5	5.91	3.6
Chloride	(mg/L)	23,040.0	34268.54	26,860.3

Hydrocarbons in Seawater

Anthropogenic activities like machinery operations, oil and gas activities, shipping, fishing and boating can introduce petroleum hydrocarbons into the marine environment. The more persistent or heavier fractions could settle in the sediment while the higher fractions are dissipated by evaporation. Mean Hydrocarbons concentrations in seawater in the study area are depicted tables 6.4

Table 4.12. Summary of hydrocarbon concentrations in surface water from the study area

Parameter	Min	Max	Mean
Oil & Grease	0.11	4.51	0.69
TPH	0.06	1.37	0.49
BTEX	0.01	0.04	0.03
PAH	0.01	0.08	0.03

Metals in Water

Generally, metals occur in the water column in trace levels, because they usually flocculate settle out of water into the sediment. Trace or heavy metals from an environmental perspective has the potential to bioaccumulate and concentrate in the tissues of marine organisms. These may enter the food chain in the process and can ultimately affect man (Tait and Dipper, 1997; Mann, 2000). The concentration of the metals was generally low during the study (Tables 6.5)

Table 4.13: Metal Concentrations in Surface Water from the study locations

Parameter	Min	Max	Mean
Iron	0.11	2.73	1.12
Manganese	0.01	0.17	0.07
Copper	0.01	0.10	0.05
Nickel	0.12	0.91	0.45
Barium	0.01	0.13	0.06
Lead	0.11	0.87	0.44
Cadmium	0.01	0.10	0.04
Chromium	0.01	0.21	0.11
Zinc	0.02	18.00	1.29
Mercury	ND		
Arsenic	ND		

4.5.5.3 Physico-chemical Characteristics of Sediment

The detailed results of the physico-chemical characteristics of sediment are presented in **Appendices, while** summaries of the values recorded for the various categories of physico-chemical parameters are presented in Tables 6.6 to 6.8. The results indicate that, pH values ranged between of 7.1 and 8.3, with a mean values of 7.7, chloride concentrations ranged between 1155 to 55441 mg/kg and a mean value of 25712.2 mg/kg, and phosphate concentrations fluctuated between 100 and 924.5 mg/kg and a mean value of 271 mg/kg. Magnesium, sodium, potassium and calcium recorded mean values of 3261.3 mg/kg, 10110.5 mg/kg, 3161.4 mg/kg, and 1828 mg/kg respectively. The grain size distribution of sediment particles shows that, the study area is dominated by muddy particle. This observation is true for most Nigerian coastal environments especially within the continental shelf, however, anthropogenic infractions tend to have affected this pattern in many of the sampled locations.

Metals

Values of metal concentrations ranged from 619 to 20351 mg/kg, 12.5 to 155.6 mg/kg, 0.6 to 10.5 mg/kg, 0.5 to 15 .9 mg/kg and 0.3 to 15.4 mg/kg for iron, manganese, copper, nickel and barium respectively. Values recorded for lead, cadmium, chromium and zinc varied between 0.7 and 12.7 mg/kg, 0.1 and 1.9 mg/kg, 0.3 and 4.9 mg/kg, and 1.2 and 42.2 mg/kg. Mercury and Arsenic occurred at concentrations below the instrument detection limit of 0.01 mg/kg, The relatively high concentration of iron and manganese in the sediment may be attributed to their high concentrations in the Earth's crust. Generally the heavy metals concentrations observed in this study were within national and international permissible limits for oceanic conditions.

Hydrocarbons

The summary of the concentration of hydrocarbon parameters in sediment as recorded in this study is shown in **Table 6.8.** Total Petroleum Hydrocarbon (TPH) concentrations ranged from 1.3 to 9.46 mg/kg, with a mean of 4.4 mg/kg. Total Organic Carbon (TOC) ranged from 4.1 to 16.8 mg/kg, with mean of 12.1 mg/kg. Oil and Grease ranged from 13.7 – 146.3 mg/kg, with mean of 69 mg/kg. PAH ranged from 0.1 mg/kg to 0.5 mg/kg with mean of 0.5 mg/kg, while BTEX concentration was generally low in this study. The results for TPH, BTEX and PAH showed that the sediments were generally free from petroleum contamination.

4.6 Physico-chemical Description of the Soil of the Project Area

As stated earlier stated in section 4.5.2 under the geology of the project area, the soil of the project area consists mainly of alluvium, coastal plain sands, Ilaro and oshoshun formation. The consists of loose, unconsolidated soil and sediment deposited by rivers and other water sources. The soil is typically soft, highly compressible, and can be prone to erosion, settling and shifting. This sub-section presents the result of the laboratory investigation of the physicochemical attributes of the soil.

***pH*:** The soils in the entire area ranged from slightly basic to quite basic based on the pH value of the soil samples. The surface soil with pH ranging from 7.2 to 9.2 with an average of 8.2 and subsurface soil pH ranging from 7.2 to 8.9 with a mean value of 8.05. Factors that affect soil pH include precipitation (rainfall), drainage, soil vegetative cover, type of soil with respect to mineral composition. The result of the present study revealed relatively high amount of sand in the soil aeration which would increase soil pH (reduce acidity).

***Soil Particle Distribution* (%):** During the fieldwork, the value of sand particle size for surface soil and subsurface soil ranged from 36.3 to 61.5 and 34.1 to 59.2% respectively. Composition of silt soil particles varied from horizon to horizon with an average of 21.1% in the surface soil and 25.1% in the subsurface soil. Clay particles ranged from 9.3 to 38.8% in the surface soil and 9.7 – 39.9% in the subsurface soil.

Total Organic Carbon (TOC %): The soils exhibited wide variability in terms of total organic carbon content. In the surface soil, TOC ranged from 0.1 to 5.1%, with a mean value of 2.56% and the subsurface soil percentage TOC ranged from 0.05 to 5.1% during 2024 dry season fieldwork. Organic matter tends to accumulate under wet or cold conditions where decomposer activity is impeded by low temperature (Buol, 1990) or excess moisture which results in anaerobic conditions (Trofimov *et al*., 2008). Conversely, excessive rain and high temperatures of tropical climates as in the present assessment enables rapid decomposition of organic matter and leaching of plant nutrients. Excessive slope may encourage the erosion of the top layer of soil which holds most of the raw organic material that would otherwise eventually become humus. In view of the observations during the field studies, the present variability in total organic carbon content of the soils could be attributed to its high accumulation around the densely vegetated and unhampered secondary forest portion of the area. The other areas possess less dense vegetation cover leading to reduced rate of plant residue returns and accumulation with inherent high decomposition rate on the sandy, loamy sand texture soil.

***Cation: Sodium, Calcium, Potassium and Magnesium*:** In the surface soil, the mean levels of the cations were as follows: Sodium (156.65mg/kg); Calcium (9332.55mg/kg), Potassium (234.25mg/kg) and Magnesium (818.1mg/kg) respectively while in the subsoil, Sodium (181.9mg/kg); Calcium (7873.75mg/kg), Potassium (322.7mg/kg) and Magnesium (766.7mg/kg).

***Anions: Sulphate, Phosphate and Nitrate*:** In the surface soil, the mean levels of the anions were as follows; Sulphate (154.35mg/kg); Phosphate (27.55mg/kg), Chloride (602.5mg/kg) and Nitrate (313.2mg/kg) respectively while in the subsoil, Sulphate (148.9mg/kg); Phosphate (31.25mg/kg), Chloride (590.6mg/kg) and Nitrate (278.3mg/kg) respectively.

Electrical Conductivity (EC): Electrical Conductivity (EC) determines the ability of soil water to carry an electrical current, as the major and minor nutrients important for plant growth take the form of either cations or anions, which are dissolved in the soil water which is the conductor of electrical current. During 2024 dry season fieldwork, the E.C. of the surface soils varied between 258.7 and 427.0µS/cm with a mean value of 34.85µS/cm while in the subsurface soil the value ranged from 251.7 to 367.8µS/cm. The electrical conductivity values were all generally low. This is an indication of low levels of electrolytes in the soil, and where they are abundant; the sandy texture of the soil facilitates leaching.

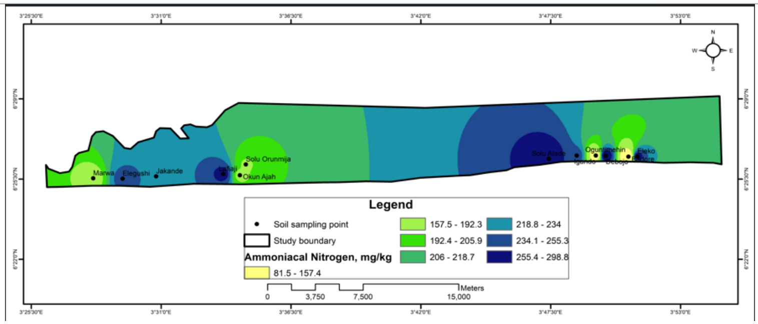
Organics (mg/kg): During current study the Total Hydrocarbon Content ranged from 0.4 to0.7mg/kg for the surface soil while it ranged from 0.1 to 0.32mg/kg for the subsurface soil. Other organics such as PAH ranged from 0.01 to 0.017mg/kg for the surface soil while it ranged from 0.01 to 0.02mg/kg for the subsurface soil. BTEX ranged from <0.001 to 0.02 in the surface and the subsurface soil. For TPH, the values ranged from 0.17 to 0.48mg/kg for the surface soil while it ranged from 0.1 to 0.57mg/kg for the subsurface soil.

Heavy Metals: In the surface soil, the mean concentration of the heavy metals and related soil micronutrient elements were as follows; Iron (575.13mg/kg), Zinc (28.35mg/kg), Lead (1.9mg/kg), Copper (1.715mg/kg), Cadmium (<0.001mg/kg), Arsenic (386.7mg/kg) and Chromium (2.68mg/kg). In the subsurface soil, the mean concentration of the heavy metals and related soil micronutrient elements were as follows; Iron (619.84mg/kg), Zinc (34.3mg/kg), Lead (2.75 mg/kg), Copper (1.9mg/kg), Cadmium (<0.001mg/kg), Arsenic (<322.1mg/kg) and Chromium (3.25mg/kg).

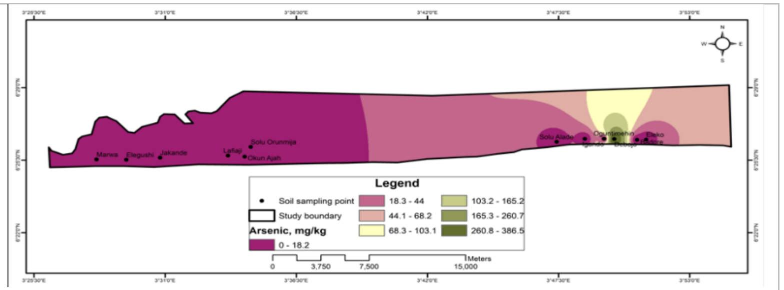
Table 4.14: Mean Concentration of the Heavy Metals

THB x 10^6 (cfu/g)	**2.16**	**4.47**	**3.315**	**1.155**	**1.83**	**4.06**	**2.945**	**1.115**
THF x 10^2 (cfu/g)	0.27	1.35	0.81	0.54	0.14	1.35	0.745	0.605
HUB x 10^4 (cfu/g)	0.52	2.48	1.5	0.98	0.31	2.48	1.395	1.085
HUF x 10^1 (cfu/g)	0.17	0.74	0.455	0.285	0.29	0.57	0.43	0.14

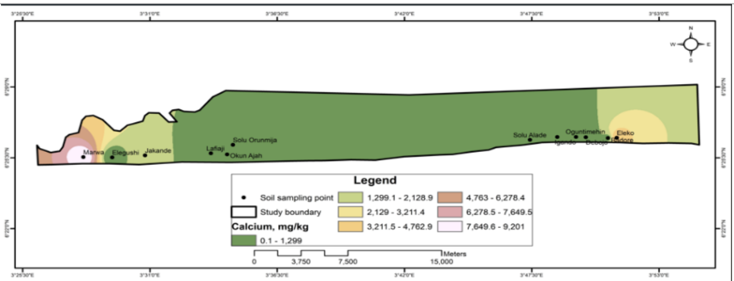
Source: Natural Eco Capital Fieldwork April 2024



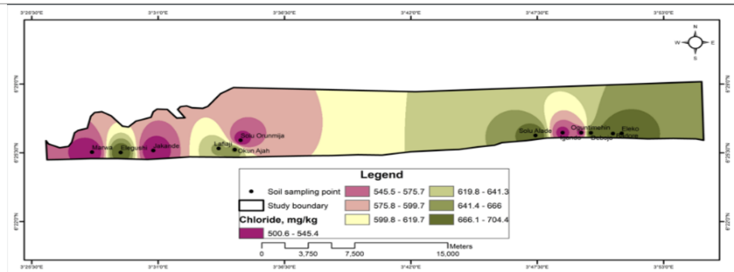
Ammoniacal Nitrogen



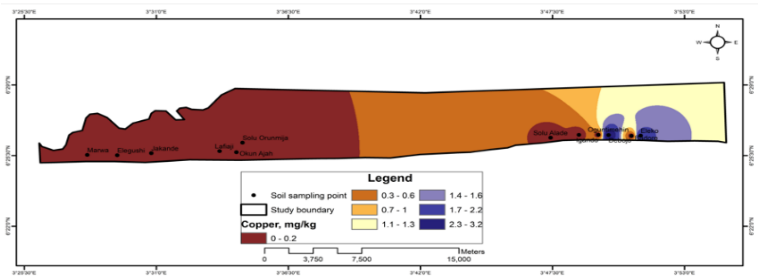
(b) Arsenic



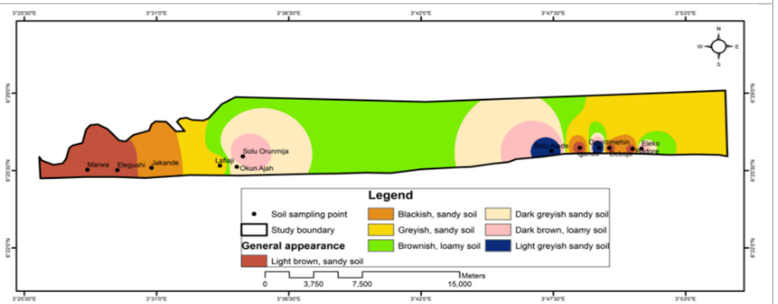
(c) Calcium



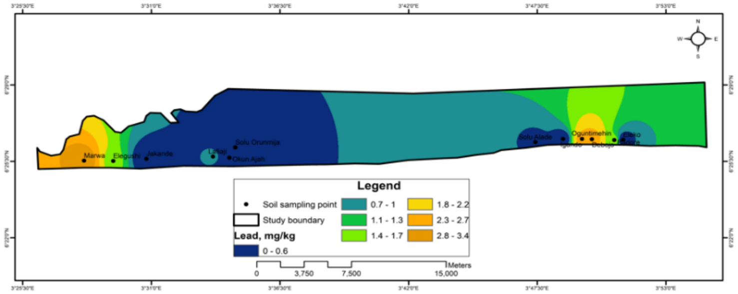
(d) Chloride



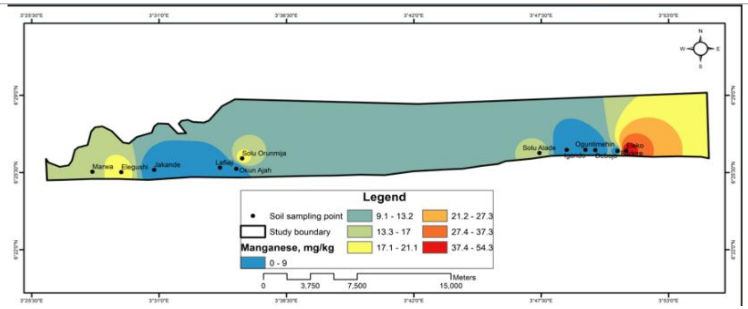
(f) Copper



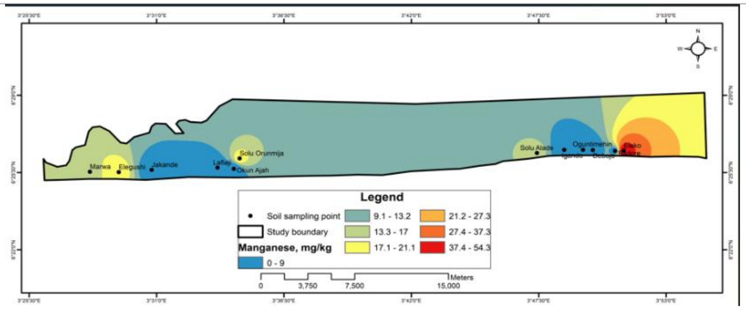
(g) Generalappearance



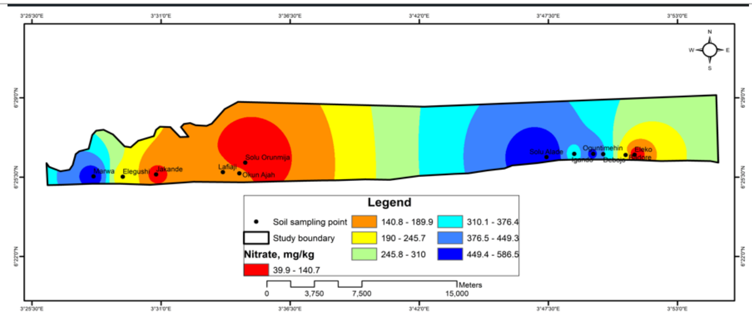
(i) Lead



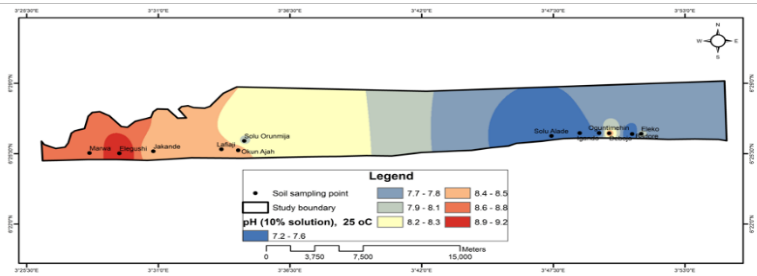
(k) Manganese



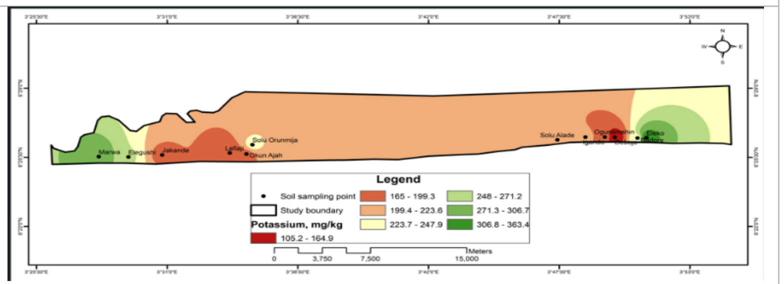
(k) Manganese



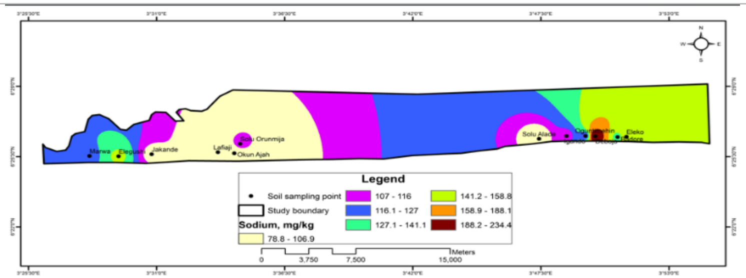
(m) Nitrate



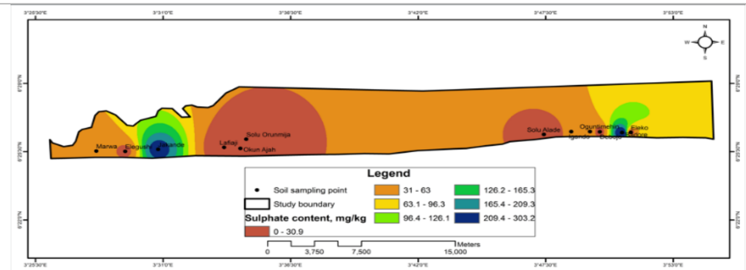
(n) pH



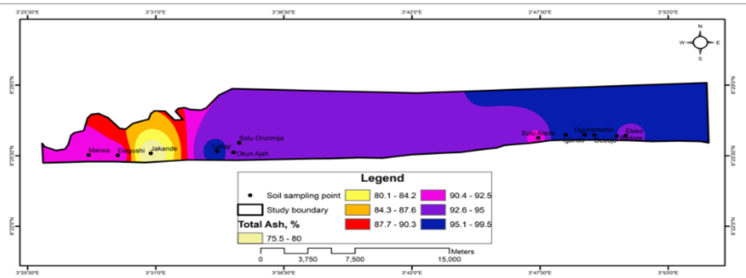
(o) Potassium



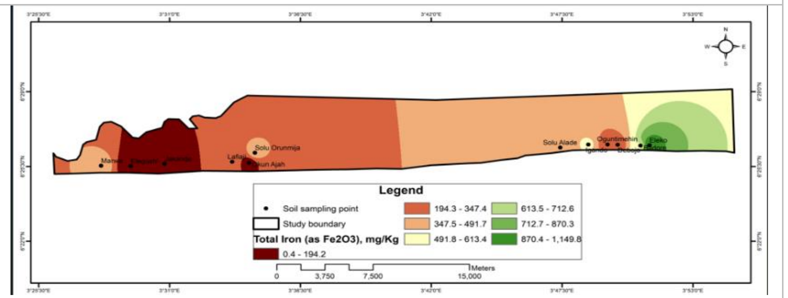
(p) Sodium



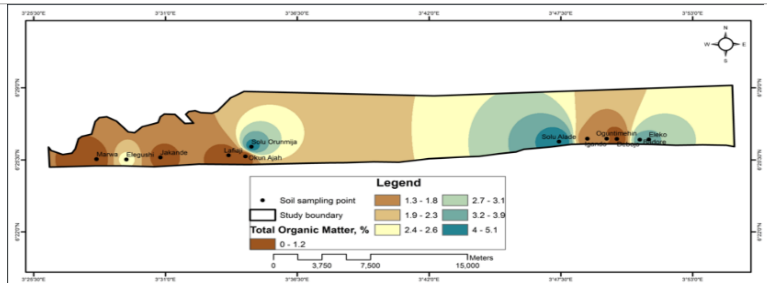
(q) Sulphate



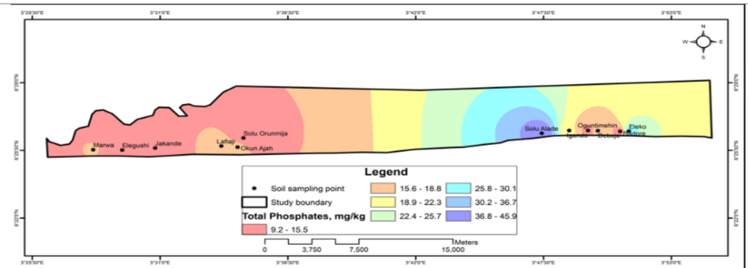
(r) Total Ash



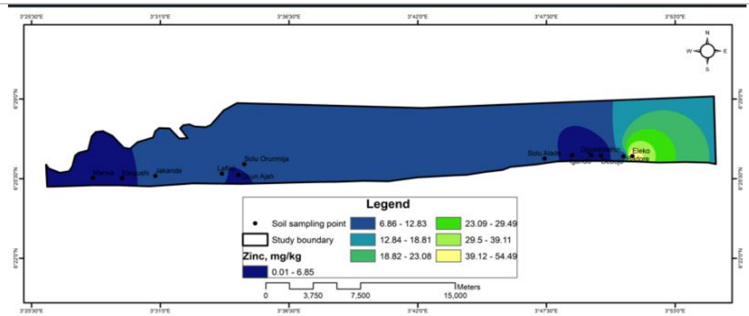
(s) Total Iron



(t) Total Organic



(u) Total phosphate



(v) Zinc

Source: Natural Eco Capital Field Work

Figure 4.30: Variability Distribution of Physicochemical of Soil Samples Along the Proposed Coastal Highway.

The map reveals the variability in concentrations of the elements in colors. Generally, deeper color tones depict higher concentrations as shown on the respective map legends as presented in Figure 4.30.

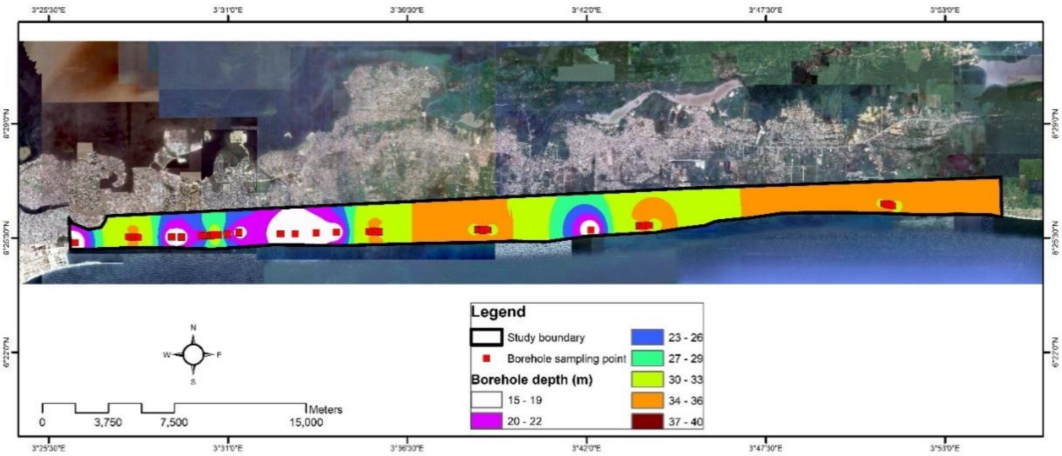


Figure 4.31: Borehole Points for the Geotechnical Investigation

4.7 Air Quality Assessment

In developing countries, monitoring “classical” air pollutants such as carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NO and NO_2), sulfur dioxide (SO_2), volatile organic compounds (VOCs), and suspended particulate matter (SPM) is common. Pollution of fine particulate matter (PM2.5) pollution is a major concern. AccuWeather data for Nigeria indicates fair to excellent air quality levels for various pollutants as presented in Figure 4.32 while the summary of the Air Quality Pollutants and Detrimental Effects is presented in Table 4.17**.**

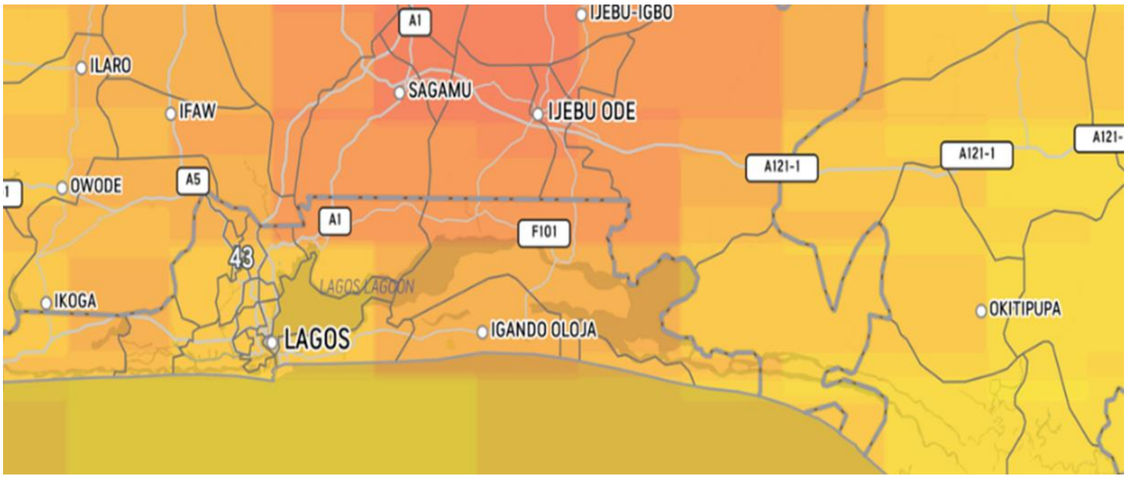


Figure 4.32: Current Air Quality in Lagos *AccuWeather* Data

Table 4.13: Air Quality Pollutants and Detrimental Effects

$PM_{2.5}$ (Fine Particulate Matter): • Fair level with a concentration of 12 µg/m³. • Can enter the lungs and bloodstream, causing serious health issues. • Associated with aggravated asthma and chronic respiratory disease.	PM_{10} (Particulate Matter): • Fair level with a concentration of 31 µg/m³. • Inhalable particles (diameter < 10 micrometers) can cause eye/throat irritation, coughing, and aggravated asthma. • Frequent exposure may lead to more serious health effects.	NO_2 (Nitrogen Dioxide): • Excellent level with a concentration of 1 µg/m³. • High levels increase the risk of respiratory problems, including coughing and difficulty breathing.
O_3 (Ground-level Ozone): • Fair level with a concentration of 52 µg/m³. • Aggravates existing respiratory diseases, causing throat irritation, headaches, and chest pain.	CO (Carbon Monoxide): • Excellent level with a concentration of 181 µg/m³. • Colorless and odorless gas; high levels can cause headache, nausea, dizziness, and vomiting. • Long-term exposure may lead to heart disease.	SO_2 (Sulfur Dioxide): • Excellent level with a concentration of 0 µg/m³. • Exposure can lead to throat and eye irritation, aggravating asthma, and chronic bronchitis.

4.7.1 Result of Measured Air Quality Levels in the Field*:* The air quality measurements in the study area are presented in Table 4.17. The gases monitored are nitrogen (IV) oxide (NO_2), carbon monoxide (CO), Ozone (O_3) Volatile Organic Compound (VOCs) and suspended particulate matter (SPM) specifically those of sizes 2.5 and 10 microns ($PM_{2.5}$& PM_{10}). Generally, the concentrations of the measured air pollutants in the ambient atmosphere suggest that the locations are relatively pristine. More so the values recorded were within acceptable regulatory limits except for a few parameters in few locations as depicted in the graphical illustrations of the parameters across the sampling locations. These results align with acceptable regulatory limits. However, despite these seemingly favorable levels, air pollution remains a critical issue as Exposure to PM2.5 is a significant health risk, contributing to a high number of premature deaths in the region.

Table 4.14b: Mean Measured Air Quality Pollutants in the Project Location

S/N	Monitoring Locations	Gaseous Pollutants (ppm)				Particulate (µg/m^3)	
		CO	NO_2	VOC	O_3	$PM_{2.5}$	PM_{10}
1.	Eko Atlantic	0.00	0.02	0.33	0.00	16.3	86.0
2.	Solu Alade	1.06	0.02	0.01	0.00	9.7	27.0
3.	Eko Akete	0.06	0.084	0.23	0.00	4	15
4.	Badore	0.00	0.03	0.00	0.00	8.3	25.7
5.	Oguntimeyin	0.00	0.012	0.00	0.00	12	44
6.	Eleko	0.41	0.09	0.27	0.00	16.7	102.0
7.	Shangotedo	1.02	0.040	0.22	0.00	5	14
8.	Debojo	0.00	0.04	0.00	0.00	10.0	52.0
9.	Oniru Private Beach	0.00	0.00	0.22	0.00	5.7	11.3
10.	Maruwa	1.63	0.01	0.22	0.00	16.8	63.3
11.	Solu Orunmija	1.03	0.01	0.03	0.00	10.7	35.7
12.	Idado	0.00	0.00	0.22	0.00	10.0	46.7
13.	Igando	0.43	0.01	0.06	0.00	8.3	32.0
14.	Mokpo Ijebu	0.79	0.01	0.18	0.00	5.0	9.5
15.	Okun Aja	0.18	0.02	0.17	0.00	10.0	27.0
16.	Lafiaji	0.00	0.03	0.19	0.00	22.3	45.7
17.	Elegushi	0.25	0.01	0.21	0.00	9.0	32.0
18.	Jakande	0.00	0.03	0.18	0.00	11.3	54.7
19.	Control (Folu, Ibeju-Lekki)	0.00	0.00	0.15	0.00	5.0	10.0
	Minimum	0.00	0.00	0.00	0.00	4.00	9.50
	Maximum	1.63	0.09	0.33	0.00	22.30	102.00
	Average	0.36	0.02	0.15	0.00	10.32	38.61
	FMEnv Limit	10	0.04	0.25	0.65		
	WHO Limit					25.0	50.0

Source: Natural Eco Capital field work April 2024

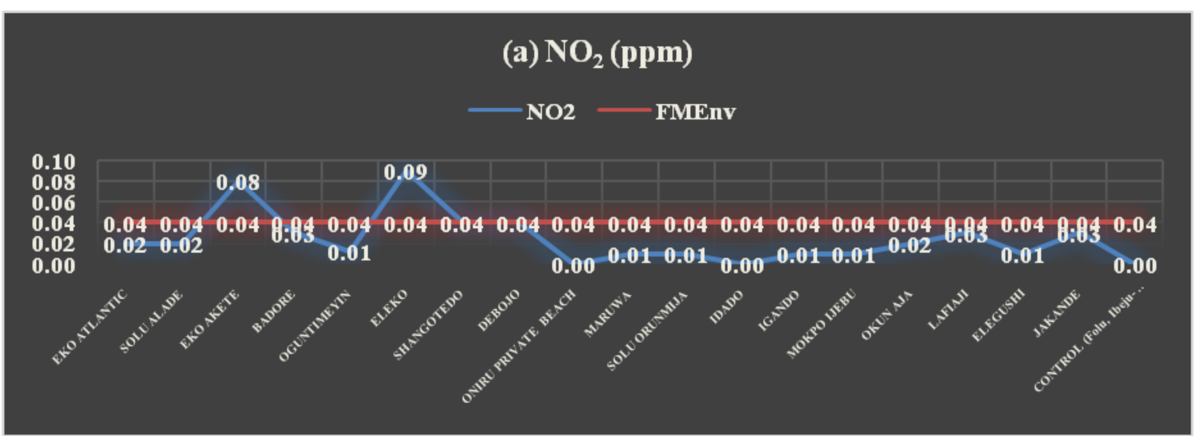
The levels of concentration of each of these gaseous pollutants across the sampling points are reported in the sections below.

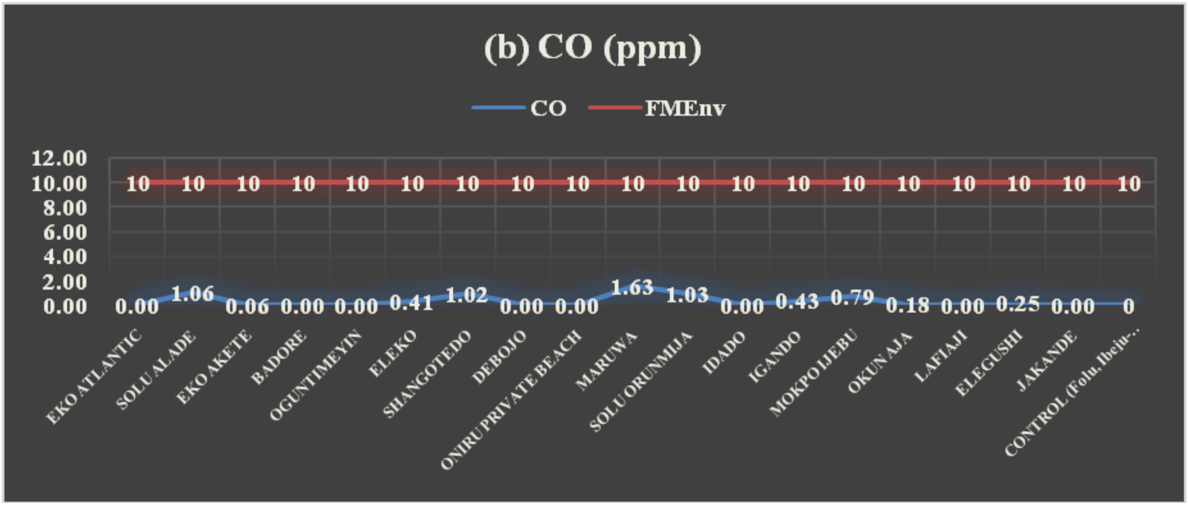
4.7.1 Gaseous Pollutants

Nitrogen Dioxide (NO_2) - The nitrogen dioxide (NO2) data from proposed project sites shows varying concentrations. Minimum, maximum, and average values were 0 ppm, 0.09 ppm, and 0.02 ppm respectively. Most locations exhibit low NO_2 levels except Eko Akete and Eleko, with slightly elevated levels attributed to vehicular emissions. The average NO2 level of 0.03 ppm falls below the regulatory limit of 0.04 ppm, indicating generally favorable air quality. This underscores the importance of monitoring and mitigating vehicular emissions to maintain healthy air quality. Figure 4.33a illustrates the variation in NO_2 values across project sites.

Carbon Monoxide- The proposed project locations show low carbon monoxide (CO) levels, ranging from 0 ppm to a maximum of 1.63 ppm, with an average of 0.36 ppm, well below the FMEnv regulatory limit of 10 ppm. This indicates favorable air quality conditions. However, occasional peaks, like the 1.63 ppm recorded at Maruwa, suggest localized vehicular emissions as major sources. **Figure 4.33b** illustrates the CO value variation. Overall, the data underscores compliance with regulatory standards and identifies localized emission sources, particularly vehicular, requiring attention.

Volatile Organic Compounds (VOCs)-Volatile Organic Compounds (VOCs) data across proposed project locations show acceptable levels overall, with minimum, maximum, and average concentrations at 0 ppm, 0.33 ppm, and 0.15 ppm respectively. Most locations comply with the FMEnv regulatory limit of 0.25 ppm, except for Eko Atlantic (0.33 ppm) and Eleko (0.27 ppm) due to construction and vehicular emissions respectively. Despite localized issues, air quality remains generally favorable. CO values' variation, depicted in Figure 4.33c, provides additional insights.





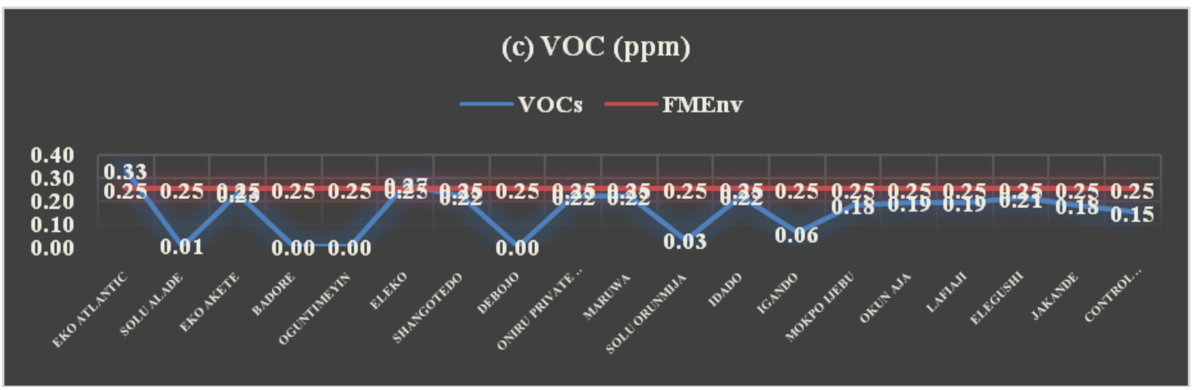


Figure 4.33 (a-c): Graphical Illustration of the Concentrations of Nitrogen Dioxide (NO_2), Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs) along the Project Site

4.7.2 Particulate Matters

Particulate Matters ($PM_{2.5}$) - The results indicate that the average levels of $PM_{2.5}$ at all the sampling locations fall within a relatively low range, with a minimum value of 4 µg/m³, a maximum value of 22.3 µg/m³, and an average value of 10.32 µg/m³. These values suggest that the air quality, in terms of $PM_{2.5}$ concentration, is generally good, staying well below the World Health Organization's daily limit of 25 µg/m³. The graphical illustration of variation of concentrations of the pollutant is depicted in Figure 4.34.

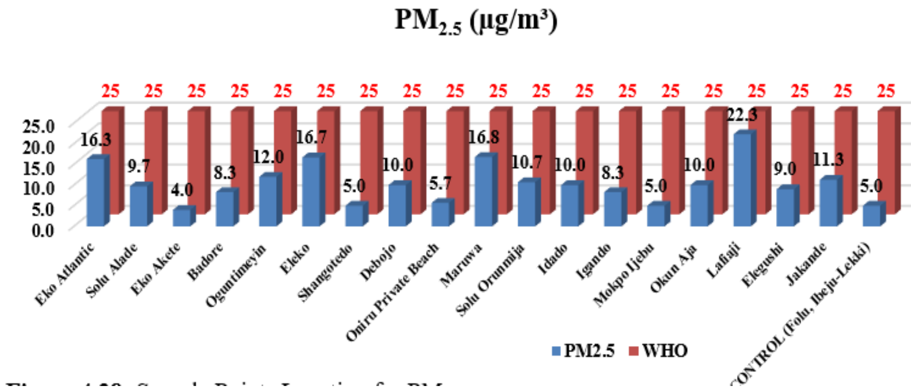
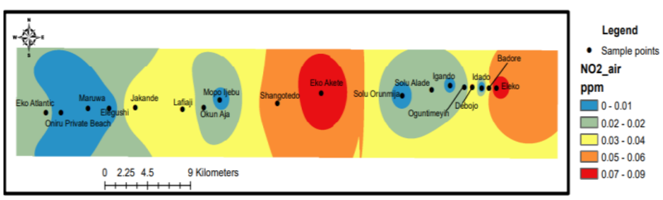
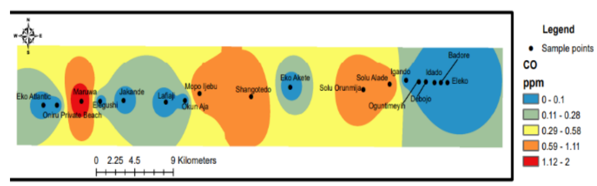


Figure 4.34: Sample Points Location for PM2.5

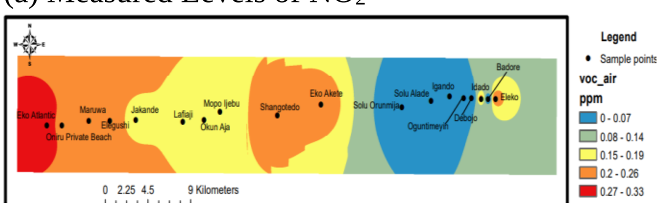
Air Quality Distribution Maps and Air Quality Modelling: Air quality distribution maps and air quality modeling are essential for understanding and managing air pollution. Distribution maps depict spatial variations in pollutant concentrations using observed data, aiding in visual representation, public awareness, and policy decisions, but they have limitations like sparse data and temporal variation. Modeling uses mathematical models to predict pollutant dispersion, incorporating emissions, meteorology, topography, and land use data for forecasting and policy evaluation, despite assumptions and uncertainties. All potential receptor communities have been assessed using distribution maps, as shown in Figure 4.35 (a-e) with continuous monitoring planned during construction.



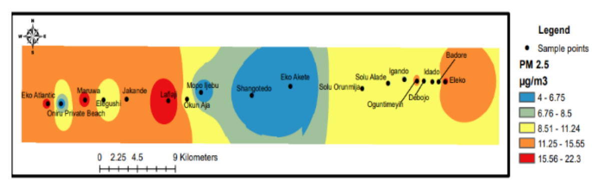
(a) Measured Levels of NO_2



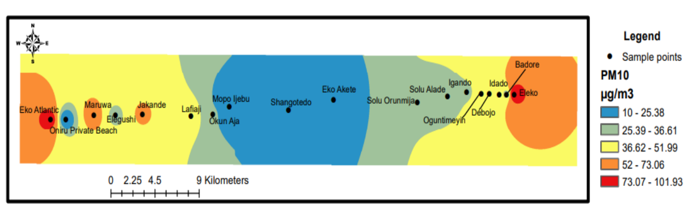
(b) Measured Levels of CO



(c) Measured Level of VOC



(d) Measured Levels of Particulate Matters ($PM_{2.5}$)



(e) Measured Levels of Particulate Matters (PM_{10})

Source: Natural Eco Capital, 2024

Figure 4.35*:* Air Quality Levels Distribution Maps Across the Project Area

4.8 Noise and Vibration

Noise Levels: Noise is a periodic fluctuation of air pressure. Apart from causing disturbance to the affairs of man, long term exposure to excessive noise can damage health and have psychological effects (SIEP, 1995). The effects of noise on residents generally relate to the annoyance/nuisance caused by the short- and long-term high noise levels. Also, disturbance to wildlife is significant especially during breeding seasons and/or when rare species are present. The average noise levels recorded at the sampling locations are outlined in Table 4.19.

Table 4.15: Noise Levels Measured in the Proposed Project Corridor

S/N	Monitoring Locations	Noise (dBA)		
		Av.	**Min.**	**Max.**
1.	Eko Atlantic	65.2	53.5	77.0
2.	Solu Alade	62.5	45.8	79.2
3.	Eko Akete	61.7	52.3	71
4.	Badore	62.4	49.3	75.4
5.	Oguntimeyin	61.6	54.5	68.7
6.	Eleko	67.5	55.6	79.3
7.	Shangotedo	66.2	49.2	83.2
8.	Debojo	56.3	45.5	67.1
9.	Oniru Private Beach	62.6	47.0	78.2
10.	Maruwa	70.6	57.9	83.4
11.	Solu Orunmija	53.1	43.2	62.9
12.	Idado	62.2	52.8	71.7
13.	Igando	57.3	48.9	65.7
14.	Mokpo Ijebu	56.6	44.7	68.6
15.	Okun Aja	66.5	49.0	83.9
16.	Lafiaji	57.9	48.6	67.1
17.	Elegushi	65.6	52.9	78.3
18.	Jakande	67.4	52.4	82.5
19.	Control (Folu, Ibeju-Lekki)	52.1	45.5	63.8
	NESREA: RESIDENTIAL	*50.0*		
	MIXED RESIDENTIAL	*55.0*		
	INDUSTRIAL	*70.0*		

Source: Natural Eco Capital field work April 2024

Table 4.16: Average Noise Levels at Sampling Locations with their Respective Land Use

S/N	Monitoring Locations	Landuse	Noise (dBA) Av.	NESREA LIMITS
1.	Eko Atlantic	Commercial	65.2	60.0
2.	Solu Alade	Residential	62.5	50.0
3.	Eko Akete	Mixed Residential	61.7	55.0
4.	Badore	Residential	62.4	50.0
5.	Oguntimeyin	Residential	61.6	50.0

6.	Eleko	Commercial	67.5	60.0
7.	Shangotedo	Commercial	66.2	60.0
8.	Debojo	Residential	56.3	50.0
9.	Oniru Private Beach	Mixed Residential	62.6	55.0
10.	Maruwa	Commercial	70.6	60.0
11.	Solu Orunmija	Residential	53.1	50.0
12.	Idado	Residential	62.2	50.0
13.	Igando	Residential	57.3	50.0
14.	Mokpo Ijebu	Residential	56.6	50.0
15.	Okun Aja	Residential	66.5	50.0
16.	Lafiaji	Residential	57.9	50.0
17.	Elegushi	Mixed Residential	65.6	55.0
18.	Jakande	Mixed Residential	67.4	55.0
19.	Control (Folu, Ibeju-Lekki)	Residential	52.1	50.0

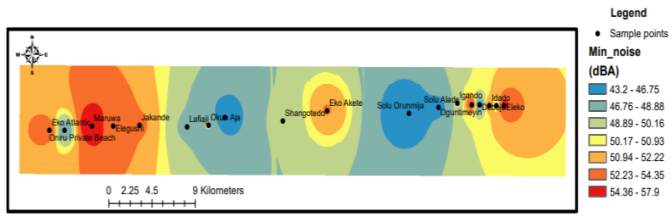
Source: Natural Eco Capital Fieldwork April 2024

Table 4.21 shows that the existing noise levels exceed NESREA limits at all points. This could be attributed to several factors depending on the location. Notably for this evidence include some of the ongoing construction activities at some of the locations, proximity of others to roads and areas with commercial activities. The noise level will further increase during the road construction and after commissioning. Overall, the widest range of noise levels measured was observed in SOLUALADE with a difference of 33.4 dBA between the minimum and maximum noise levels. These ranges provide insights into the variability of noise exposure across different monitoring locations. The calculated range for each set of noise levels across the alignment and nearby locations are outlined in Table 4.21.

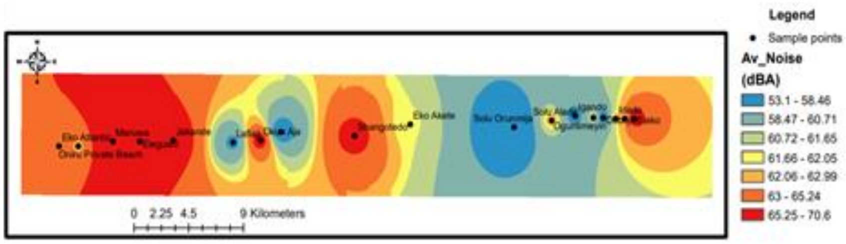
Table 4.17: Mean, Minimum, Maximum and Range Noise Levels

EKO ATLANTIC	SOLU ALADE	EKO AKETE	ELEGUSHI	EKO AKETE
• Average: 65.2 dBA • Minimum: 53.5 dBA • Maximum: 77.0 dBA • Range: 23.5 dBA (77.0 - 53.5)	• Average: 62.5 dBA • Minimum: 45.8 dBA • Maximum: 79.2 dBA • Range: 33.4 dBA (79.2 - 45.8)	• Average: 61.65 dBA • Minimum: 52.3 dBA • Maximum: 71.0 dBA • Range: 18.7 dBA (71.0 - 52.3)	• Average: 66.55 dBA • Minimum: 50.3 dBA • Maximum: 82.8 dBA • Range: 32.5 dBA (82.8 - 50.3)	Similar calculations forEKO AKETE are more like same for the remaining locations

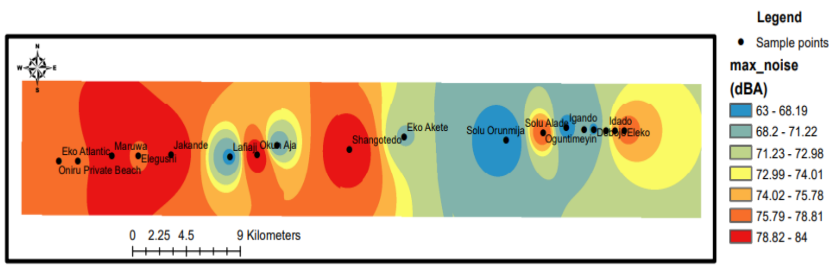
These noise levels when interpolated across the project area present a graphical interphase of the variability distribution. The noise distribution was interpolated to produce a surface of noise levels that can be visualized. **Figures 4.36 (a-c)** shows the maximum, minimum and average noise levels across the project area.



a. Minimum Noise Levels Measured



b. Maximum Noise Levels Measured



c. Average Noise Levels Measured

Source: Natural Eco Capital, 2024
Figures 4.36: Noise levels across the project area.

Vibration Levels: Vibration levels were determined for duration of 1 hour at all sampling locations. The results of the vibrations in millimetres per second (mm/s) are provided in Figure 4.37. The levels of vibration were all contained within the regulatory limit of 2.8mm/s with the highest value obtained at Eko Atlantic where skeletal road construction activities (for the proposed project will start from) were ongoing during the data gathering exercise.

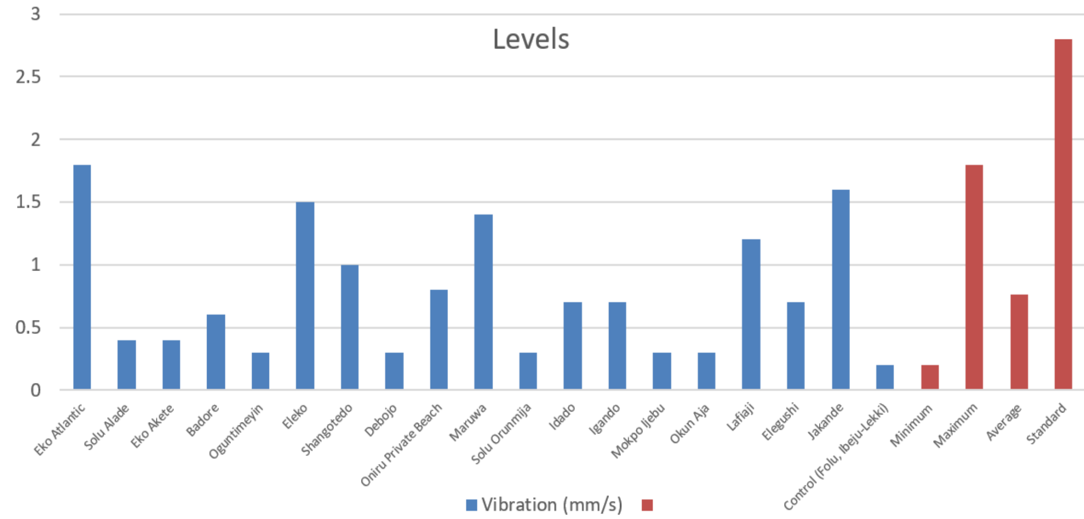


Figure 4.37: Results of Vibration Assessment along the Project Corridor

4.9 Erosion and Accretion Pattern

The Lagos coast is characterized by west-east trending barrier islands, fortified by the Badagry Creek, the Lagos, and Lekki lagoons as depicted in Figure 4.38.

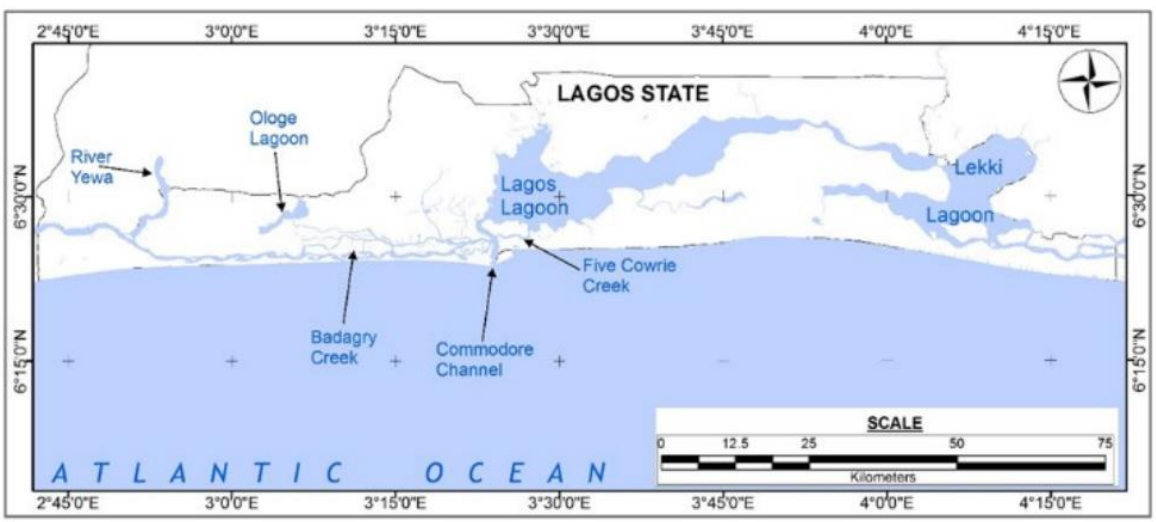


Figure 4.38: Map showing the Lagos coastal area.
Source: Nwilo, Ibe, Adegoke and Nwabufo (2020)

The study of the shoreline changes is crucial for understanding coastal erosion and accretion. The construction of breakwaters between 1908 and 1912 at the entrance to Lagos harbor disrupted the natural flow of the longshore drift, leading to accelerated erosion in the Victoria Island area and accretion on the western side (Plate 4.3)

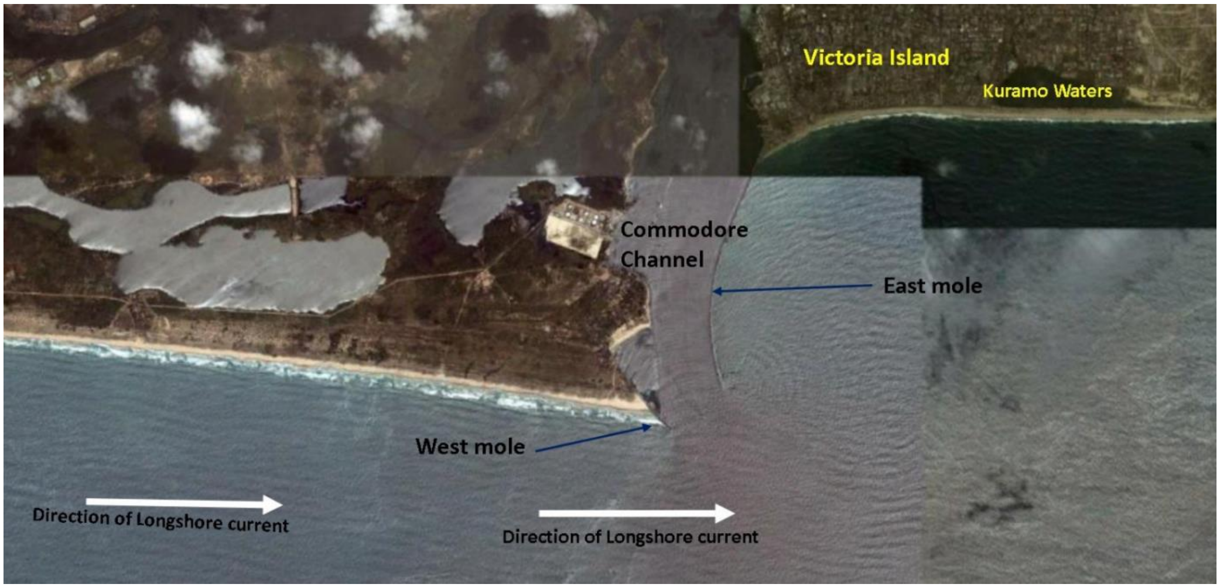


Plate 4.3: East and West Moles with the Prevailing Long shoreCurrent Direction
Source: Nwilo, Ibe, Adegoke and Nwabufo (2020) -Google Earth, October 2002

Using archival maps and satellite imagery, the Nwilo, Ibe, Adegoke and Nwabufo (2020) revealed a clear pattern of accretion on the western side of the shoreline up to the West mole and significant erosion eastwards of the East mole. The demarcation of the western and eastern sides of the Lagos coast which are also referred to as the West and East moles **(Figure 4.39)**

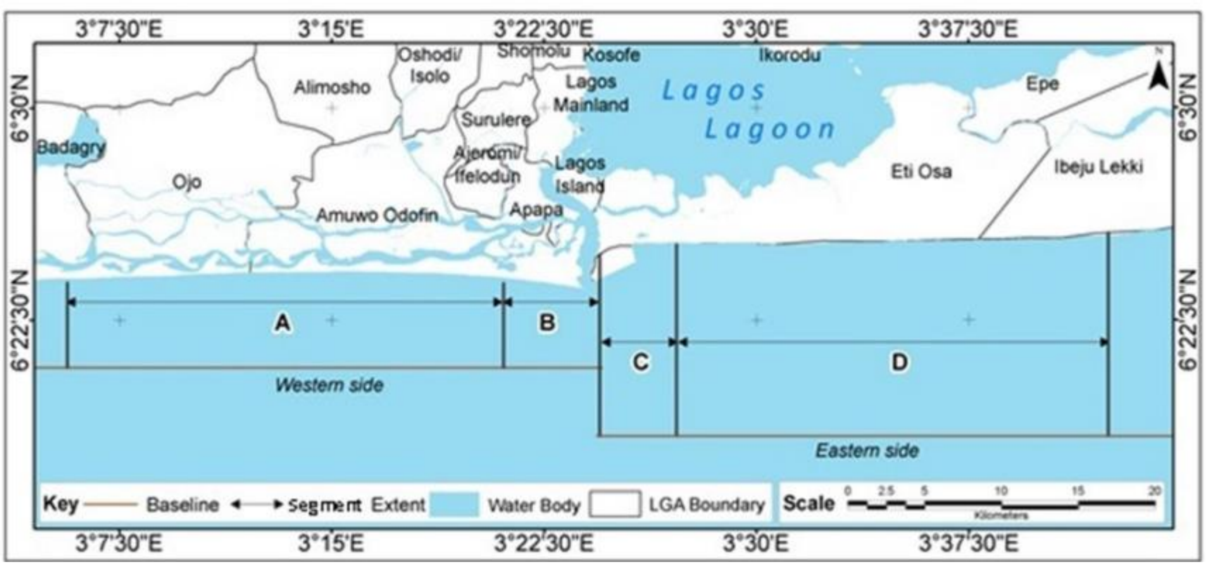
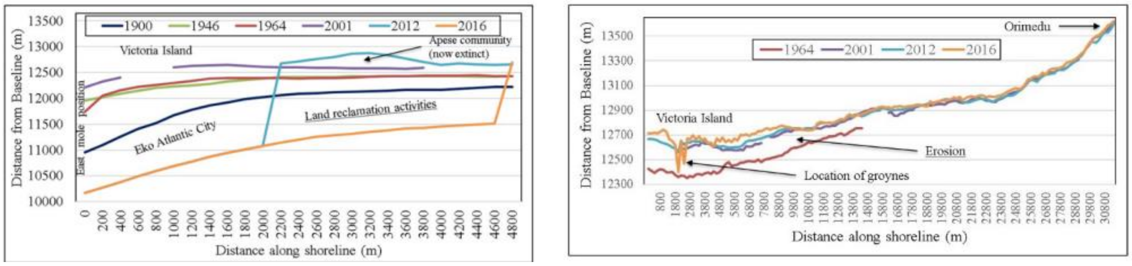


Figure 4.39: Western and Eastern Sides (Molesof the Lagos Coast)

Despite interventions like the Eko Atlantic City project and coastal defenses, recent satellite imagery and shoreline change analysis show that these measures have only shifted erosive actions to areas downstream of the coastal defenses.



A B

Figure 4.40: Shoreline changes at Victoria Island from the East mole going eastwards and Shoreline changes from Victoria Island to Orimedu, Ibeju Lekki LGA
Source: Peter C. Nwilo, Chidi A. Ibe, Jimmy O. Adegoke and Jerry Nwabufo (2020)

Table 4.18: Rate of Erosion (m/yr) on the Eastern Side of the Lagos Coast

	From the East mole (545097*mE*) going eastwards					From Victoria Island (550097*mE*) to Orimedu, Ibeju-Lekki LGA		
	1900 - 1946	1946 - 1964	1964 - 2001	2001 - 2012	2012 - 2016	1964 -2001	2001 - 2012	2012 -2016
Min	4.38	0.07	1.97	5.94	0.00	1.24	0.00	0.08
Max	21.95	5.48	12.85	26.50	8.50	7.18	9.24	26.17

Source: Peter C. Nwilo, Chidi A. Ibe, Jimmy O. Adegoke and Jerry Nwabufo (2020)

Furthermore, the Lagos shoreline undergoes continuous changes due to natural processes and human development. A 20-year study using Google Earth images between 2001 and 2020 showed an average shoreline change rate of +0.93 m/year, erosion rate of -1.94 m/year, and accretion rate of +4.84 m/year. Victoria Island experienced the highest shoreline change rate, with an average of +6.24 m/year due to accretion activities. Land reclamation activities contributed to the high accretion rate. However, significant erosion is observed eastward of Victoria Island. Effective land use and cover management plans are needed, especially for Victoria Island. (Adeaga, O., Folorunsho, R., Foli, B.A.K. *et al.* Assessment of Shoreline Change along the Coast of Lagos, Nigeria. *Remote Sens. Earth Syst. Sci.* 4, 186–198 (2021). https://doi.org/10.1007/s41976-021-00059-w)

In a Community-based assessment of coastal erosion in Lagos, Nigeria, Fashae, Olutoyin, Obateru, Rotimi, Adagbasa, Efosa and Emeh, Cindy (2022): Community-based assessment of coastal erosion in Lagos, Nigeria, VL - 114, Natural Hazards, https://www.researchgate.net/publication/362632063_Communitybased_assessment_of_coastal_erosion_in_Lagos_Nigeria the impacts of erosion on communities in Lagos State, Nigeria was assessed. Google Earth Pro images from 1984, 1999, and 2021 were used to analyze shoreline movement. 670 questionnaires were distributed, revealing varying perceptions of erosion causes and impacts across communities. Findings show that communities have a low resilience to coastal erosion, making them vulnerable to climate change effects.

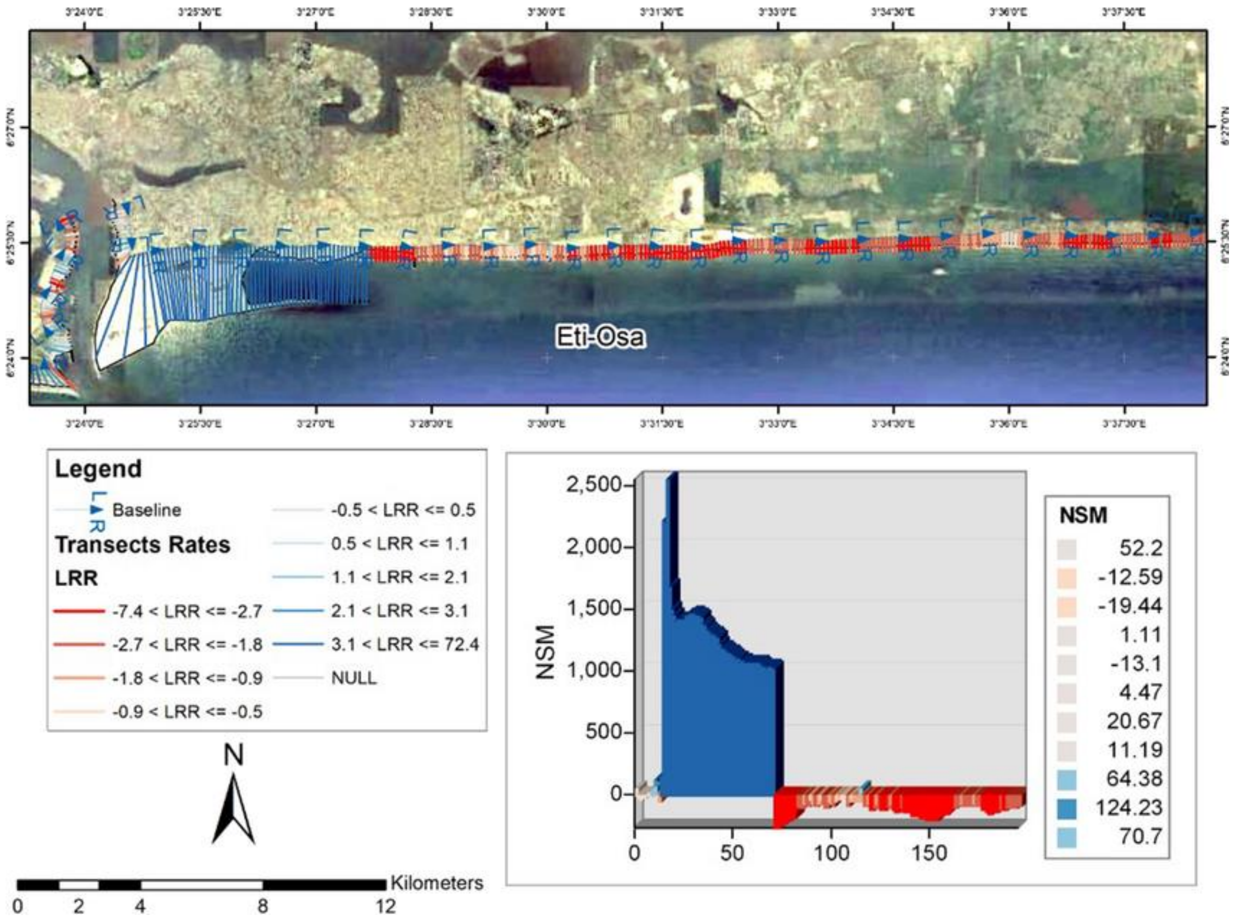


Figure 4.41: Shoreline characteristics at Eti-Osa LGA
Source: Fashae, Olutoyin, Obateru, Rotimi, Adagbasa, Efosa and Emeh, Cindy (2022)

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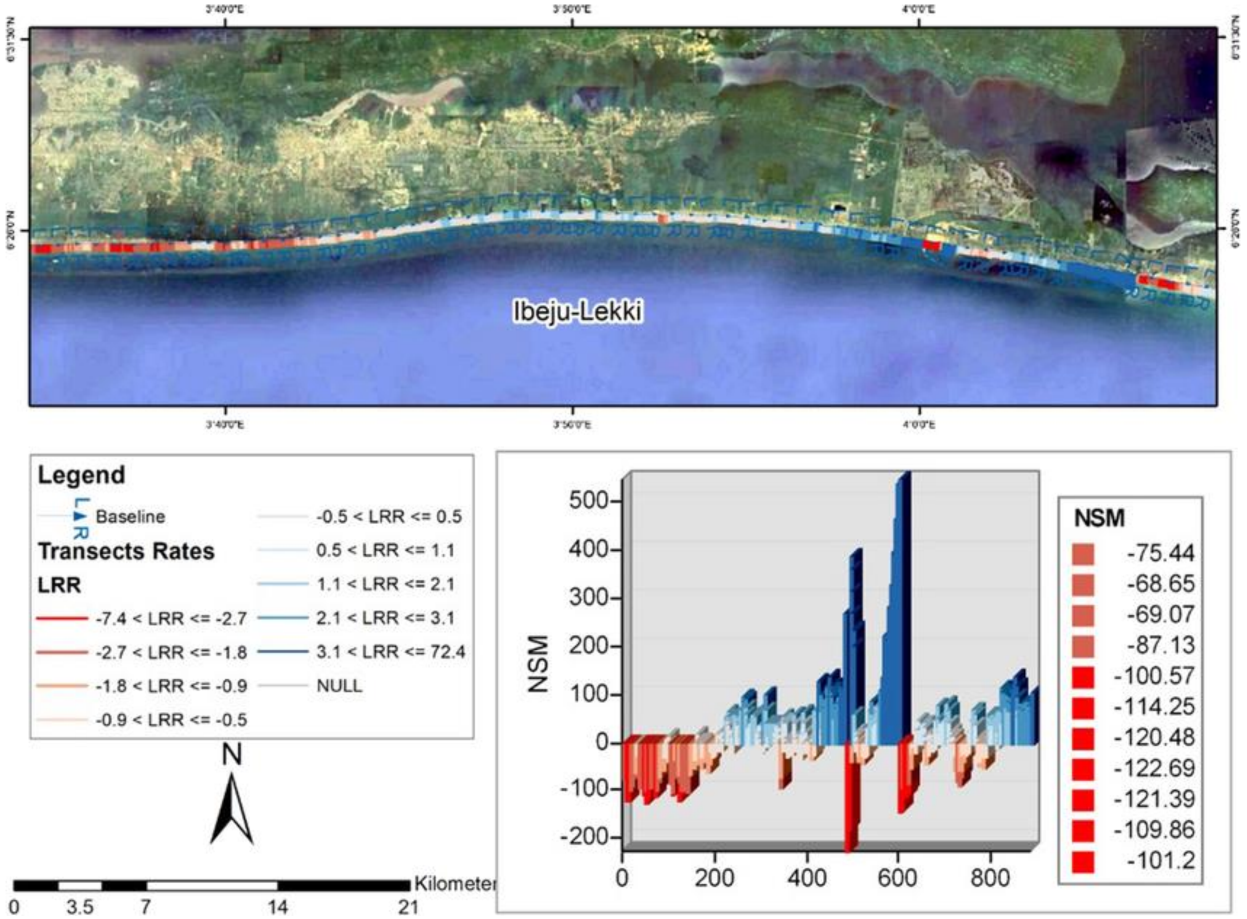


Figure 4.42: Shoreline characteristics at Ibeju Lekki LGA
Source: Fashae, Olutoyin, Obateru, Rotimi, Adagbasa, Efosa and Emeh, Cindy (2022)

The Project area, located within the Barrier Lagoon Coastal Section of Nigeria, is part of a larger chain of barriers and lagoons that extend along the West African coast from Cote d'Ivoire to Western Nigeria. The area is characterized by low-lying islands, small beach ridges that align parallel to the shore, and numerous creeks (Sexton & Murday, 1994). The shoreline, relatively straight, is composed of a precisely measured medium-to-coarse (0.4–0.61 mm, d50: 0.6 mm) iron-coated quartz sand (Sexton & Murday, 1994; Antia & Nyong, 1988). The project area for the shoreline dynamics is meticulously divided into two sectors (A & B) and the analysis was carried out for short terms (1974-2002, 2002-2024) and long term (**1974-2024**) for each of the two sectors (Table 4.23).

Table 4.19: Shoreline Change Statistics across the Project Area

Sectors	Period		No. of Eroding transect	No. of Accreting transect	No. of Stable transect	Erosion (%)	Accretion (%)	Shoreline erosion (NSM) (m)	Shoreline accretion (NSM) (m)
A	Short term	1974-2002	60	59	32	39.7	39.0	. 17,237.20	13,023.62
		2002-2024	100	51	5	66.2	33.8		
	Long term	1974-2024	141	10	0	93.4	6.6		
B	Short term	1974-2002	119	21	9	79.9	14.1	24,238.86	0
		2002-2024	132	16	1	88.6	10.7		
	Long term	1974-2024	149	0	0	100	0		

Sector A

The shoreline in this sector covers areas between Alpha Beach and Iwerekun. In the short term, the shoreline showed an accretional tendency followed by erosional and landward gain from 1979 to 2002 Shoreline position in 2002 and 2002 to 2024 (Figure 4.43) Shoreline position in 2002. The shoreline was stable, with increased erosion around transects 17-21 and an abrupt erosional trend around transects 39-56. In other words, there is evidence of accretion and a high erosion rate (93.4 percent) from the start date.

Over the long term, from 1979 to 2024 (Figure 4.44), the shoreline in this sector has shown a consistent erosional tendency. While there was a slight prevalence of accretion (6.6%) over erosion (93.4%) at the beginning of the project area, this trend quickly shifted to erosion, which has been sustained throughout the project area. This long-term trend is crucial for stakeholders and decision-makers to anticipate future changes and plan accordingly.

According to Awosika (2002), this section's erosion may be attributed to the construction of the east and west moles between 1908 and 1912. The moles were constructed to protect the dredged deep (Commodore Channel) entrance into the Lagos harbour from intense wave action and the silting up of the channel. The construction of breakwaters interrupted the long-shore transport of sand from the west of the west mole to the east along the shoreline. The interference has resulted in trapping about 0.5 and 0.75 million cubic meters of sand per year behind the west mole, leading to an accreting Lighthouse beach on the western side of the harbour entrance. However, the down-drift side is starved of sediments. Earlier studies revealed the nature and dynamics of erosion at project area following several beach nourishment programmes in the past. Over the years, the erosion problem has been aggravated by periodic ocean storm surges. The construction of Eko Atlantic City and the Lagos Seawall which started in 2009 has not solved the problem but rather shifted it down the coast with areas like Alpha beach currently seriously eroding.

Sector B

The shoreline in this sector covers areas between Iwerekun and Akodo. The shoreline change in this sector in the short-term was mainly erosional with a percentage of 79.9 in 1979-2002. Erosion greatly increased after then in 2002-2024 at 88.6%. The analysis shows an almost steady erosional transect from the beginning of the study year of 1979-2024. A continuous predominant erosional trend is noticed in all of the periods. It is also observed that amidst the erosional transects, there are no transects showing trends of accretion. In the long term, the percentage of erosion (100%) far exceeds that of accretion.

The shoreline trend in this sector can be attributed to the event in the preceding section, natural processes including variation in sea level rise, coastal topography, and nature of sediment. Pidwirny (2006), Moran (2003) and Chronis (2005) confirmed that the coastline changes as a result of the dominant processes which operate at constant rates regularly.

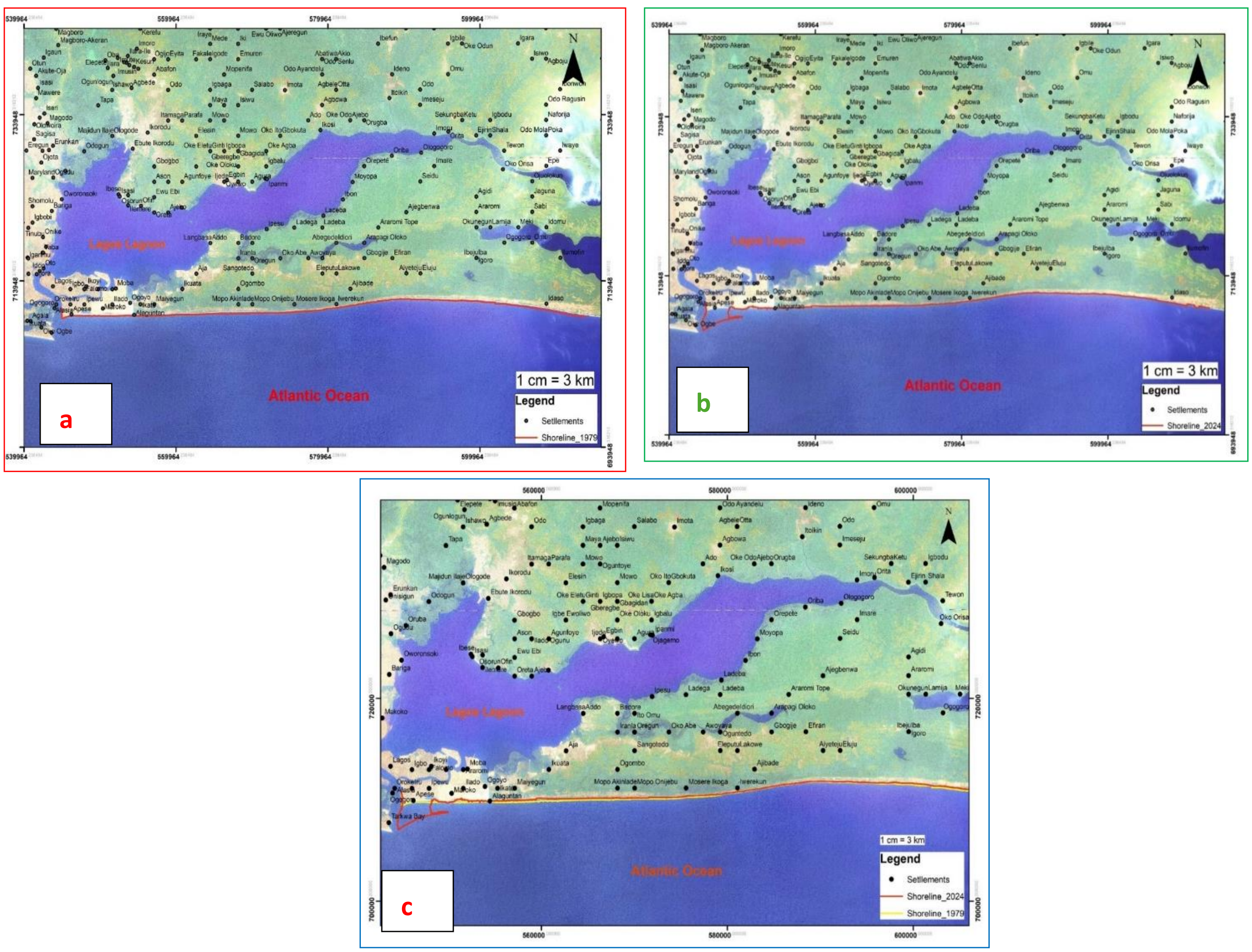


Figure 4.43 (a-c): Shoreline position in 1979, 2002 and 2024

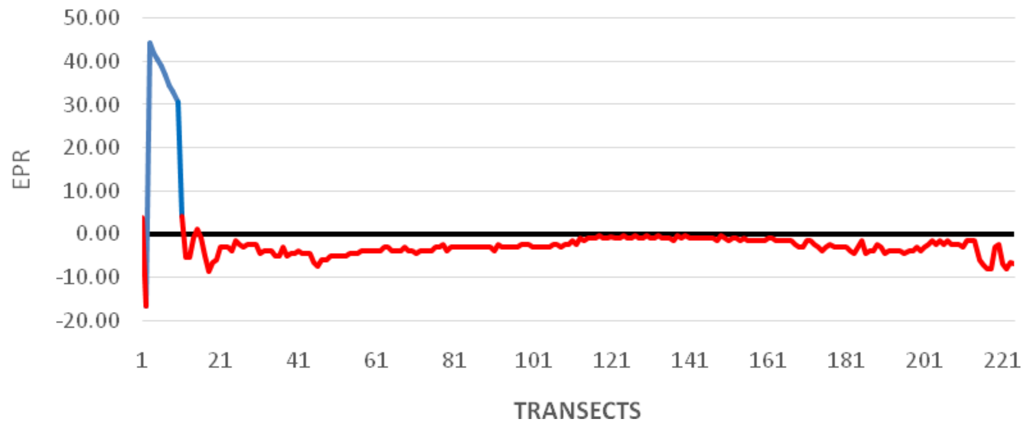


Figure 4.44: Shoreline change trajectory between 1979 and 2024.

Shoreline Dynamism in Metres along the project area using Net Shoreline Movement (NSM) Methodology: The net shoreline movement (NSM) is the distance between the oldest and the youngest shorelines for each transect, whoseunits are in meters. In NSM, the negative value (-ve) signify erosion, while the positive value (+ve) signify accretion. The distance is in metres, as shown in Figure 4.45.

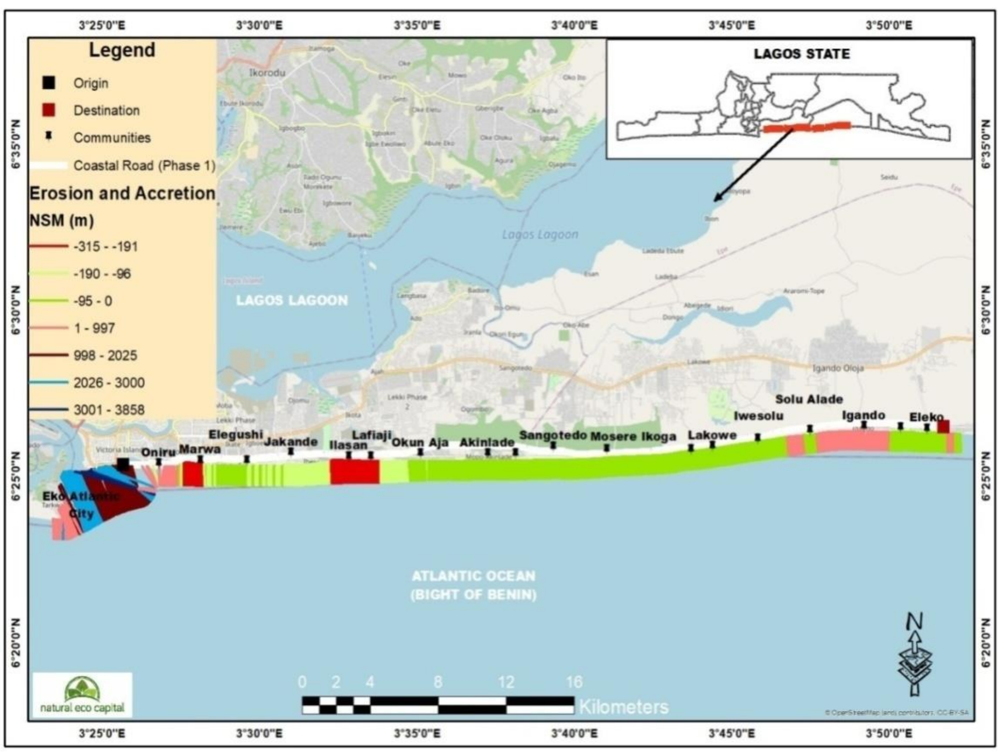


Figure 4.45: Coastline Change Statistics using NSM from the Year 1984 to 2024 in Metres

As shown in Figure 4.45, the erosion (-ve) range from -315m to 0m, while accretion ratio ranges from 1m to 3858m. From Figure 4.46**,** the highest range of coastal erosion from the year 1984 to the year 2024 (-315m to -191m) was observed for areas between Oniru and Marwa along the proposed coastal road (from chainage 3+600m to chainage 4+800m). The highest coastal accretion range was also observed around areas from Ilasan area, Lafiaji and extended to some parts of Okun Ajah, from chainage 12+300m to 15+100m. The second level of coastal erosion (-190m to -96m) was observed in areas around Marwa (Chainages 4+800m to 5+200m), areas from Elegushi to Jakande area (Chainages 7+400m to 12+200m), and areas from Lafiaji to Okun Ajah area (15+100m to 17+600m). The third level of coastal erosion (-95m – 0m),were first observed in areas between Marwa and Elegushi area, which is from chainage 5+600m to 7+400m, areas along Elegushi, around chainages 7+700m, 8+200m, 8+500m, 9+000m and 9+500m.This third level of coastal erosion was majorly concentrated along the coastline from Okun Ajah, Akinlade, Mopo Ijebu, Sangotedo, MosereIkoga, Iwerekun, Lakowe and Iwesolu, which cuts across the coastline from chainage 16+800m to 37+400m. This level of erosion was also observed from Badore to Eleko area, between chainage 45+500m to 47+400m. These latter areas are a bit stable area relatively.

Coastal accretion, which is a gain of land ranged from 1m to 3858m, along the project areas of the Phase 1 of theLagos to Calabar coastal road. The highest three ranges of coastal accretion (3001m to 3858m, 2026m to 3000m and 998m to 2025m) were observed at Eko Atlantic city, due to land reclamation in the area. The least range of coastal accretion along the project area Phase 1was observed between Iwesolu and Badore, which is between chainage 37+400m to 45+500m.

Shoreline Dynamism in Metres/Year (Rate of Change) along the Project Area using End Point Rate (EPR): The rate of change statistics of the shoreline using the End Point Rate (EPR) method revealed significant changes in the coastline in metres per year (m/year) is shown in Figure 4.45.

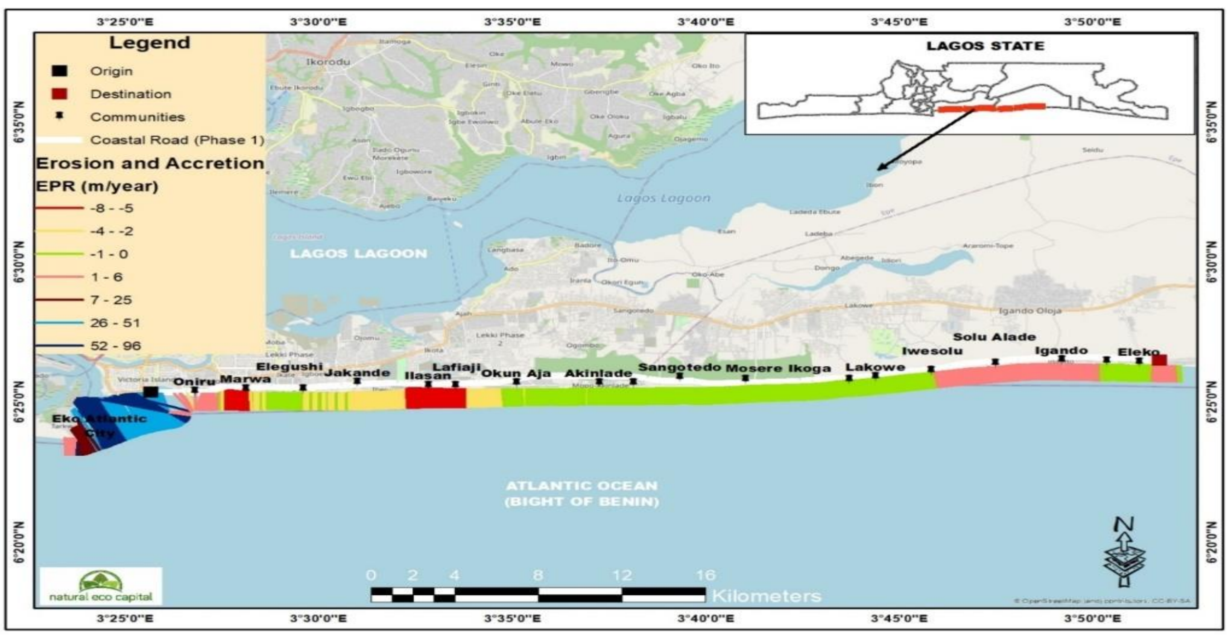


Figure 4.46: Rate of Change statistics using EPR from the year 1984 to 2024

The result of the EPR provided the rate of erosion and accretion in m/year along the coastline in the project area as shown in Figure 4.46**,** the rates of erosion (-ve) ranged from -8m/year to -

1m/year, while accretion rate ranged from 1m/year to 96m/year. he highest range of coastal erosion rates from the year 1984 to the year 2024 was observed in areas between Oniru and Marwa along the proposed coastal road (from chainage 3+600m to chainage 4+800m). The highestrate of coastal accretion range (-8m/year to -5m/year) was also observed in areas from Ilasan area, Lafiaji and extended to some parts of Okun Ajah, from chainage 12+300m to 15+100m. The second level of coastal erosionrate (-4m/year to -2m/year) was observed in areas around Marwa (Chainages 4+800m to 5+200m), areas from Elegushi to Jakande area (Chainages 7+400m to 12+200m), and areas from Lafiaji to Okun Ajah area (15+100m to 17+600m). The third level of coastal erosionrate (-1m/year to 0m/year), were first observed in areas between Marwa and Elegushi area, which is from chainage 5+600m to 7+400m, areas along Elegushi, around chainages 7+700m, 8+200m, 8+500m, 9+000m and 9+500m. This third level of coastal erosion rate was majorly concentrated along the coastline from Okun Ajah, Akinlade, Mopo Ijebu, Sangotedo, MosereIkoga, Iwerekun, Lakowe and Iwesolu, which cuts across the coastline from chainage 16+800m to 37+400m. This level of erosion was also observed from Badore to Eleko area, between chainage 45+500m to 47+400m.

The rate of Coastal accretion, which is a gain of land ranged from 1m/year to 96m/year, along Lagos to Calabar coastal road. The highest three ranges of coastal accretion rates (7m/year – 25m/year, 26m/year - 51m/year and 52m/year - 96m/year) were observed at Eko Atlantic City, due to land reclamation in the area. The least range of coastal accretion rate along the project area was observed between Iwesolu and Badore, which is between chainage 37+400m to 45+500m.

Forecast for Coastline Change in the next 10 and 20Years (Years 2034 and 2044) - The forecast for the coastline changealong the project area in the next 10 and 20 years was carried out using the coastlinechange ratesfor the years 1984, 1994, 2004, 2014 and the year 2024. Figure 4.47 and 4.48 (not 8 and 9) below shows the probable alignments of the coastline along the Phase 1 of the Lagos-Calabar Road in the next 10 and 20 years.

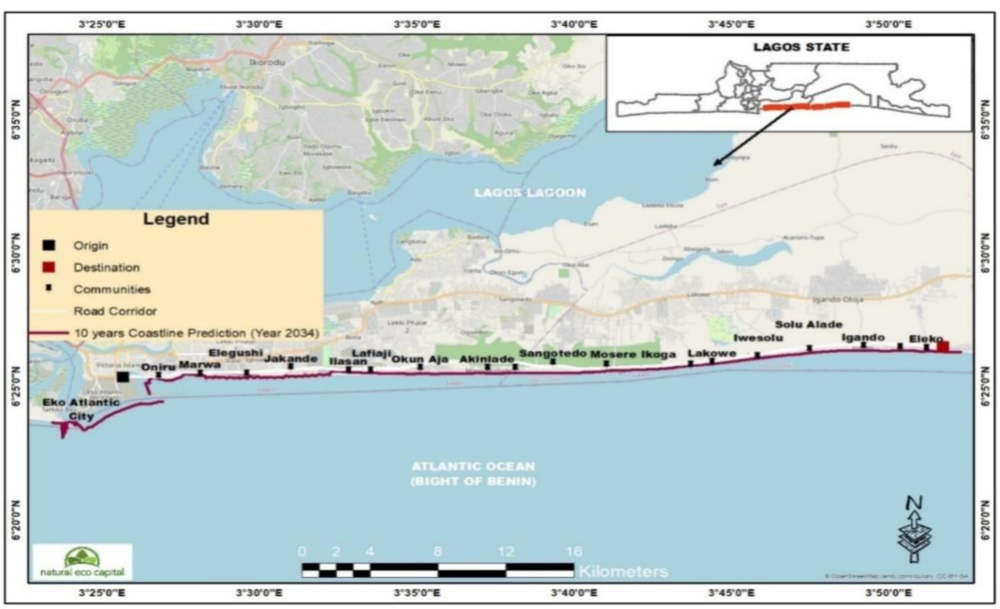


Figure 4.47: Forecast for the Position of Coastline along the Project Area in 10years.

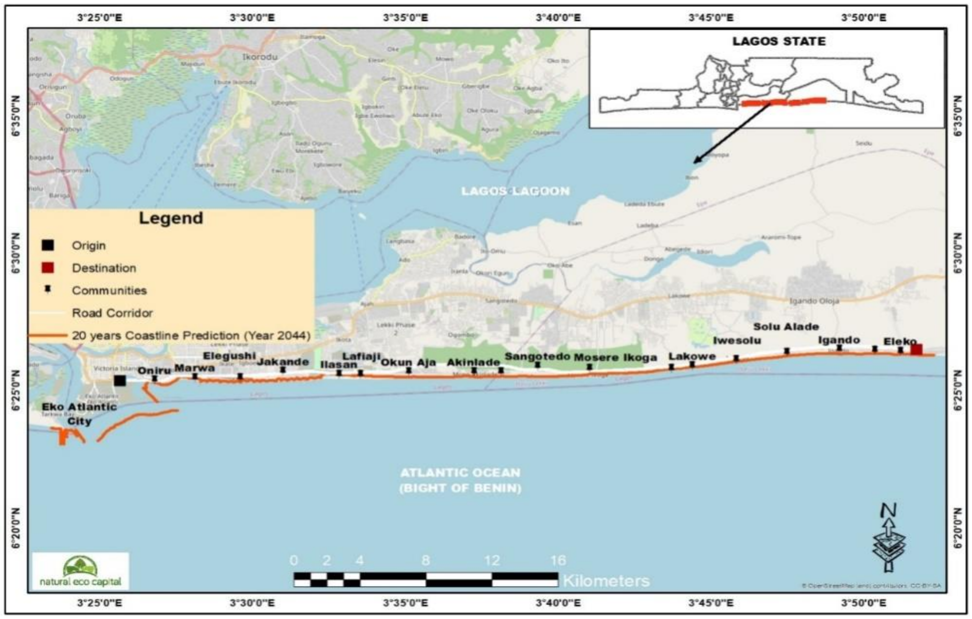


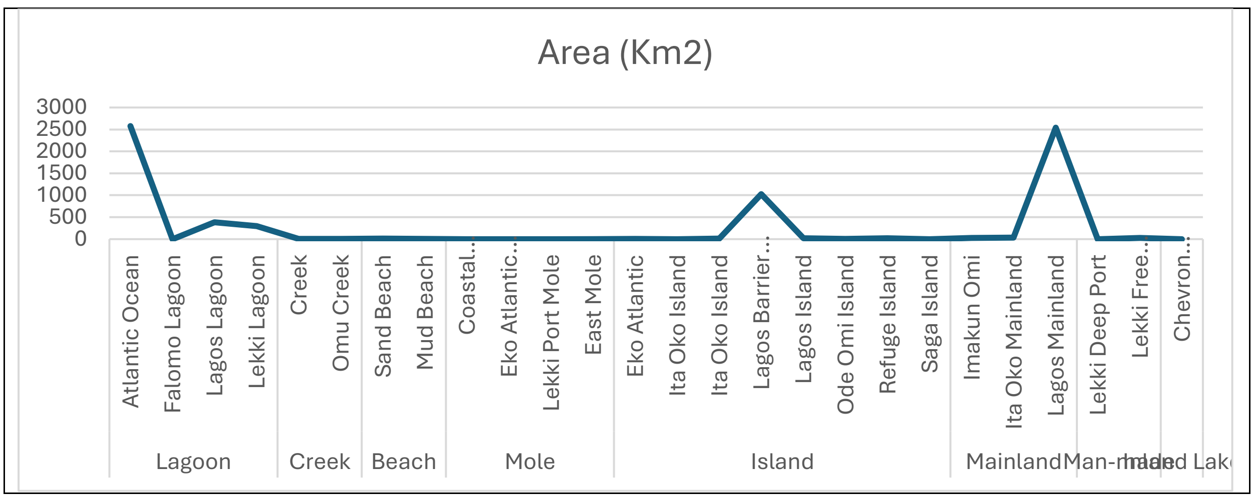
Figure 4.48: Forecast for the position of coastline along the project area in 20years.

From **Figures** 4.47 and 4.48, it can be deduced that coastline erosion, which is the landward movement of the coastline will majorly erode the proposed road around Marwa area at chainage 3+800m, around Ilasan between Chainage 12+400m and 12+900m, and areas between Iwerekun and Solu Alade (Chainage 33+600m to 37+500m). This signifierss that if proper measures are not taken, coastal erosion will degrade the proposed road in these areas in the next 10 to 20 years.

4.10 Coastal Morphodynamics

Understanding the complexity of the geomorphic evolution with respect to the dynamics of coastal geomorphic land formation brought about by the interactions of the lithosphere, hydrosphere, atmosphere, and the biosphere is the first step towards sustainable coastal development and coastal ecosystem services. Geomorphological mapping begins with the identification of the fundamental units that compose the landscape. Faniran *et al.,* (1976) have described a geomorphic unit in general terms as "an individual, genetically homogeneous landform produced by a definite constructional or destruction geomorphic process." There are two general approaches to the question of geomorphic units which includes the Landform Elements Model and a Landform Patterns Model (Bloom, 2003). The two approaches are complementary. Either model can be used to describe any piece of land, with the choice dependent on the scale or purpose of the mapping. Geomorphic mapping is necessary, particularly in the developing world to support periodic development plans and provide vital information on landform characteristics for developmental purposes (Faniran & Jeje, 1986).

The morphodynamic approach provided a time–space framework within which all coastal systems could be located at timescales from the instantaneous to the Quaternary, and spatially from bed forms to barrier and deltaic systems. Equally important was the interdependence of processes and morphological response, so that coastal systems could be studied in a state of dynamic equilibrium with the prevailing processes and boundary conditions. This approach enabled the full spectrum of landforms systems and types to be identified and characterized and is utilized to examine coastal response at scales from the instantaneous, to event, to long term. In this study, the various landforms along the right of way (RoW) of Section 1 (0km - 47.5km) and Section 2 (47.5km - 103.5km) of Phase 1 of the Proposed Lagos-Calabar Coastal Highway will be identified and map. A geomorphological map of the study area from the coastline northward for about 20 km was developed from the Enhance Thematic Mapper (ETM+) scene and the Spot DEM. Basic photo-interpretation techniques using black and white images of bands 3, 5, 6, and 7 and a colour image composite from bands 2, 3, and 4 were used. Other sources of spatial data used in this mapping were the Nigeria topographic map sheets 1:50 000 produced in 1965, used principally to identify and map the names of places and features, contrasting geometric patterns were used to display different geomorphological units of the RoW of the proposed Lagos-Calabar coastline. Appendix 4.5 and **Figure 4.xxxx** show the Morphology of the coastal landforms alongst the RoW of the proposed project while **Figure 4.49** and **Figure 4.50** shows morphological maps of the section 1 phase I and section 2 phase I of the proposed Lagos-Calarbar coastal road.



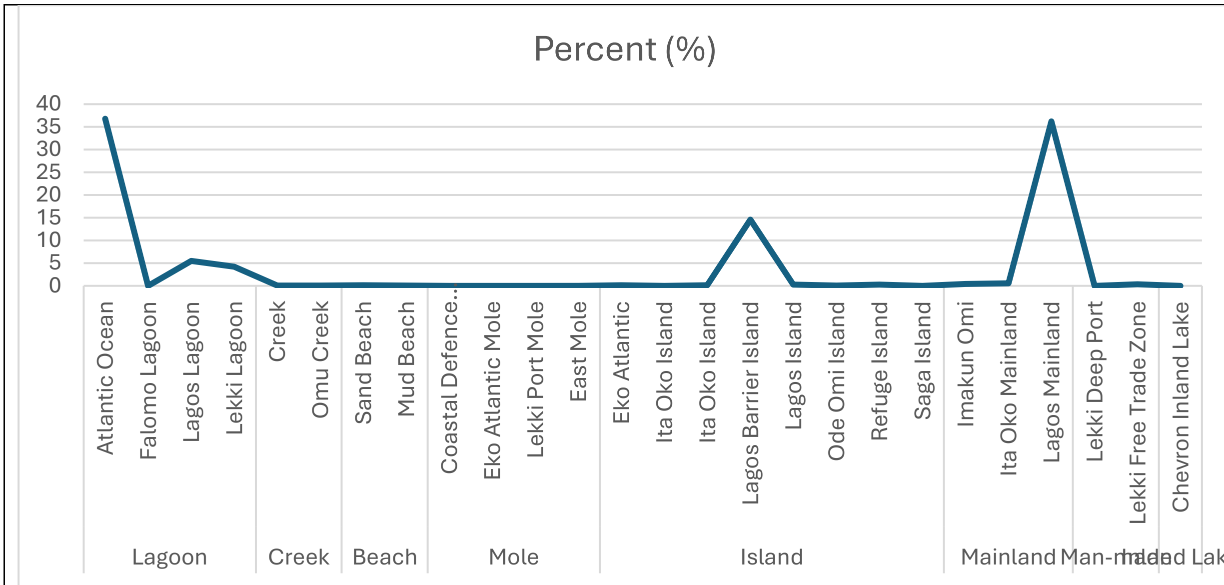


Figure 4. Morphology of the Coastal Landforms alongst the RoW of the Proposed Project
Source: Natural Eco Capital Fieldwork April 2024

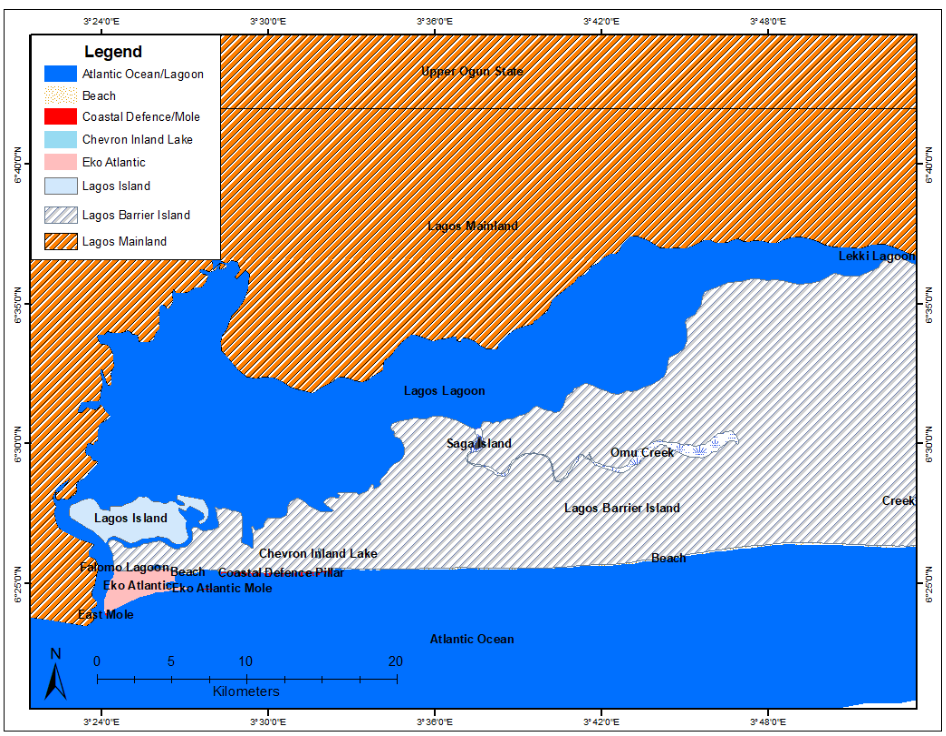


Figure 4.49: The Coastal Landform of Section 1 Phase I of the proposed Lagos – Calabar Coastal Highway

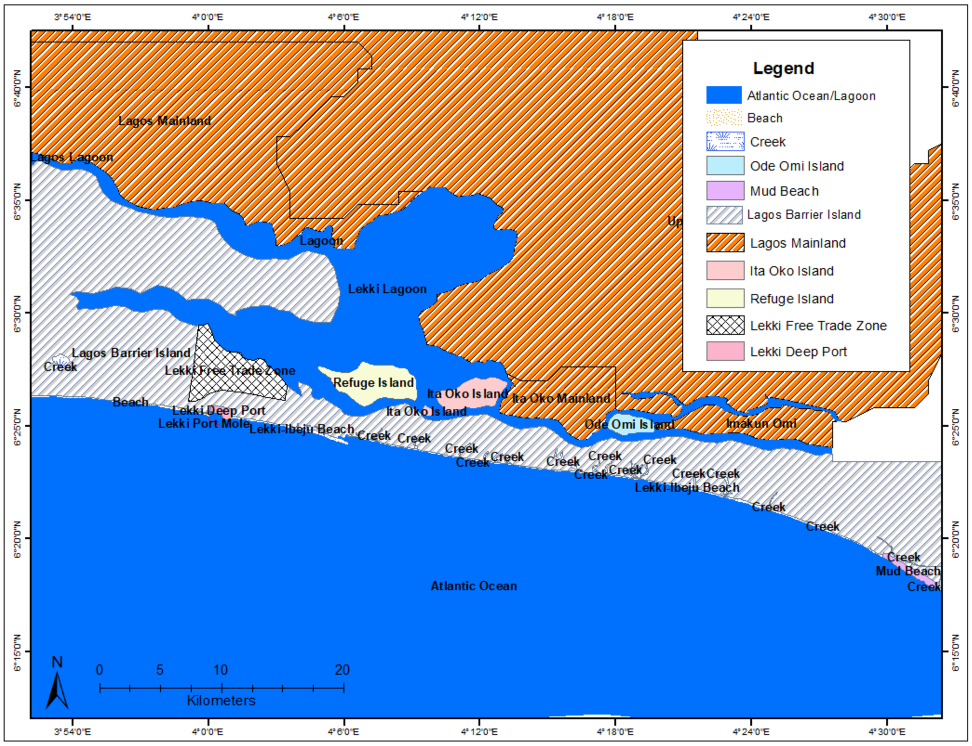


Figure 4.50: The Coastal Landform of Section 2 Phase I of the Proposed Lagos – Calabar Coastal Highway

Water Current: The coastal waters of Nigeria form part of the Atlantic Ocean, falling within the Gulf of Guinea, which starts at Cape Palmas near Harper. The Guinea Current can be represented by Mariano Global Surface Velocity Analysis (MGSVA). Depending on the season, the primary source of water for the Guinea Current is either the Canary Current or the North Equatorial Counter Current (NECC). The Guinea Current, which travels from the west-east, is the dominant ocean current affecting the Nigerian continental margin.

According to the simulation results of a hydrodynamic study for Lekki Port conducted by Muttray (2008), the near shore currents across the project area are induced mainly by winds and tides. Tidal currents are mostly oscillating and travel parallel to the shoreline. Wind-induced currents tend to follow the wind direction and are transformed into currents moving parallel to the coastline as they approach the shoreline. The currents in the project area mostly head in an eastward direction.

The prevailing current direction is northeast at a distance of more than 5 km offshore. Again, the current rates are significantly reduced at Avon's Canyon, with more variable current directions. At a 2–4 km offshore distance, the prevailing current direction changes to parallel with the shoreline, in an eastward direction. East of the proposed project site, the current is similarly primarily directed eastward; east-southeast currents occur less frequently, and westward currents arise more frequently than at the other location. Current rates are slightly higher and occasionally reach 0.25 m s^{-1}.

Waves: The wave action was analyzed using a hydrodynamic study based on wave data at time intervals of 3 h from 1997 to 2007 (Muttray, 2008). The prevailing (~90%) near shore waves across the project area travel from the south-southwest (186° to 208° from the north). Near shore wave heights of Hs = 3.0 m are hardly exceeded; wave heights are typically between Hs = 0.75 m and 2.0 m. Significant wave heights of Hs = 0.5 m, 1.0 m, 1.5 m, 2.0 m, and 2.5 m are exceeded approximately 99.5%, 77%, 29%, 5% and 0.3% of the time, respectively.

The project area is persistently exposed to a certain amount of wave action. Near shore wave heights are seldom less than Hs = 0.5 m. Wave heights of Hs = 0.75 m are exceeded approximately 95% of the time. The seasonal variation of near shore wave heights is plotted in Figure 4.51**.**

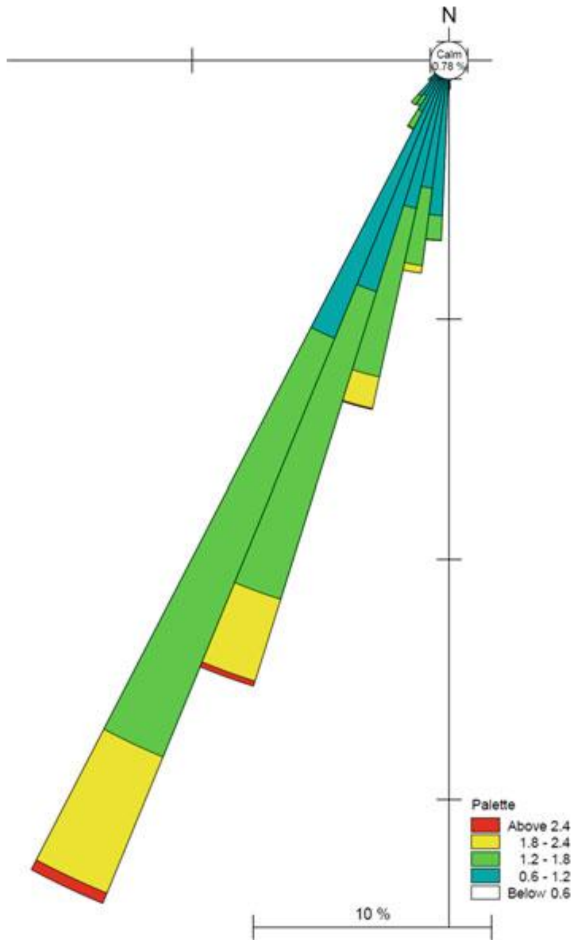


Figure 4.51: Wave direction in the project area

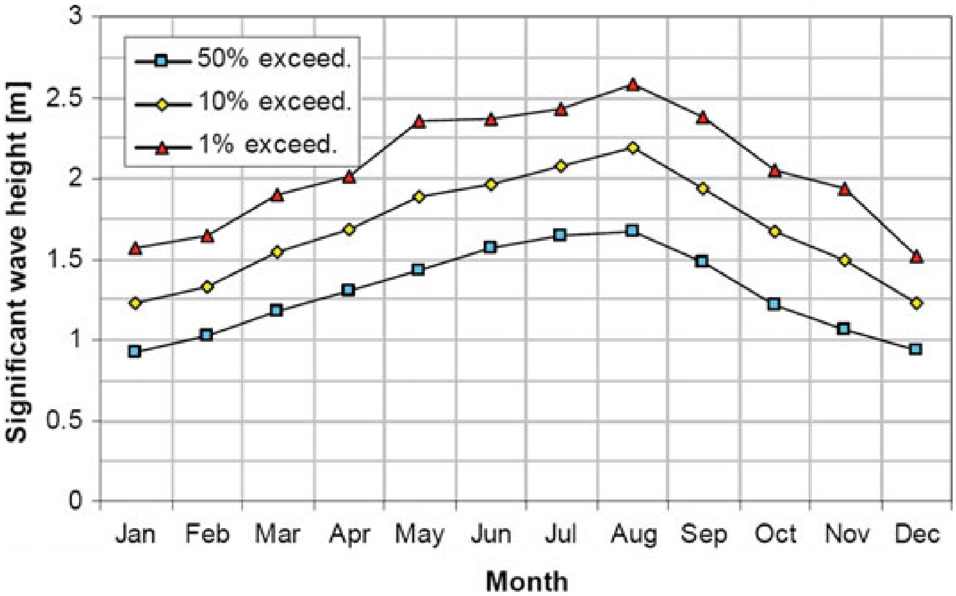


Figure 4.52: Significant Wave Height in the Project Area

The largest waves were observed in summer (June to August), with average wave heights exceeding Hs = 1.5 m. The near shore wave height in summer is typically 1.0–2.0 m and is persistently larger than 0.7 m. The smallest near shore wave heights were observed in winter (December to February), with average wave heights of approximately Hs = 0.9 m. The near shore wave height in winter is typically 0.5–1.5 m and is persistently larger than 0.3 m.

Sedimentation*:* The sediments, a crucial component of the offshore seabed, exhibit a fascinating variety. Ranging from very coarse sand to silty clay, they are generally medium to coarse and moderately well sorted, with a fining sequence in grain size eastwards. This spatial variation, with muddy material, mainly silt, found on the Continental Shelf west of Lagos and clay dominating the deeper parts, is a significant finding (Allen, 1965). These sediment characteristics are not only interesting from a geological perspective but also have implications for the local marine ecosystem and potential offshore construction projects.

The stretch of sandy seabed roughly 100 km long by 10 km wide, starts at the entrance to Lagos Harbor and ends at the OKLNG site. West of Lagos, the sandy bed is relatively thin (approx. 500 m), and its width appears to increase at the entrance (Ballendux, 2011).

In the context of past studies, the present research stands out for its comprehensive and meticulous approach. We sampled beach sediments at 12 sites along the study area, covering 13 km. The site locations and the D50 (particle diameter representing the 50% cumulative percentile value) distribution along the shoreline are depicted in Figure 4.53**.** Notably, among the sampling sites, W1, W2 and O2 show clear signs of being affected by beach fill near site W2. The lighter sand colours at these sites, originating from offshore, are a unique feature of our findings, a testament to the thoroughness of our research.

Sediment grain size (D50) ranges between 0.424 mm at E5 and 0.613 mm at W5. No notable distribution trend could be identified along the 13 km stretch of beach near the project site. The present study found sediment grain size close to those Titocan *et al*., (2011) measured for Okun-

Mopo Beach, Ajah, approximately. This comparison with previous studies not only adds to our understanding but also keeps us abreast of the latest research in the field.

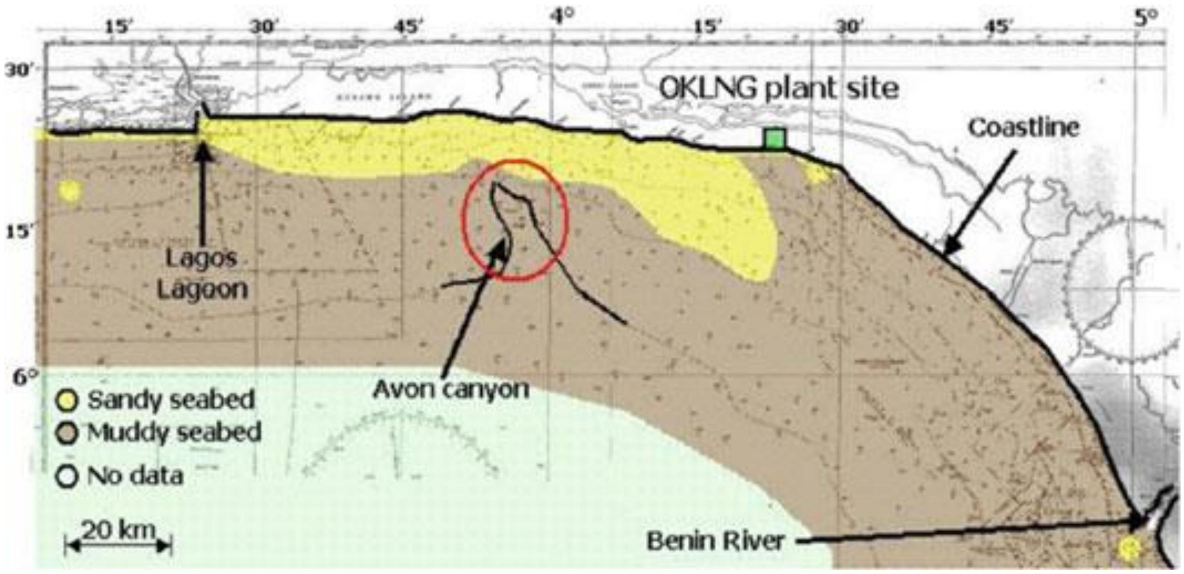


Figure 4.53: Sediment Distribution in the Project Area

Sediment Transport Tendency*:* At a large spatial scale, most of the sediment originates from the Volta, Benin, and Niger rivers, as well as erosion of the West-African coast by waves and ocean currents. The longshore sediment transport is related to the angle between the waves and the coast. The general wave direction in this region is from south-southwest, which results in eastward transport up to the point where the coastline is perpendicular to the wave direction, close to the OKNLG site shown in **Figure 4.53**. Sediment originating from the Niger River is transported both in a westward and eastward direction. A build-up of sediment is expected near the OKLNG site, where material from both the Niger River in the east and longshore transport from the west is deposited. It is unlikely that coarse sediment originating from the Niger River reaches the proposed port area via wave-generated longshore transport as the transport direction within this section is to the east. The sediment transport pattern has been reported by Pugh (1954), Sexton and Murday, (1994) and Ballendux, (2011).

Estimates of the littoral transport near Lagos Harbor range from 0.5 to 1.0 M m3 a−1, as estimated by Allersma and Tilmans (1993), or 0.6 to 0.7 M m3 a−1, as estimated by Bentum et al., (2012). Estimates of 0.7–1.3Mm3 a−1 have been reported for the coast of the Lekki port by Muttray (2008). On the Dangote Permanent Jetty, approximately 10 km east of the Lekki port, 0.5–0.8 M m3 a−1 of sediment transport has been estimated by Royal Haskoning DHV (2016). Therefore, the longshore sediment transport rates vary from 0.5 to 1.3 M m3 a−1 among the different sources. With focused wave action, high longshore sediment transport capacity, and highly mobile sediments on the beach, the shoreline is very sensitive to changes in boundary conditions, even though it is relatively stable under present conditions. Small-scale structures like ship wreckage and steel pipes may lead to notable erosion and deposition.

A long shore Distribution of Littoral Drift: Sediment transport along the model domain was calculated using the local coastline orientation. The yearly net littoral drift was calculated for the years 2021. The eastward sediment transport capacity varied between 602,000 m3 a−1 and 963,000 m3 a−1, westward between 1000 m3 a−1 and 18,000 m3 a−1, and a net transport capacity (eastward) between 584,000m3 a−1 and 962,000m3 a−1.Westward transport was calculated to be negligible.

The values of average net yearly sediment transport showed a decreasing trend eastward, corresponding to the coastline orientation along the domain. The average net yearly transport was calculated to be 652,000 m3 a−1. The volume and direction of sediment transport calculated in the present study corresponds with the results obtained from other studies along the Nigerian coast which enhances confidence in the model setup and performance.

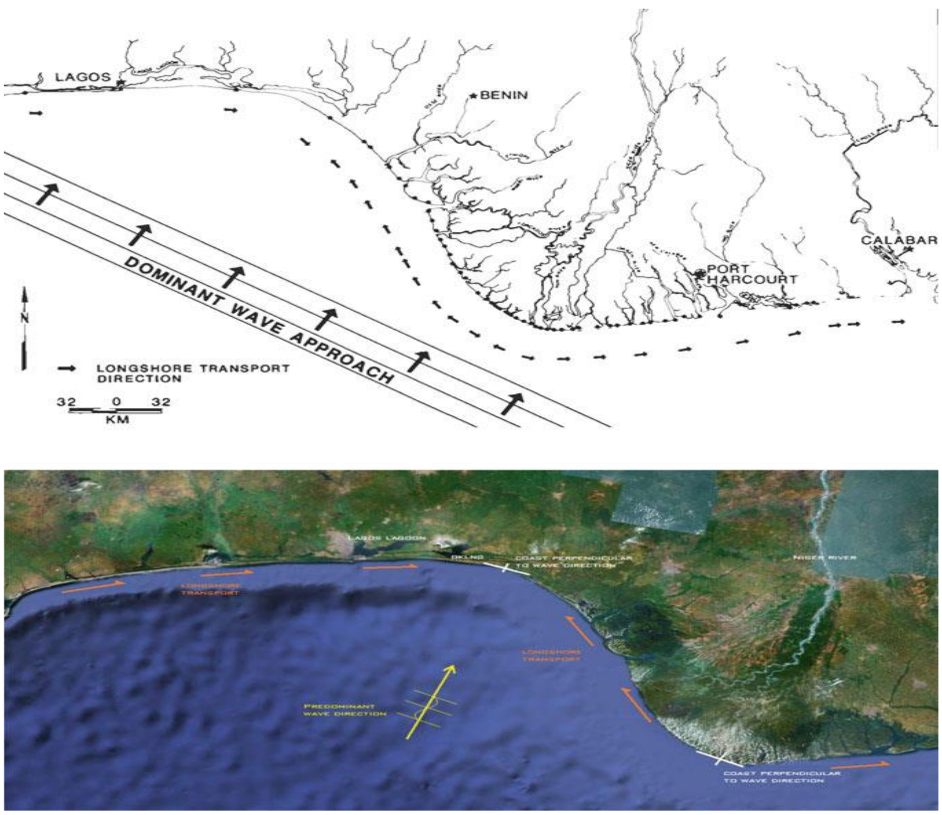
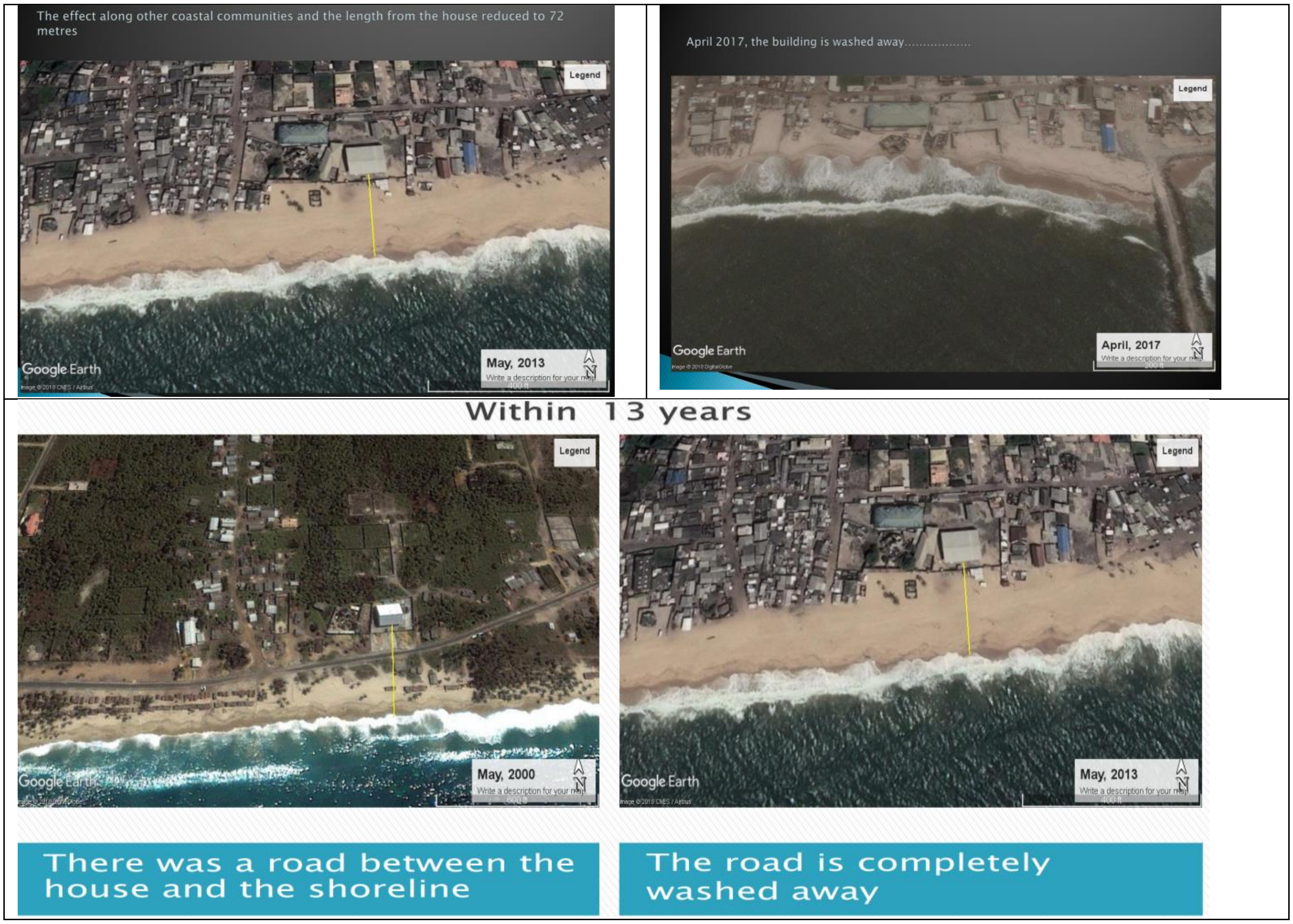


Figure 4.54: Dominant Wave Direction across the Project Area

Specifically, the major underlying driver of hydrodynamics in the project area is the long shore component of near shore circulation that controls littoral drift and sediment transport regime. In this case, the wave-induced currents are directed from the western part of the study area. In other words, the model reveals that the major drivers of coastal morphodynamics in the study area is the littoral drift / longshore current transport which moves sediment mainly towards the east within the Barrier lagoon section. Winds are the main factor that determines the oceanographic regime in the coastal zone under investigation. The study area is classified as a micro-tidal coast with a tidal range less than 15 cm, and therefore, tides cannot affect the wave-dominated pattern.

The key findings of the study are:

Prevailing near shore wave's travel from predominantly southwest direction. The mean significant wave height increases eastward while the mean wave period decreases eastward. The current mainly moves eastward in parallel to the shoreline with a slight westward current movement especially in the eastern part of the study area. Predominance of the eastward sediment transport which is the continuation of the sediment transport along the Bight of Benin (Volta River)



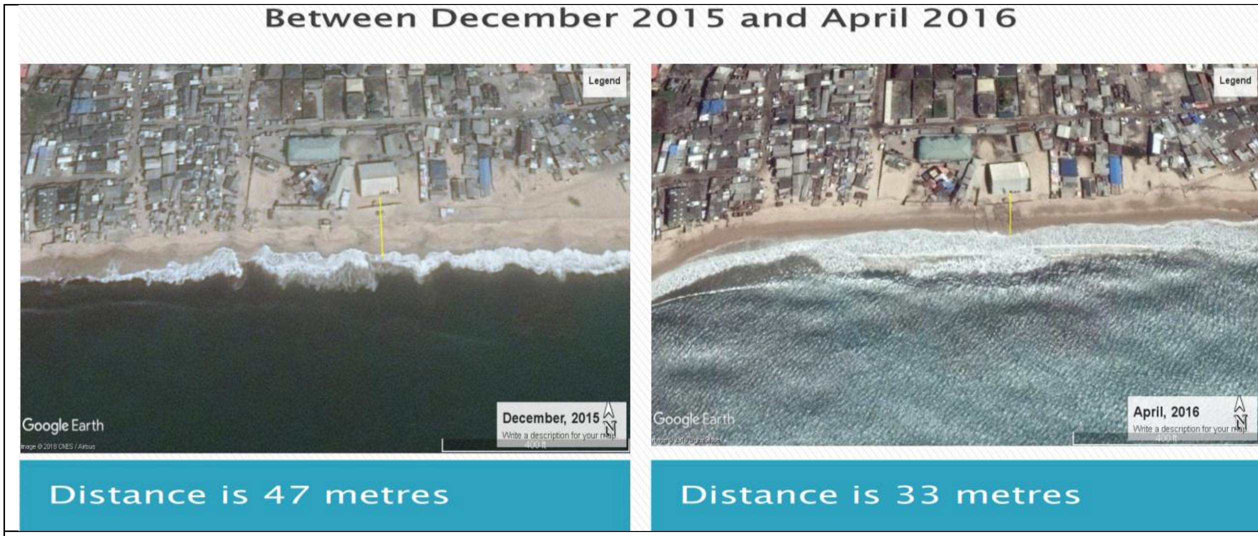
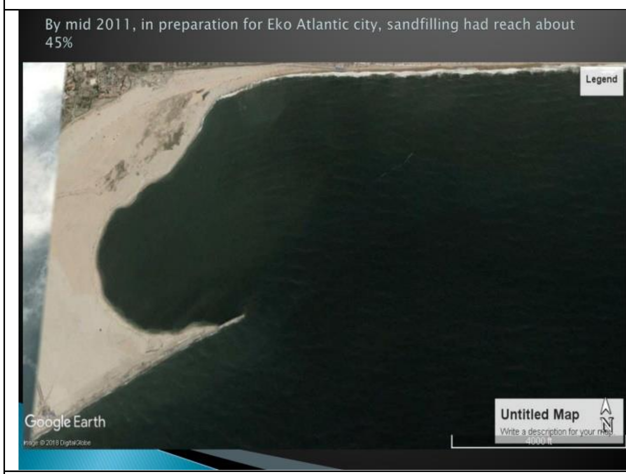


Plate 4.4: Coastal Erosion Nightmare in the Project Area
Source: The Nigerian Conservation Foundation

Plate 4.5: Okun Afa Area Coastal Erosion
Source: The Nigerian Conservation Foundation

Erosion and accretion near to the moles of Commodore Channel



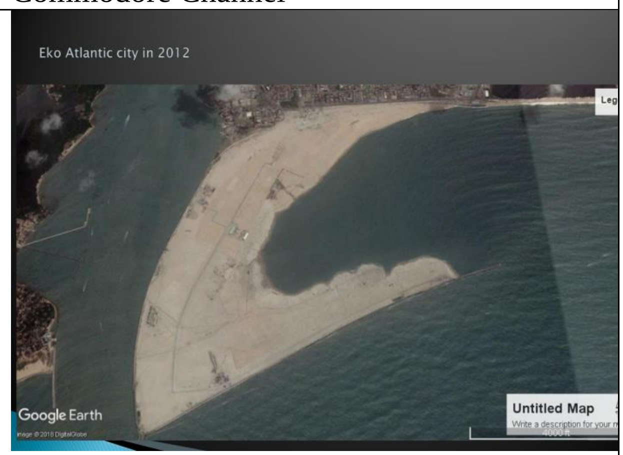


Plate 4.6: Emergence of Eko Atlantic
Source: The Nigerian Conservation Foundation

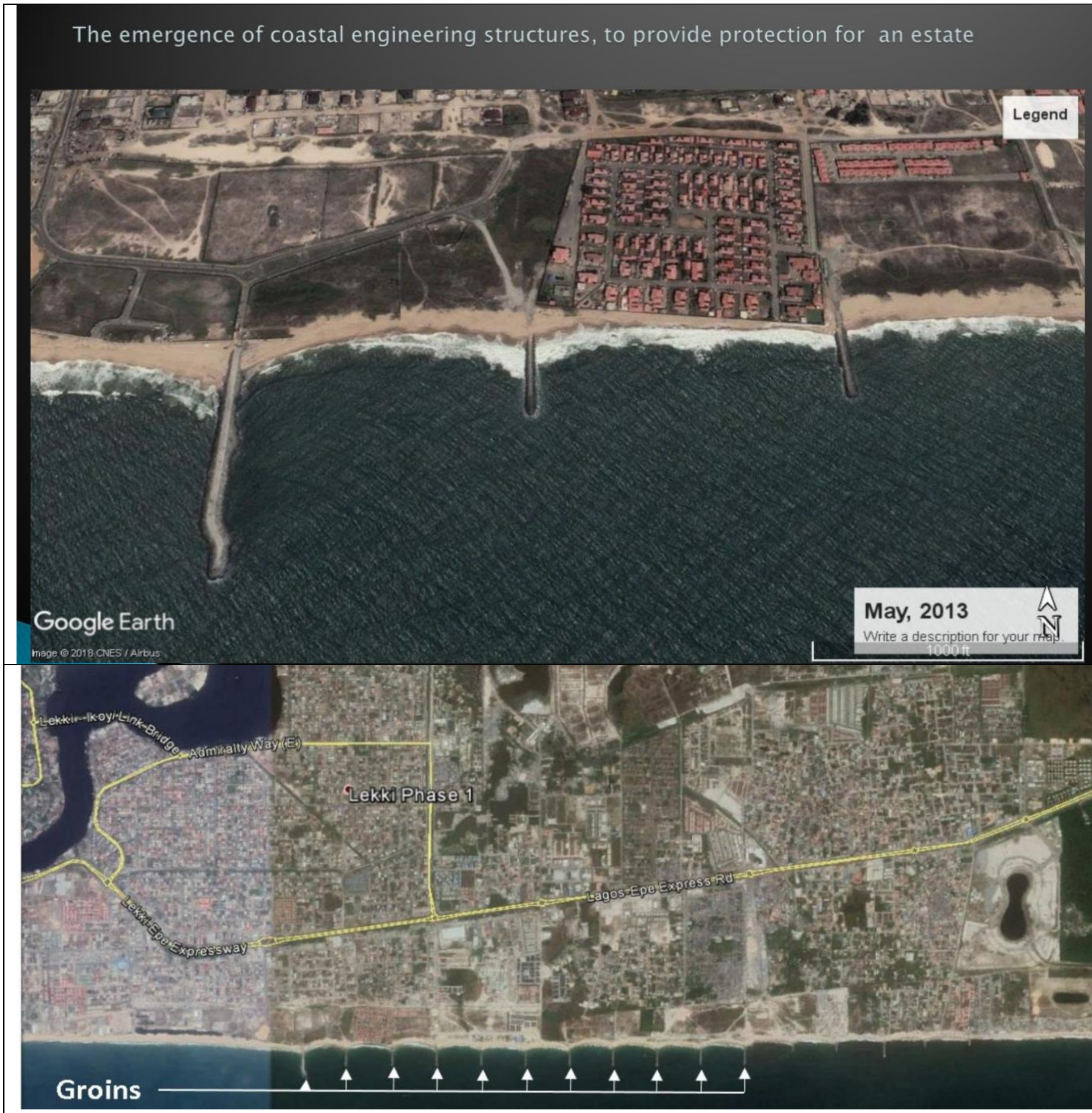


Plate 4.7: Constructed Groins off the Lagos coast (Imagery source: Google Earth, December 2015)
Source: The Nigerian Conservation Foundation

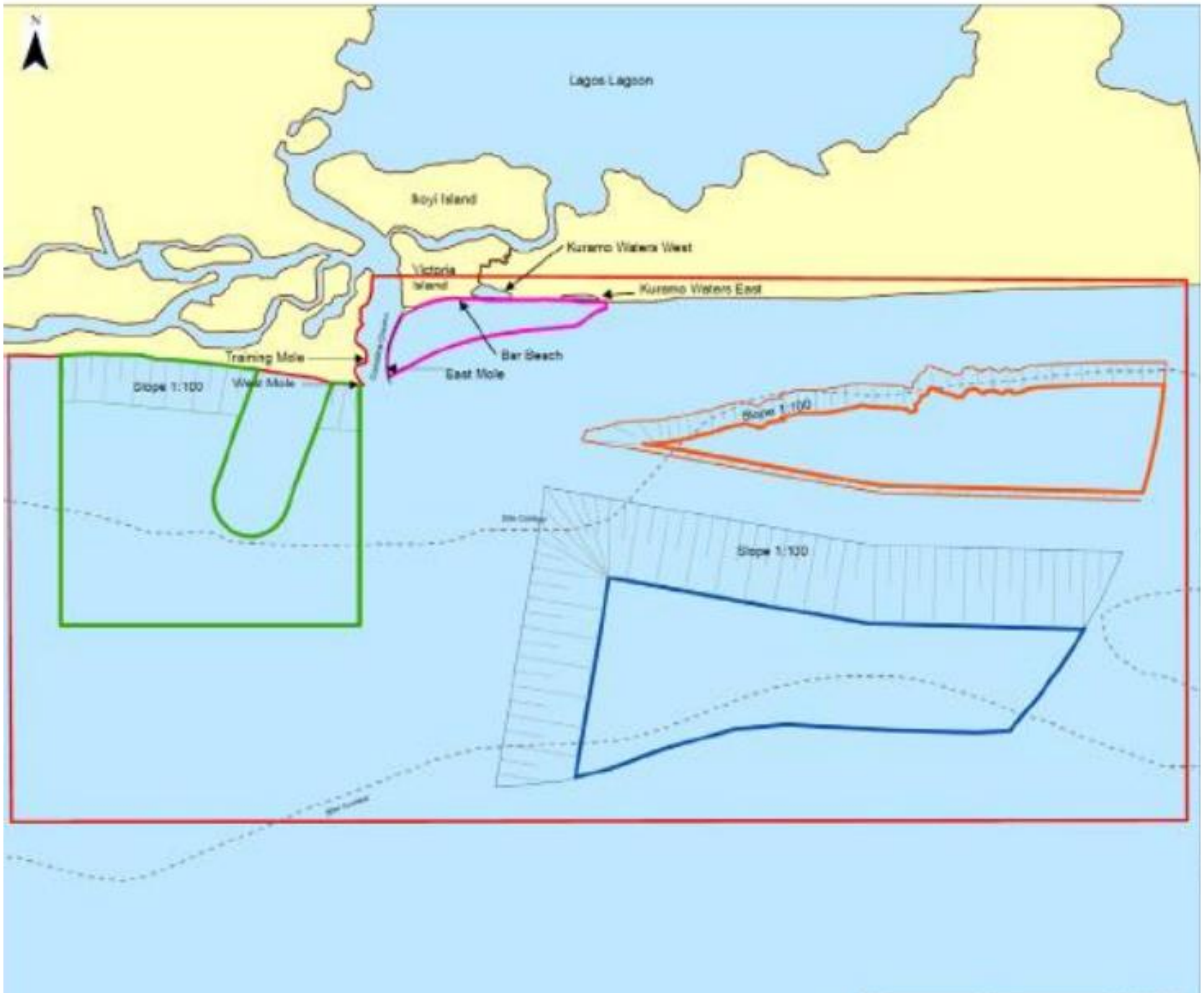


Figure 4.55: Location of Eko Atlantic and sand borrow area.

Plate 4.8: Coastal erosion along the Lafiagi – Alpha Beach axis
Source: The Nigerian Conservation Foundation

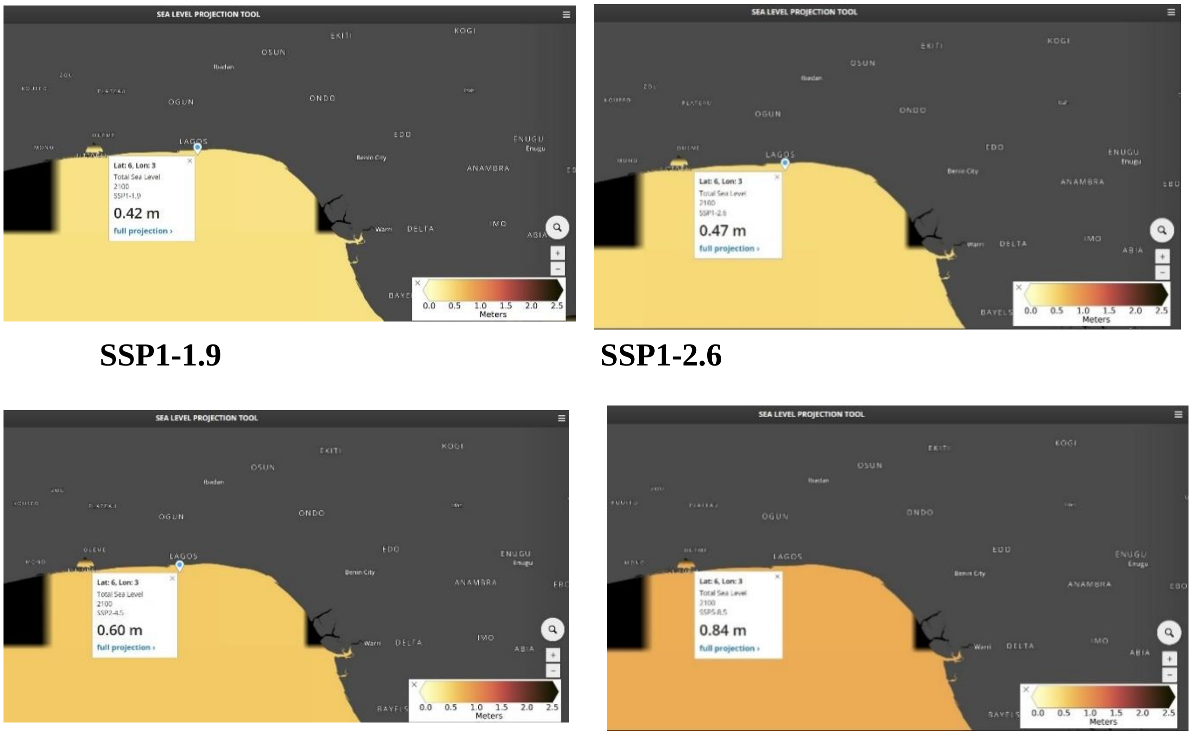
4.11 Sea Level Rise

Considering long-term trends in sea level rise is essential for the coastal road project in Lagos to address climate change impacts and ensure the resilience of coastal infrastructure. Sea level rise has been incorporated into the project:

Evaluating coastal areas at risk of inundation due to sea-level rise is essential for the coastal road project in Lagos to mitigate potential risks and plan for adaptation measures. By evaluating coastal areas at risk of inundation due to sea-level rise, the coastal road project in Lagos can proactively address climate change impacts, minimize risks to infrastructure and communities, and ensure the long-term resilience and sustainability of coastal development efforts.

NASA's 2100 sea level rise projections for Lagos vary by Shared Socioeconomic Pathways (SSPs). Under SSP1-1.9, with very low emissions and strong climate policies, the rise is 0.42 meters. SSP1-2.6, with slightly less stringent efforts, projects a 0.47-meter rise. SSP2-4.5, a moderate pathway, projects 0.60 meters, while SSP5-8.5, with high emissions, projects 0.84 meters. Higher emissions result in greater sea level rise, emphasizing the impact of policy choices as presented in Figure 4.56.

Sea-Level Rise: **Evaluate Coastal Areas at Risk of Inundation*:*** Projections based on warming thresholds show a clear correlation: a 1.5°C rise results in 0.48 meters, 2.0°C in 0.55 meters, 3.0°C in 0.65 meters, 4.0°C in 0.75 meters, and 5.0°C in 0.86 meters. Limiting temperature increases is crucial to mitigate sea level rise impacts. **Figure 4.57** is the projection of sea level rise till 2100 A.D.



SSP1-1.9 **SSP1-2.6**

SSP2-4.5 SSP5-8.5

Figure 4.56: Sea Level Rise Projections

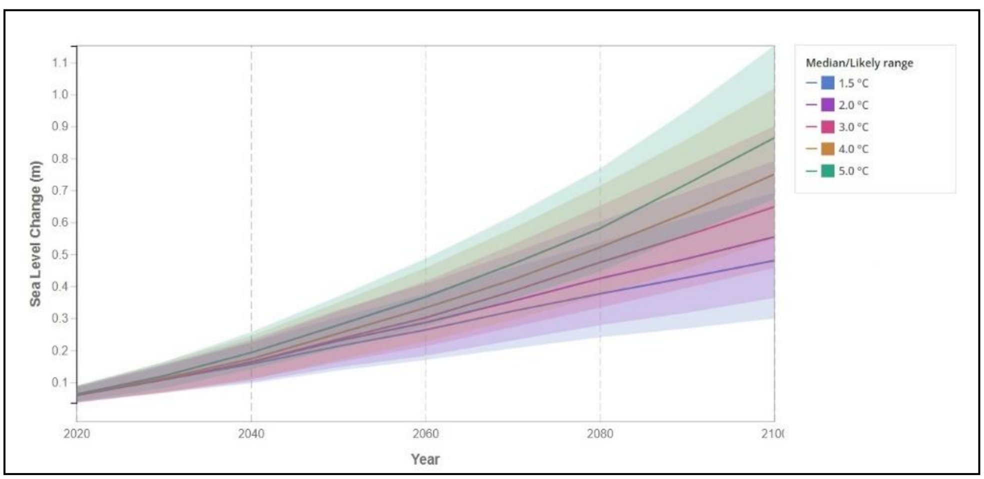


Figure 4.57: Projection of sea level rise till 2100 A.D.

Using the Coastal Risk Screening Tool developed by Climate Central, it was observed that a water level rise of 0.5 meters around the coast of Lagos will not affect the proposed Lagos-Calabar coastal road. Figure 4.58 shows the areas that will be submerged by 2100 with 0.5 increases in water level.

Figure 4.58: Areas that will be Submerged In 2100 with 0.5m Increase in Water Level

The red spots show the locations that can become inundated with a 0.5-meter rise in sea level which has been projected for 2100 under the present climate change scenario. This indicates that the elevation and design of the road are sufficient to withstand a moderate rise in sea level, ensuring its resilience against potential coastal flooding scenarios anticipated from such a rise. This assessment provides confidence in the infrastructure's ability to remain functional and safe even as sea levels increase.

4.12 Risk Assessments

Flood Risk Assessment: The flood risk assessment results provide essential information for planning and mitigating potential hazards.

As summarized in Table 4.25, the flood risk coverage along the kilometer corridor of the Lagos-Calabar Highway (Section 1) shows the obtained results. The key findings are further depicted in Figure 4.59 and described briefly below.

Table 4: 20: Flood Risk of Lagos Coastal Road Section 1

S/N	Flood Risk Category	Area of Coverage (Hectares)	Remarks
1	Very Low	0.00	no area along the road corridor was completely free from flood hazard.
2	Low	0.00	Even in regions classified as having very low or low flood risk, some level of risk persists.
3	Moderate	1022.34	Moderate flood hazard areas were identified in specific locations: • Marwa • Akinlade • Sangotedo • MosereIkoga • Iwerekun • Solu Alade
4	High	4981.07	High flood hazard was observed along the proposed road, particularly in the following sections: • Marwa to MosereIkoga • MosereIkoga to Lakowe
5	Very High	3873.15	The most critical flood risk areas were identified along the coastal road, including: Oniru Jakande Ojun Ajah Sangotedo Igand to Eleko These regions face significant flood threats.
Total		9876.56	Overall, the combined flood risk coverage within the corridor is 9876.56 hectares.

Source: Natural Eco Capital Fieldwork April 2024

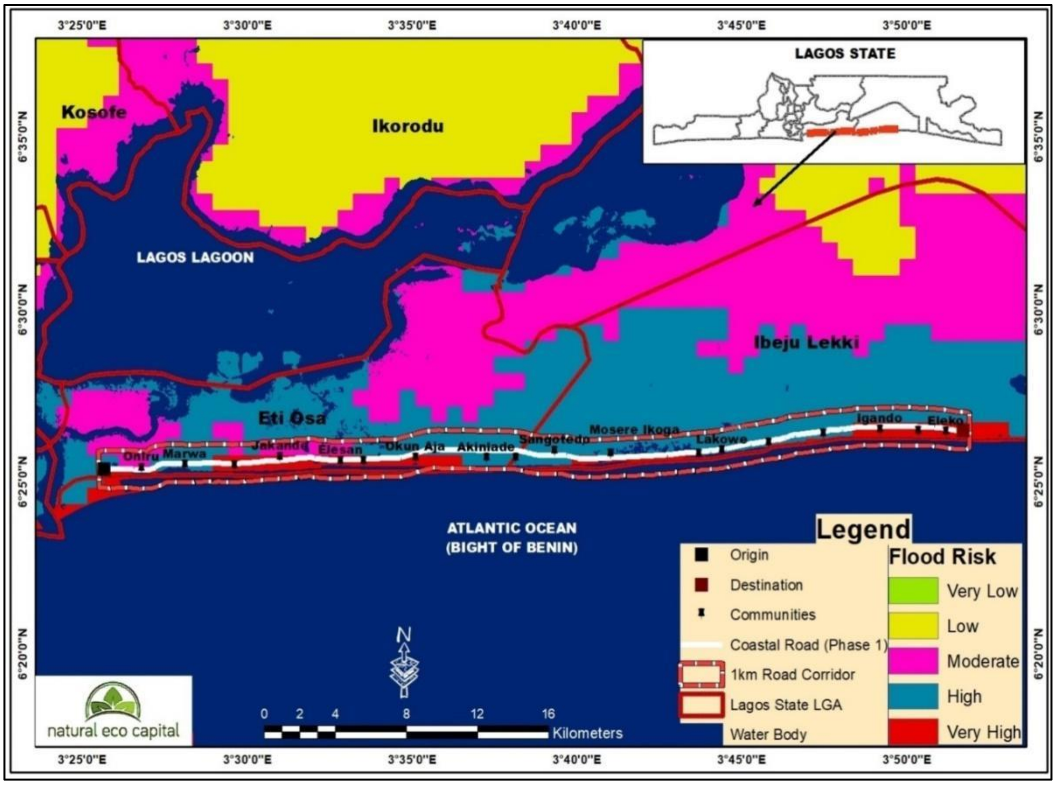


Figure 4.59: Flood Risk Map

Climate Risk Assessment-Vulnerability and Resilience*:* Lagos, Nigeria's foremost city, confronts profound vulnerability to climate-induced flooding due to inadequate resilience measures amidst escalating climate impacts. Situated along the coast, it contends with rising sea levels and extreme weather, exacerbating flooding risks. Vulnerability assessments pinpoint 6,983 susceptible features, notably floodplains, riverbanks, and Alfa Beach, exacerbated by projects like Eko Atlantic City, culminating in substantial losses.

The vulnerability analysis of Lagos State, using GIS, analysed four climate change impact scenarios: coastal flooding, urban flood, coastal subsidence, erosion, heat waves, and ecosystem services depreciation. An evaluation of the population distribution also revealed that diverse vulnerable groups, consisting of 12,910,948 individuals existed in Lagos as of 2020, and projecting to 2025, the city will have 25,012,637 vulnerable individuals. It is therefore important to emphasize the urgent need for resilient strategies amidst population growth.

Risk of climate change to the tourism sector: Lagos State's aspiration as Africa's premier tourist destination faces a grave threat from climate-induced coastal flooding and ocean surge, particularly affecting the coastline encompassing the lagoon and Atlantic Ocean. Alfa Beach, once a vibrant tourist hub hosting events like Lekki Sunsplash, succumbed to the Atlantic's encroachment. Urgent action is imperative to mitigate recurrent coastal flooding, given the critical role of the coastal road in the national economy.

Plate 4.9: Submerged and damaged building at Alfa Beach, Eti Osa LGA

Land Surface Temperature in Lagos State: Figures 4.60 (a-c) is the map of Land Surface Temperature (LST) in Lagos for 1999, 2009 and 2019 respectively. LST data for the year 1999, 2009 and 2019 were used to evaluate the spatial variability in heat waves and assessment of heat island in Lagos State

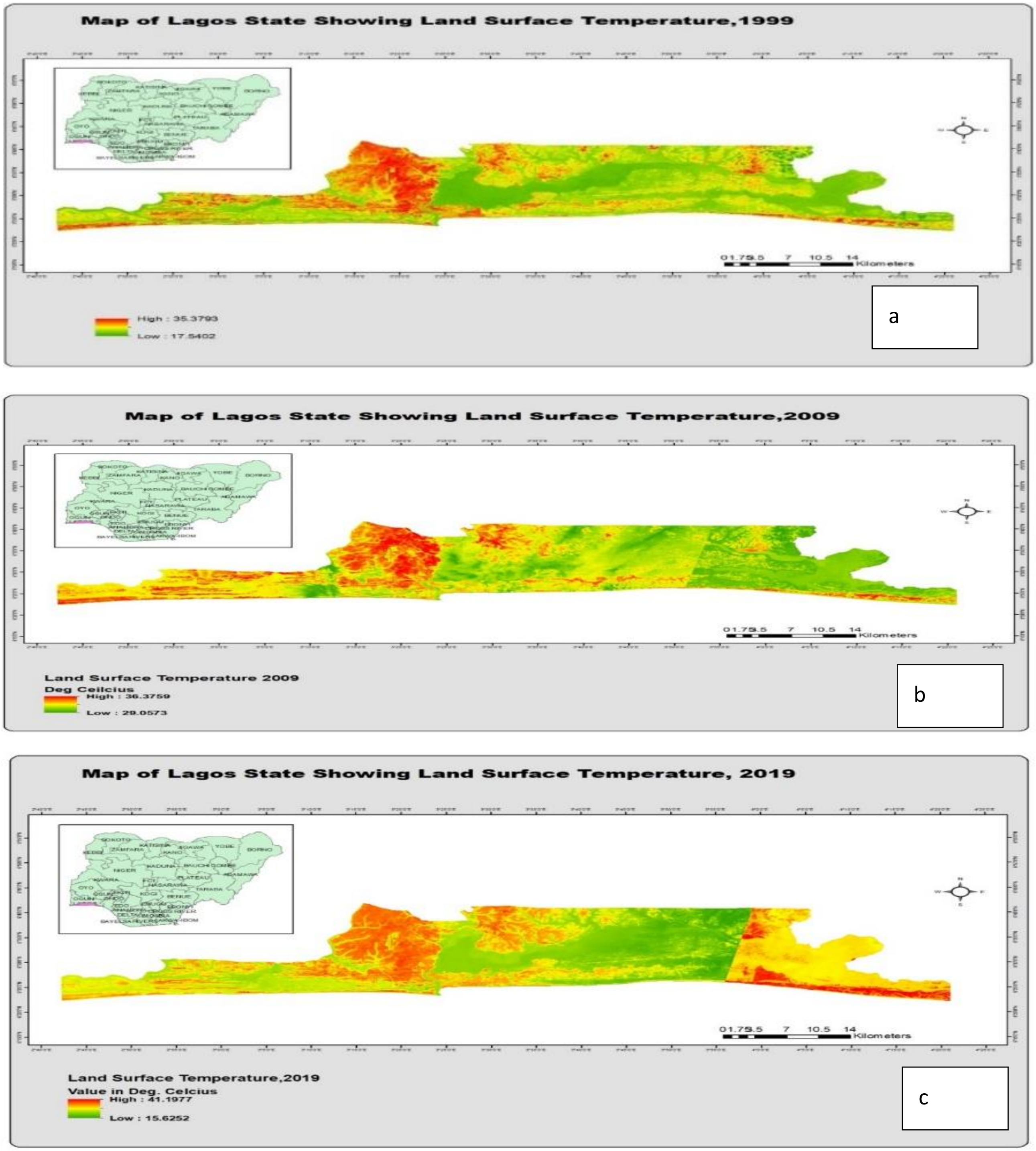


Figure 4.60 (a-c): Land surface temperature of Lagos State 1999, 2009 and 2019

Figure 4.60a showed that the surface temperature in Lagos state in 1999 is very mild having majority of the space with low temperature ranging between 17^0C to 25^0C. The built-up areas and some parts of the state have temperatures in the range of 35^0C which was very high at that time. However, in the year 2009, the area with low surface temperature has significantly reduced and the areas with extreme surface temperature have increased as shown in Figure 4.60b**.** The average low temperature has increased to about 29^0C. In the year 2019, the highest surface temperature recorded was 41^0C and the area with extreme temperature has increased across the state. Moderately high surface temperature has also increased throughout the study area such as some communities Epe and Ibeju Lekki.

Risk of land cover change and ecosystem vulnerability: The depletion rate of ecosystem services of Lagos State and project the depletion rate for the year 2030, 2050 and 2070 was computed from Landsat images of 2006 and 2016 The specific ecosystem used in the analysis and modelling of ecosystem services depletion in Lagos state are as follows: undisturbed forests, coastal vegetation, freshwater vegetation, planted forests, disturbed forests, tree crop vegetation, wooded savannah, grassland/vegetated bluff, arable land, settlements, bare surfaces, and water bodies.

Ecosystem services decline over ten-year intervals and projections for 2030, 2050, and 2070 were made using Markov Chain modeling in IDRISI software. The 12 ecosystems were categorized into forest-based and non-forest-based. Degraded forests reduce ecosystem services, impacting forest-based economy and livelihoods. Lagos central is heavily urbanized, while areas like Lekki and Epe are rich in forest-based ecosystems. Water bodies, including lagoons and coasts, dominate the landscape. The two-time results were used for the change projections into the near, medium, and distant future as shown in Table 4.26. The table shows that the major ecosystems in the year 2006 are waterbodies 21.69%) settlements 18.41%), freshwater vegetation (14.21%).

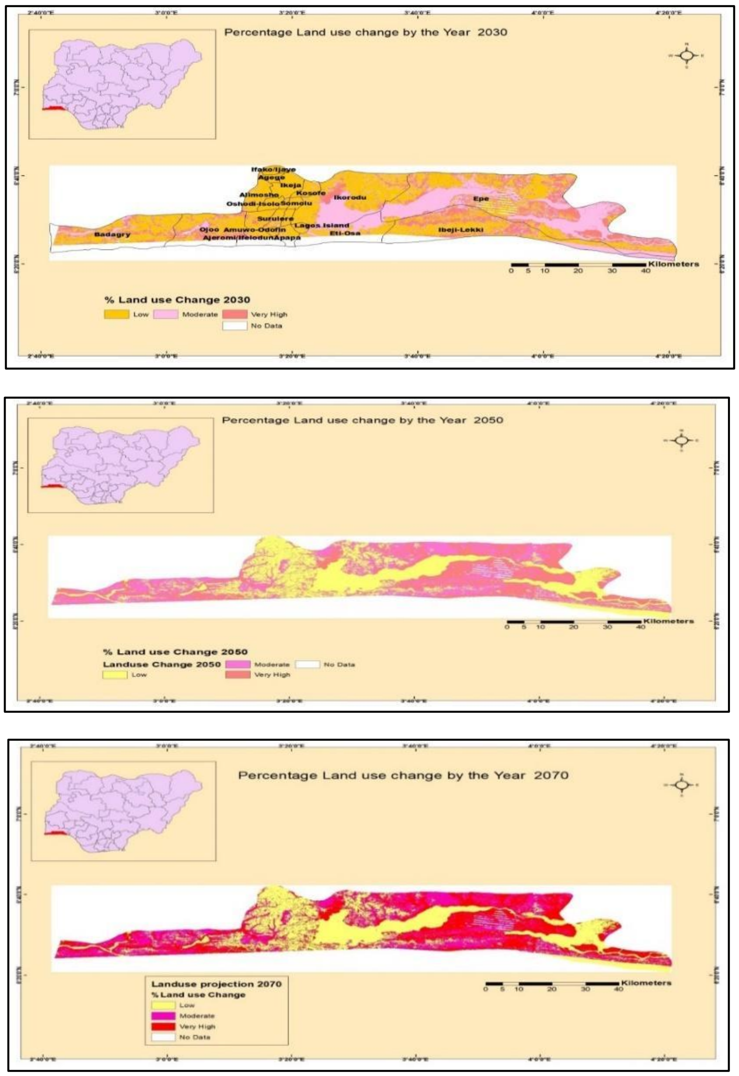
Table 4.26: Land use Analysis of Lagos State 2006 and 2016

Ecosystem	Area in Hectares (2006)	Percentage (%) Ecosystem (2006)	Areas (Hectares) in 2016	Percentage (%) Ecosystem (2016)
Undisturbed forest	2118.42	0.60	11907.54	3.42
Coastal vegetation	13872.96	3.95	10739.16	3.09
Freshwater vegetation	49881.15	14.21	30783.15	8.85
Forest plantation	6565.59	1.87	8287.38	2.38
Disturbed forest	16007.58	4.56	15404.13	4.43
Tree crop plantation	40012.29	11.40	27990.99	8.04
Savannah woodland	5983.29	1.70	19868.58	5.71
Grassland	712.71	0.20	4446.18	1.28
Arable land	26740.53	7.62	60265.44	17.32
Settlements	64650.78	18.41	69453.9	19.96
Bare Surfaces/cleared areas	48377.34	13.78	15873.84	4.56
Water bodies	76159.08	21.69	72931.59	20.96
Total	351081.72	100.00	347951.88	100.00

Source: Natural Eco Capital Fieldwork April 2024

In 2016 the major ecosystems have slightly changed and were water body (20.96%), settlements (19.96%), arable land (17.32%) and freshwater vegetation (8.85%). This shows significant depletion in the freshwater vegetation (from 14.21 to 8. 85%) and slight depletion in the water body from 21.69 to 20.96 %) This is due to an increase in building development projects in the State.

Figures 4.61 (a-c) the projected land use changes for 2030, 2050 and 2070 are presented in maps.



Figures 4.61 (a-c): Percentage projected change in Lagos state 2030, 2050 and 2070 respectively

Figures 4.61a shows that Lagos area will have a high percentage of notice able ecosystem change around the upper Ikorodu axis. The ecosystem change projection extends to 2050 (b), primarily affecting rural areas, notably the northeastern part of Lagos with available lands. Minimal changes are anticipated in water bodies and already urbanized zones. No growth by attrition is expected (c) shows that the projected land use changes for 2070 will ratify the entire state including the project area. The implication of this on the coastal road is the harshness of weather on the infrastructure. It is advisable to plant trees along the roadsides and on the road median.

The tabulated probability of ecosystem changes from 2016 to 2070 is crucial for climate change analysis. Vegetation cover acts as a carbon sink in urban centers, impacting carbon emissions and indirectly affecting the ozone layer, as highlighted by the REED+ project. Ecosystem changes in Lagos influence residents' ability to cope with climate change effects, especially with the urban landscape contributing to high emissions and microclimatic modifications. These impacts underscore the significance of ecosystem management in mitigating climate change repercussions in Lagos. The socio-economic implications of increased hard landscape and decreased soft landscape in Lagos include a slight rise in outdoor temperature, affecting human comfort and potentially leading to associated health challenges.

Enhanced coastal access presents economic prospects, stimulating local businesses and tourism. However, it triggers challenges: rising land costs and gentrification threaten resident displacement, while increased traffic poses safety risks. The coastal road's construction will reshape the environment, impacting communities, industries, and schools. Heavy machinery disturbs habitats like wetlands, displacing wildlife, and jeopardizing biodiversity. Construction disrupts livelihoods and exacerbates erosion, polluting waters with sediment and chemicals.

For the communities nestled along these coastlines like Eleko and other villages, the impacts will be deeply felt. Families may be uprooted to make way for roadways, severing ties to ancestral lands and cultural heritage. Meanwhile, the influx of construction activities brings with it noise pollution and the constant hum of machinery, disrupting daily life and posing health risks to residents especially those in the hospitals. For schools situated nearby, construction poses its own set of challenges. The noise and disruptions can disrupt learning environments, affecting students' concentration and academic performance.

Amidst these complexities, there's a pressing need for careful planning and mitigation strategies. Comprehensive impact assessments, stakeholder engagement, and monitoring efforts are essential for sustainable progress, balancing development with conservation to preserve coastal communities' rich tapestry of coastal life.

Climate Risk Assessment - Green House Gas Emission: The Lagos-Calabar coastal road is a critical artery for transportation and commerce, which will be expected to be one of the busiest roads in Nigeria. It will be traversing through densely populated and industrial zones of Lagos areas and as such, contributing significantly to GHG emissions. Vehicle emissions, particularly from heavy traffic congestion, will be a primary source, compounded by industrial activities along the route. Assessment of potential greenhouse gas (GHG) emissions along Lagos' coastal road with a means of providing climate mitigations is essential due to its environmental and societal implications.

A comprehensive climate risk assessment of GHG emissions along the Lagos coastal road is imperative for informed decision-making and policy formulation. Strategies to mitigate emissions, such as promoting public transportation, implementing emission standards for vehicles, and transitioning towards renewable energy sources, are critical for building climate resilience and ensuring a sustainable future for Lagos and its residents.

- *An assumption of operation of 1000 diesel-powered trucks per hour with individual operation capacity of an average of 10 hours per day, could guide in emissions estimates based on typical factors for diesel engines.*
- *If average distance travelled by each truck per hour is 10 kilometers and its average fuel consumption per kilometre: 4 liters (for heavy-duty trucks), then the Carbon dioxide (CO2) emission factor for diesel fuel will be approximately 2.68 kg CO2 per litre. With the above assumption, the total CO2 emissions per hour per truck 107.2kg of CO_2 per hour Total fuel consumption per hour per truck = 10 km/hour * 4 liters/km = 40 liters/hour*
- *Total CO2 emissions per hour per truck = 40 liters/hour * 2.68 kg CO2/liter = 107.2 kg CO2/hour. Now, multiply the emissions per truck by the number of trucks:*
- *Total CO2 emissions per hour = 107.2 kg CO2/hour/truck * 1000 trucks = 107,200 kg CO2/hour.*

Box 4.2: Carbon Emission Scenario Based on Truck Movement

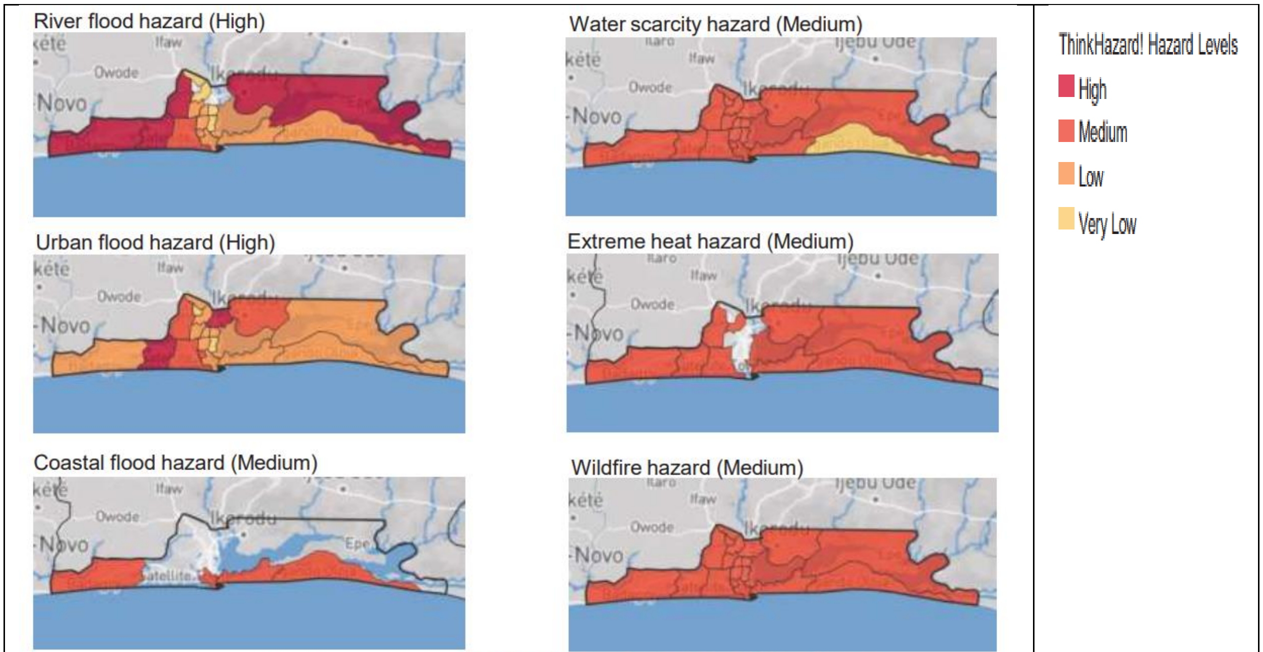
The above calculation provides an estimate of the CO2 emissions from the coastal road due to truck movements. However, it's important to note that actual emissions may vary depending on factors such as traffic congestion, vehicle efficiency, and fuel quality.

Moreover, the coastal road's proximity to the Atlantic Ocean amplifies the risks associated with climate change, as rising sea levels and coastal erosion threaten infrastructure and livelihoods. Additionally, the reliance on fossil fuels for transportation exacerbates the region's carbon footprint, necessitating urgent action to transition towards cleaner and more sustainable transportation solutions.

Climate Risk Assessment - Hazards in Lagos

Like other cities in Nigeria, Lagos faces several hazards that result in significant damage and setbacks of developmental progress:

- River flood hazard (High)
- Water scarcity hazard (Medium)
- Urban flood hazard (High)
- Extreme heat hazard (Medium)
- Coastal flood hazard (Medium)
- Wildfire hazard (Medium)



Source: GFDRR. *ThinkHazard! Lagos.* https://thinkhazard.org/en/report/2230-nigeria-lagos

Figure 4.117: Frequent Hazards in Lagos ***Source: Lagos State Bureau of Statistics (2022)***

Lagos is at high risk of both river (fluvial) flooding and urban (pluvial) flooding, with estimated annual flood damages (to assets, economic production, and mortality) costing almost $4 billion. Other prominent risks include coastal flooding, erosion, extreme heat, droughts, and wildfires, with an estimated cost of $1.7 billion each year in loss of assets, economic production, and land due to coastal erosion. Additionally, climate change is exacerbating these risks. 18% of land is on low-lying coastal plain, prone to regular flooding. Eti-Osa is one of the LGAs said be one of the most exposed when considering a 100-year flood (Figure 4.117).

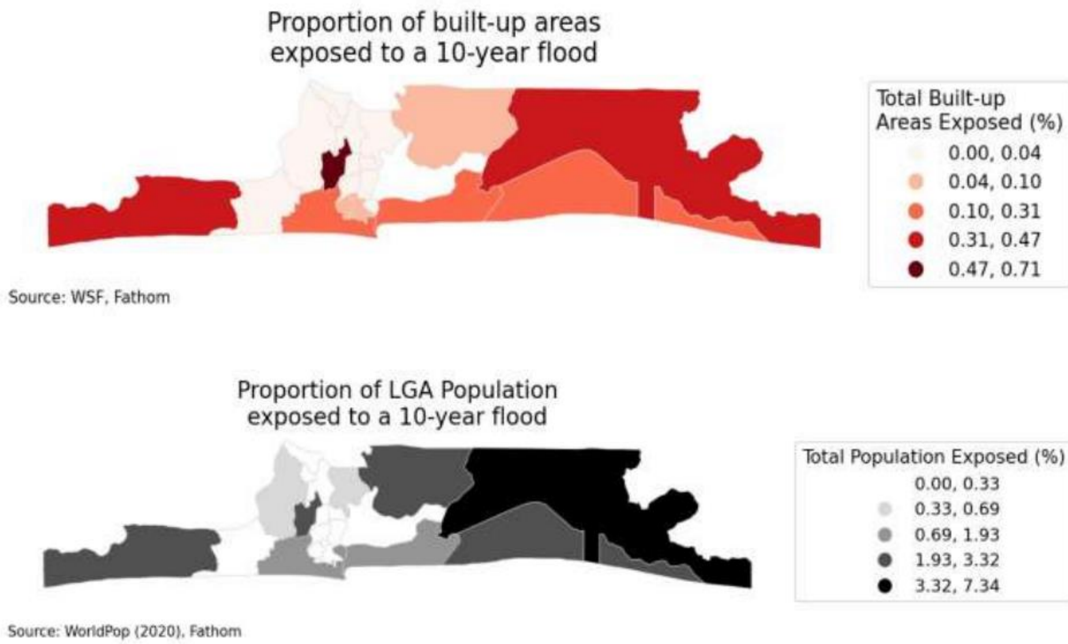


Figure 4.118: Low-lying Coastal Plain, Prone to Regular Flooding
World Bank, SURGE, and SECO (2023)

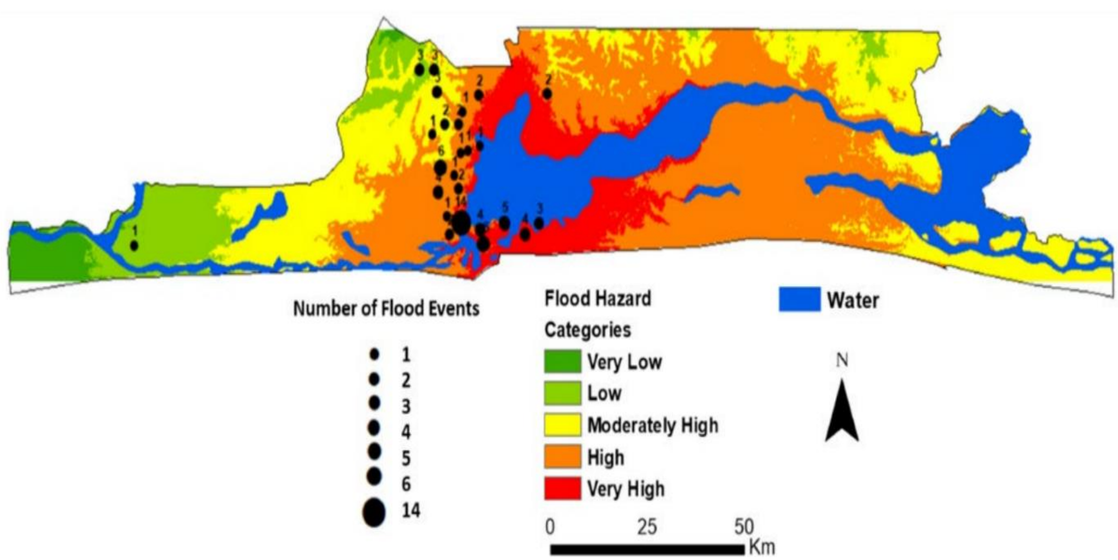


Figure 4.119: Flood Hazard in Lagos

Higuera Roa, Jack O'Connor, Taiwo Seun Ogunwumi, Christopher Ihinegbu, Josefine Reimer Lynggaard, Zita Sebesvari, Caitlyn Eberle, Margaret Koli (2022): Lagos floods, Technical Report

Lagos' coast is affected by severe pressures: unplanned urbanization has increased people's exposure to floods and erosion risks. The erosion process is threatening coastal communities along the Lagos shoreline: 86% of the state's coastline is subject to erosion, with an 8% average annual erosion rate of 8.2 meters per year 1. The eastern coast is at higher risk as it is more developed with buildings and infrastructure.

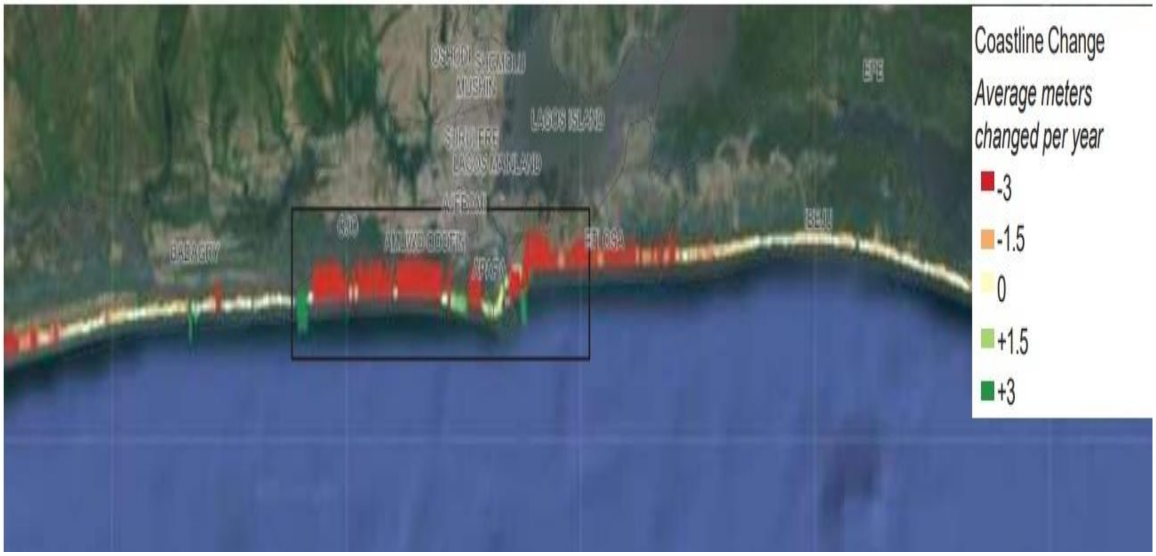


Figure 4.120: Lagos Coastline Affected by Erosion
Source: World Bank, SURGE, and SECO (2023)

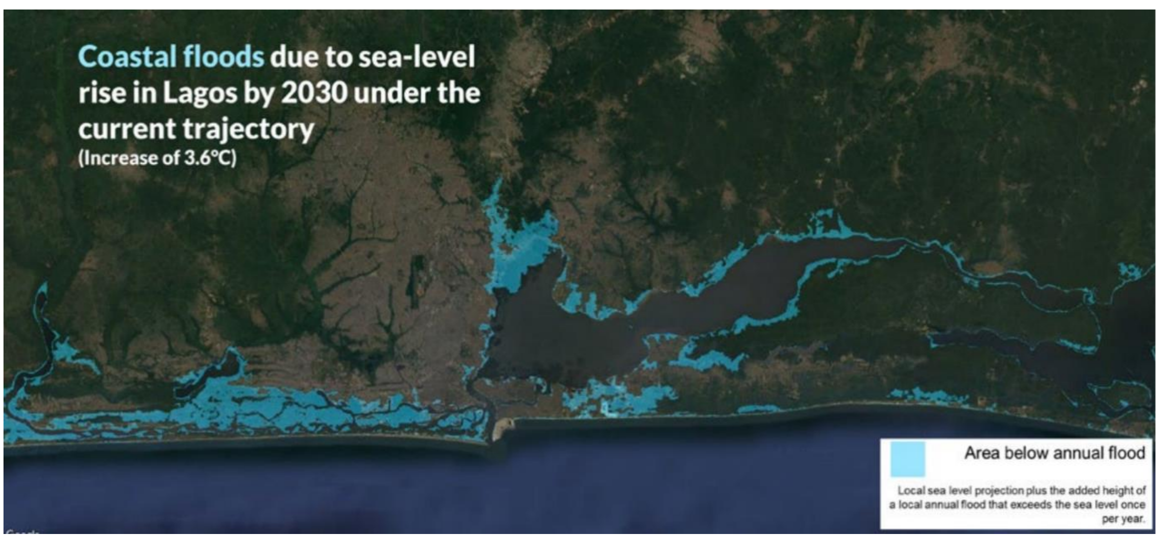


Figure 4.121: Coastal Floods due to Sea Level Rise in Lagos by 2030 SSP3.0-7
Source: Extracted from Climate Central (2021)

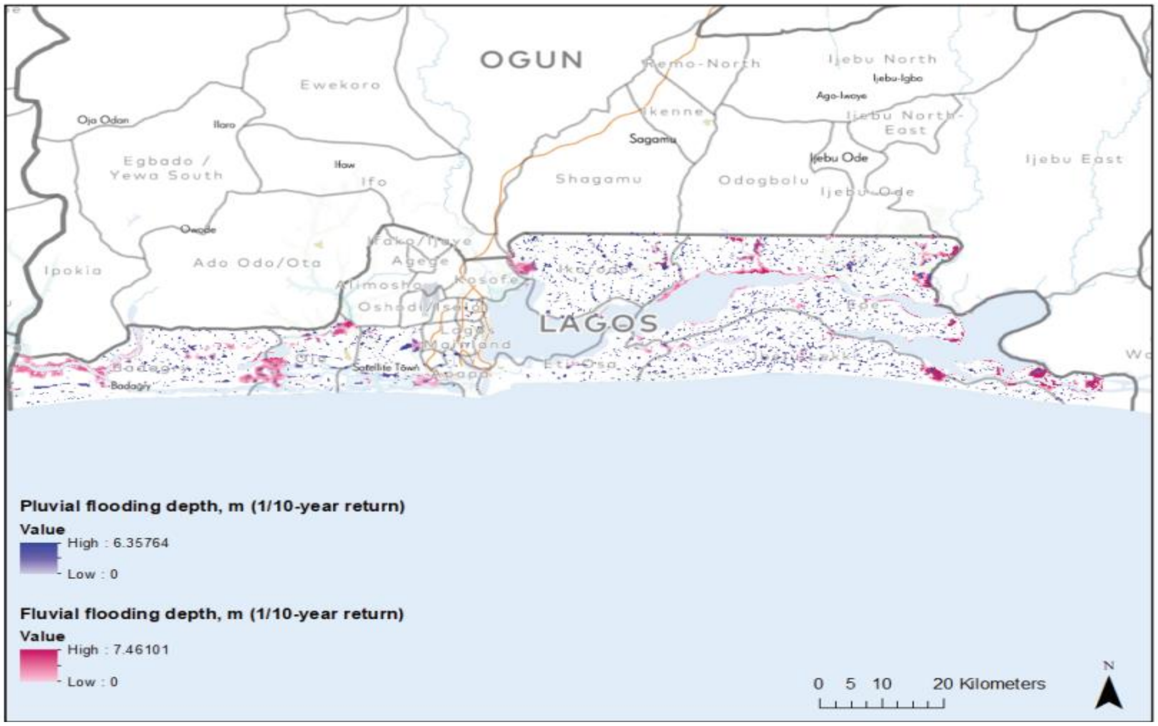


Figure 4.122: Fluvial and Pluvial Types of Erosion in Lagos
Source: World Bank, using SSBN Global Flood Hazard Model data, based on Sampson et al., (2015)

Table 4.21: Estimate the Impacts of Erosion

	No
Production lost*	124
Land lost	691
Assets lost	835
Total cost of erosion	1,650
% of the States' GDP	1.7%

Lelia Croitoru, Juan José Miranda, Abdellatif Khattabi and Jia Jun Lee (October 2020) The Cost of Coastal Zone Degradation in Nigeria: Cross River, Delta, and Lagos States

Risk and Vulnerability of Infrastructures: Like other physical structures, infrastructural facilities such as roads, schools, and hospitals are also vulnerable to flooding. Road facilities are so crucial, even in the period of flooding for rescue, support services and could equally provide temporary succour for flood victims. Infrastructures tend to fail faster to flood and the failure no doubt would deprive the people of the area the opportunity to use the infrastructure while replacing such infrastructure may not be so easy in this period of economic melt-down.

Plate 4.10: Failed access road in Alfa beach, Eti-Osa LGA

The spatial distribution of vulnerable infrastructure in Lagos State is presented in Tables 4.27 to 4.29. Eti-Osa, Ikorodu, Amuwo-Odofin, and Ojo are vulnerable to the threats of flooding. The distribution of severely affected infrastructures is presented in **Table 4.27** while the vulnerability maps are equally presented in the appendix (flood risk vulnerability maps) for the affected Local Government Area and for the entire State.

Table 4.22: Lagos Flood Risk Vulnerability Statistics (Severely Affected)

Description	**Ikorodu**	**Kosofe**	**Ojo**	**Amuwo-Odofin**	**Alimosho**	**Eti-Osa**
No. of PAPs	342	2,169	52	218	35	465
Residential	296	1,862	40	197	27	385
Commercial	1	62	2	-	-	25
Mixed	25	110	4	10	5	18
Industrial	2	1	-	-	-	1
Institutional buildings	13	89	5	5	2	18
Roads	5	45	1	5	2	9
Recreational	-	-	-	1	-	9
Estimate (₦‘000)	2,092,930.00	34,735,930.00	385,150.00	6,367,500.00	493,000.00	29,577,697.00

Lagos Ministry of Environment

A buffer of 500m was set to determine the total number of infrastructures that are moderately affected by flooding. The analysis however revealed that a total of 339 infrastructures (residential, commercial, mixed, industrial) were moderately exposed to the threats of flooding with an estimated value of ₦4, 991,800,000.00. In determining the estimate of the least affected infrastructures, a buffer of 700m was set along the coastline.

Conversely, the total distribution of infrastructures that are susceptible to the threats of flooding across the State based on the vulnerability mapping of the CRA project for Lagos State is 6,983 with varying degrees of impact ranking viz, severely affected (6563), moderately affected (339) and least affected (81).

The Morphology of the Coastal Landforms alongst in Lagos is depicted below:

Morphological Feature	Feature	Area (Km2)	Percent (%)
Lagoon	Atlantic Ocean	2576.42	36.790
	Falomo Lagoon	0.22	0.003
	Lagos Lagoon	385.53	5.505
	Lekki Lagoon	295.72	4.223
Creek	Creek	4.89	0.070
	Omu Creek	7.01	0.100
Beach	Sand Beach	11.84	0.169
	Mud Beach	2.54	0.036
Mole	Coastal Defence Pillar	0.59	0.008
	Eko Atlantic Mole	0.08	0.001
	Lekki Port Mole	0.10	0.001
	East Mole	0.01	0.000
Island	Eko Atlantic	8.37	0.119
	Ita Oko Island	0.59	0.008
	Ita Oko Island	10.92	0.156
	Lagos Barrier Island	1023.27	14.612
	Lagos Island	18.80	0.268
	Ode Omi Island	5.11	0.073
	Refuge Island	18.00	0.257
	Saga Island	0.32	0.005
Mainland	Imakun Omi	29.23	0.417
	Ita Oko Mainland	37.62	0.537
	Lagos Mainland	2537.81	36.239
Man-made	Lekki Deep Port	1.40	0.020
	Lekki Free Trade Zone	26.56	0.379
Inland Lake	Chevron Inland Lake	0.11	0.002
		7003.02	100

Source: *Natural Eco Capital Fieldwork April, 2024*

Climate Risk Assessment-Forest Carbon Audit: The assessment, spanning 47.8km, utilized remote sensing, field surveys, and carbon accounting to estimate forest carbon equivalents. Data on vegetation types, carbon density, and biomass were analysed to quantify carbon storage. Climate risk scenarios assessed project impacts on carbon sequestration. **Figure 4.62** details the sampling design.

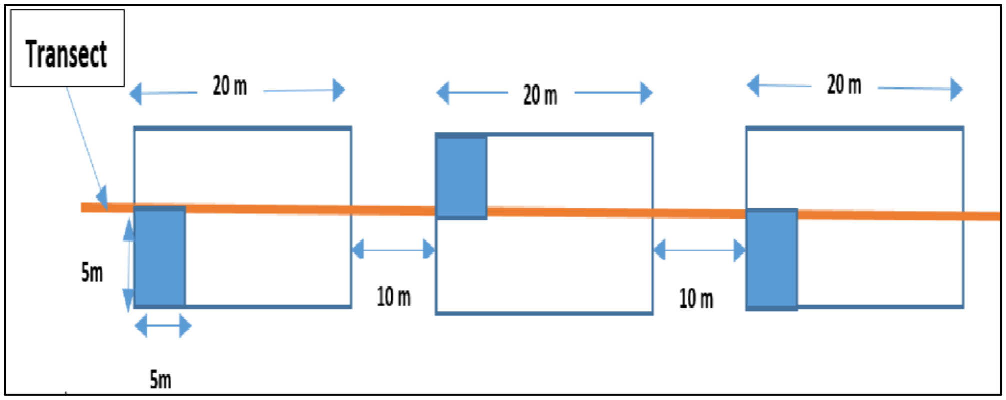


Figure 4.62: Sketch Diagram of Sample Transect Sampling Design

In this project, the total amount of sequestered CO2eq. (t ha-1) in the above-ground biomass was 6.7340 t CO2eq. ha-1 for the entire sample plots while the standard error and standard deviation had values of 0.0005 and 0.0106 with an uncertainty value of 35%. This findings corroborate the report of Alongi, (2014) and it states that the mangrove plants are very productive and it is estimated that the average annual carbon sequestration rate of mangrove ecosystems is between 6 and 8 Mg CO2e/ha (tons of CO2 equivalent per hectare) (Murray et al., 2011). However, mangroves are considered as potential sinks of atmospheric carbon due to their significant role in the global carbon cycle and cultural ecosystem services (Matsui et al., 2010). The estimation of sequestered carbon stock in the landscape was done in accordance with the Nigeria Forest Carbon Inventory Field Manual supervised by Food and Agricultural Organization of the United Nations (2020). Moreover, carbon sequestration potentials for the landscapewas estimated according to the tree composition and structure.The total estimated CO_2 equivalent for the landscape was **6.7340**t$CO_{2eq.}$ha^{-1}for the entire sample plotswhile thestandard error and standard deviation had values of 0.0005 and 0.0106 at confidence level of 0.09% with an uncertainty value of 35%as presented below:
Estimation of CO_2 sequestered of the above-ground biomass for the Landscape

	AGB (kg ha^{-1})	CO_2eq. (t ha^{-1})
Standard Error	0.2839	0.0005
Standard Deviation	6.1017	0.0106
Total	2144.837	6.7340
Count	412	412
Confidence Level (95%)	55.78%	0.09%
Uncertainty	26%	35%

4.13 BIOLOGICAL BASELINE ASSESSMENT

Microbiology

In all ecosystems, microorganisms are the most numerous organisms and through them flows a large fraction of primary production. Bacteria are responsible for a large fraction of aerobic respiration, all of the anaerobic respiration, and a large portion of the remineralization of organic nutrients. In aquatic systems, especially those receiving some allochthonous organic input, the secondary production of planktonic bacteria can be co-equal or even larger than that of the primary production of phytoplankton (Findlay and others 1991).

Microorganisms are the main source of fertility and of degradation of organic matter and pollutants in the aquatic environment. Their large biochemical diversity enables them to exist in many different habitats everywhere on earth where they are essential for the geochemical cycle of many elements and the elimination of many pollutants. Many of these reactions are performed by specialized organisms that cannot be easily substituted. Furthermore microorganisms are indispensable for a lot of symbiotic and pathogenic relationships with higher organisms and gives additional competithive abilities for many animals. A distortion in microbial communities could cause extinction of many species. Due to their ubiquitous presence, microorganisms are very important as environmental indicators for contamination and are important for the establishment of quality guidelines. Tables 6.12 and 6.13 below show the average microbial count of water and sediment samples respectively.

The total number of microbial cells in marine sediment is presently estimated as 2.9×10^{29} to 5.4×10^{29} cells, accounting for 0.18 to 3.6% of Earth's total living biomass. The abundance of microbes in marine sediment generally decreases with increasing depth and increasing sediment age. The microbial load in water sediment samples from the investigated area are depicted in Tables 6.12 and 6.13. In this study, microbial investigations of surface water samples indicate that heterotrophic bacteria count ranged between 45.23×10^6 and 121.32×10^6 cfu/ml while heterotrophic fungi populations varied from 89.30×10^6 to 135.10×10^6 cfu/ml. Microbial count for HUB varied between 11.11×10^6 and 34.40×10^6 cfu/ml whereas that of HUF ranged from 13.02×10^6 to 87.02×10^6. In the sediment samples, heterotrophic bacteria and fungal populations varied from 981.01 to 1542.01×10^6 cfu/g and from 1178.20×10^6 to 1875.11×10^6 cfu/g respectively, while the populations of HUB and HUF ranged from 344.00×10^6 to 765.12×10^6 cfu/g and 432.04×10^6 to 793.02×10^6 cfu/g. The results of microbial analysis for water and sediment samples showing composition and distribution in the study stations are illustrated in tables 4.19 and 4.20 The results of this study show that the water

The main species of bacteria found in seawater from the sampling location belong to the genera *Pseudomonas* sp., *Vibrio* sp., *Achromobacter* sp., *Flavobacterium* sp. and *Micrococcus* sp., while the major fungal groups represented include *Aspergillus* spp, *Penicillium* spp., *Fusarium* spp., *Trichoderma* sp., and *Bacillus* sp.

4.13.1 Soil Microbiology

The result of the analysis of the various soil samples in the project area, as shown in Appendix 4.6 indicated that the total heterotrophic bacteria in the surface soil ranged from 2.16 to 4.47×10^6 cfu/gm with an average of 3.315×10^6 cfu/gm while in the subsoil, it ranged from 1.83 to 4.06×10^9 cfu/gm with a mean value of 2.95×10^6 cfu/gm. Total heterotrophic fungi in the surface soil ranged from 0.27 to 1.35 x 10^2 cfu/gm with an average of 0.81 x 10^2 cfu/gm while in the subsoil, it ranged from 0.14 to 1.35 x 10^2 cfu/gm with a mean value of 0.745 x 10^2 cfu/gm. Total heterotrophic fungi in the topsoil layer were higher than the subsoil which may be due to the soil cover and most especially the litter decomposition activities.

Total hydrocarbon utilizing bacteria in the surface soil and subsurface soil ranged from 0.52 – 2.48 x 10^4 cfu/gm and 0.31 to 2.48 x 10^4 cfu/gm which showed that more hydrocarbon utilizing bacteria are in the surface soil than the subsurface soil. The hydrocarbon utilizing fungi also followed similar trend of having more microbial load in the surface soil layer than the subsurface soil as indicated in the microbial analysis with ranges of 0.17 to 0.74 10 x 10^1 cfu/gm and 0.29 to 0.57 x 10^1 cfu/gm. The predominant species of microorganisms isolated were *Bacillus spp., Corynebacterium spp., Nocardia spp., Penicillium spp., Fusarium spp., Aspergillus niger, Geotrichum spp., Pseudomonas putida, Mucor spp., and Trichoderma spp.*

4.13.2 Water Microbiology

The occurrence of microbiological contamination in water resources used for drinking or domestic activities and irrigation, purposes represents both environmental and public health issues that give rise to great concern. At present, the entire global population is still not guaran-teed access to a clean water supply and adequate water facilities. Moreover, in recent decades, the global demand for water for human needs has increased because of demographic growth. At the same time, the availability of high-quality water resources has decreased because of the increase in anthropogenic is pressures, mainly related to urbanization, industrialization, agricultural and livestock practices, and the effects of climate change.

The interactions of these factors have increased the risks of contamination from human pathogens and the diffusion of waterborne diseases. People who are exposed to contaminated water can experience adverse health effects, such as *E. coli* infections, diarrhoea, giardiasis, cholera, typhoid fever, salmonellosis, hepatitis A, and polio. It has been estimated that about one million people, of whom 395,000 are children under 5 years old, die every year because of diarrhoea epidemics that result from poor sanitation and the use of unsafe water in domestic settings. The microbiological contamination of groundwater can be traced back to the presence of point or diffuse contamination sources. Appendix 4.1 shows the result recorded for the various microbiological parameters investigated in groundwater samples collected study locations.

The results from the analysis of water and sediment samples from the study area shows that values of parameters investigated were within national and international permissible limits for oceanic conditions.

Hydrobiological Community

The Gulf of Guinea (GoG) is considered as one of the World's most productive marine economic zones with fishery resources, oil and gas reserves, and precious minerals (Amuwo, 2013; Francis and Mohammed, 2020). It is also a significant global reservoir of marine biological diversity. It is estimated that the region is home to over 300 species of finfish, 17 species of cephalopods, 25 species of crustaceans, and 3 species of turtles (Belhabib et al., 2016). These resources are exploited by both artisanal and industrial fishing fleets, of which the latter is made up of both local and foreign vessels, reflecting the economic importance of the GoG to over 472 million people of coastal communities in its vicinity.

In the appendix 4.5, find a summary of the results related to the various components of the aquatic environment studied. Suffice it to say that brief information on the results are presented below:

Plankton

The biotic content of the Nigeria offshore waters is relatively rich and greatly influenced by the physical and chemical characteristic of the Gulf of Guinea. Plankton are the basis of aquatic production and also play critical role in the marine ecosystem, particularly on the carbonate system, thus, any serious alteration in their composition and abundance may have deleterious effects on the food chain and consequently on the entire water body. They consist essentially of unicellular microscopic algae, either solitary or colonial, whose movements are more or less dependent on current and waves. Due to the ecological importance of phytoplankton populations in the marine environment, and given the harmful nature of certain species, several studies have been carried out to investigate these organisms and understand how their growth is influenced by their respective environments. Some studies, using model simulations, have predicted the increase of harmful algal blooms (HABs) in response to global warming.

A total of 21 phytoplankton species belonging to two taxonomic phyla (Bacillariophyta, Dinophyta,) were recorded. The phylum Bacillariophyta, accounted for the highest number (19) species recorded and constituted about 90% of the total number of species observed, while the phylum Dinophyta comprised two taxa, and accounted 10 percent of the total species enumerated. The phytoplankton assemblage in the area is composed of estuarine and neritic marine forms. Most of the species recorded were widely distributed. Species richness ranged between 13 and 19 and there was no remarkable difference in the species composition at the sampling locations.

A great number of biotic (grazing pressure, competitive exclusion, predation) and abiotic (temperature, light, nutrients, water regime) factors affect community structure of phytoplankton in aquatic ecosystems. Endogenous variables (such as nutrients and grazing) and exogenous variables (including hydrology, climatology, wind mixing and rainfall) play important roles in determining phytoplankton community structure. In natural environments, non-equilibrium conditions prevail and diversity of phytoplankton communities depends on both the number of limiting resources and on environmental fluctuation. Environmental changes or disturbances are among the most important factors affecting phytoplankton assemblage, and human activities which can strongly alter environmental conditions, can result in rapid changes in their community structure.

4.13.2 Fishery

The fishery resource of the area has been collated from sample collection, local knowledge from fisher folks and literature review. As a direct consequence of the diversity and abundance of the fishing resources, large fishing boats and trawlers continuously exploit the commercial potential of these waters. Daily landing from fishing vessels and the research carried out by the Nigerian Institute for Oceanography and Marine Research revealed a high proportion of commercially important fish. Fish is the principal source of animal protein for billions of people all over the world, and it provides important nutritional and health benefits. Fish is known to be a rich source of fatty acids, vitamins and essential oils. The fats and fatty acids in fish, especially the long chain n-3 fatty acids are highly beneficial and difficult to obtain from other food sources. Apart from its importance in human diets, fish is increasingly demanded for use in animal feed formulation and is the most important internationally traded animal commodity.

Fish and fisheries play significant roles in providing support for livelihoods by proving employment and income for the teeming populations of coastal communities worldwide, both directly for those harvesting the fish, and indirectly for those supplying materials, processing, and marketing the catch. According to Longhurst 1961), three major ecological zones can be distinguished along the West African Coast, namely; A). The northern subtropical zone of abundant fish resources, beginning from the south of Senegal (under the influence of the Cold Canary Current). B). A subtropical zone equally abundant resources beginning from the mouth of Congo River (under the influence of Cold Benguila Current), and C). These two rich zones enclose a less productive equatorial zone with Nigerian Marine area located in the Gulf of Guinea.

These ecological zones play significant roles in determining the composition and distribution of fish species found in the Gulf of Guinea waters. The productivity of the Gulf of Guinea is also influenced by the seasonal upwelling that occurs between Nigeria and the Ivory Coast mainly in July to September and to a less extent in December to February. The transport of colder, dense and nutrient-rich deep waters to the warmer, usually nutrient-depleted surface water during periods of upwelling stimulates high levels of primary production in phytoplankton. This primary productivity in turn increases production of zooplankton and fish.

Fishery generally involves the utilization of harvestable aquatic organisms in fresh, brackish and marine waters. It reflects a complex interaction between the population of organisms being harvested, the population of fishermen and environmental conditions. Fishing is the main occupation of the communities along the shoreline. Different gears are used for fishing but canoes, fishing nets See plate below) and fishing trawlers are mostly used in the project area.

The major impact of the high way project on fish community are usually associated with sediment pollution of the environment. This may not have significant direct effect on fishes, because they can avoid the polluted area for a period of time. However, species that spawn in the estuary (e.g bonga) may suffer mortality of eggs and larvae. Studies by Thistleton (1965); Olaniyan (1978); Amadi (1991); Tobor and Ajayi (1993); and Odulate *et al.*, (2013) catalogued different fish species in the pelagic and mesopelagic zones of Nigeria deep offshore waters. Some important fish species found in the study area include Shrimps and Prawns, Lobsters, Crabs (Portunidae), Bivalves, Gastropods, Cephalopods, Sharks, Skates, Batoids, Marine Turtles, and a host of Bony fishes. Predominant amongst the bony fish families were the *Carangidae*, *Polynemidae*, *Clupeidae*, *Pomadasyidae*, *Sciaenidae*, *Ariidae*, *Elopidae*, *Cynoglossidae*, *Lutjanidae*, *Sphyraenidae*, *Monodactylidae* etc. The study area currently houses the country’s vast fishery resources. Thus, a shift in the population of organisms at a given trophic level, such as the producers (Phytoplankton) and primary consumers (Zooplankton), may lead to ecological changes in the marine environment that could have its attendant effects. Appendix 4.7 is a checklist of the finfish resources in the coastal marine waters of the Nigeria (Ajayi, 1995; Odulate *et al*., (2013)

The fishery resource of the area (Plates 8 and 9) has been collated from sample collection, local knowledge from fisherfolks and literature review. As a direct consequence of the diversity and abundance of the fishing resources, large fishing boats and trawlers continuously exploit the commercial potential of these waters. Daily landing from fishing vessels and the research carried out by the Nigerian Institute for Oceanography and Marine Research revealed a high proportion of commercially important fish species in Nigerian Coastal Waters.

Studies by Thistleton (1965); Olaniyan (1978); Amadi (1991); Tobor amd Ajayi (1993); and Odulate et al., (2013) catalogued different fish species in the pelagic and mesopelagic zones of Nigeria deep offshore waters. Some important fish species found in the study area include: Shrimps and Prawns, Lobsters, Crabs (Portunidae), Bivalves, Gastropds, Cephalopods, Sharks, Skates, Batoids, Marine Turtles, and a host of Bony fishes. Predominant amongst the bony fish families were the Carangidae, Polynemidae, Clupeidae, Pomadasyidae, Sciaenidae, Ariidae, Elopidae, Cynoglossidae, Lutjanidae, Sphyraenidae, Monodactylidae etc. The study area currently houses the country’s vast fishery resources. Thus, a shift in the population of organisms at a given trophic level, such as the producers (Phytoplankton) and primary consumers (Zooplankton), may lead to ecological changes in the marine environment that could have its attendant effects. Table 6.14 is a checklist of the finfish resources in the coastal marine waters of the Nigeria (Ajayi, 1995; Odulate et al., (2013)

Fish species that occur regularly in catches of Fishing Trawls operating within the Nigerian Coastal waters are presented in **Appendix 4.6**

The major impact of the highway project on fish community is usually associated with sediment pollution of the environment. This may not have significant direct effect on fishes, because they can avoid the polluted area for a period. However, species that spawn in the estuary (e.g bonga) may suffer mortality of eggs and larvae.

4.13.3 Flora and Fauna, Habitats, Ecological Significance

Zooplankton*:* Zooplankton include microscopic animals (krill, sea snails, pelagic worms, etc.), the young of larger invertebrates and fish, and weak swimmers like jellyfish. Most zooplankton feed on phytoplankton, and most are, in turn, eaten by larger animals (or by each other). Krill may be the most well-known type of zooplankton; they are a major component of the diet of blue whales. Zooplankton is incredibly important to the ocean ecosystem, and very sensitive to changes in their environment, including in the temperature, salinity, pH level, and nutrient concentration of the water. Because many zooplankton species eat phytoplankton, shifts in timing or abundance of phytoplankton can quickly affect zooplankton populations, which then affect species along the food chain. The zooplankton in the study stretch comprised 16 taxa . The phylum copepoda was the most abundant, it was represented by 11 species which accounted for about 69 percent of the total zooplankton population. The remaining two phyla were represented by one species each. Species richness ranged between 11 and 16. Most of the zooplankton species recorded were widely distributed, and there was no remarkable difference in species composition at the sampling locations. Factors affecting zooplankton abundance include total nitrogen, water depth, pH, salinity, hydro-climatic factors, water quality variables, and the presence of stressors such as pollution and habitat degradation. Water quality parameters, such as nitrate (NO_3^-) and phosphate (PO_4^3) concentrations, have also been found to have significant effects on zooplankton abundance and diversity.

Sample collection and analyses

Physico-chemical characteristics of water and sediment

Collection and analyses of water and sediment samples were carried out according to procedures outlined in APHA (2017).

Hydrobiological Samples

Benthic Macrofauna

Benthic samples were collected using a van Veen Grab with a n internal surface area of 0.025 m^2. The grab was lowered vertically from a stationary position (Plate 6), in an open position to the lagoon floor. On striking the bottom, the clutch holding the heavy metal jaws was slackened releasing the jaws to take of the sediment. When the grab was hauled, the jaws came together under their own weight and so enclosed a standard sample of sediment. At each successful haul of bottom sediment, a little portion (50-100 g) of the sediment was removed and kept in polythene bags for onward transportation to the laboratory for physiochemical analysis as detailed in the Appendix4.12. The remaining portion was sieved aboard with the aid of a 0.5 mm sieve (Plate 6) of to extract macrobenthic organisms. Benthic macrofauna were kept in appropriately labeled containers and fixed with 10% formalin and taking to the laboratory. In the laboratory, all preserved animal specimens were washed in tap water and transferred to 70% ethanol and stored in the laboratory to remove the preservative and the fine sediments. The organisms were sorted out and examined with the aid a dissecting microscope. The macrobenthic fauna was examined with the aid of a dissecting microscope. The organisms were identified as much as possible to species level using relevant literature (Barnes, 1981) The composition of benthic communities and abundance at each sampling site were determined to provide information on species richness, species abundance.

Benthic macrofauna, are animals that are larger than 0.5 millimeter and live on rocks, logs, sediment, debris, and aquatic plants during some period in their life. The benthos includes vast array of aquatic organisms. These animals are widespread in their distribution and can live on all bottom types, even on manmade objects. Benthic organisms constitute an important part of the aquatic food chain, especially for fish, and because of their abundance and position as “middlemen” in the aquatic food chain, benthos play a critical role in the natural flow of energy and nutrients. Most benthos exhibits limited mobility and so they are less able to escape the effects of pollutants that diminish water quality. Therefore, benthos can give reliable information on water quality. Their long-life cycles allow studies conducted by aquatic ecologists to determine any decline in environmental quality.
The large numbers of species possess a wide range of responses to stressors originating from agricultural, domestic, and industrial sources. Many benthic macro-invertebrates are long-lived, allowing detection of past pollution events such as oil spills and dumping of wastes (Abel, 1989). The following characteristics of benthic species play critical roles in the evaluation of water quality.

- Pollution tolerance: many types of benthos are sensitive to pollutants. If many intolerant species are collected in a sample, the water quality is likely to be good. If only pollution-tolerant organisms are found, the water is likely to be polluted.
- Functional groups: the presence or absences of certain feeding groups (such as scrapers and filterers) may indicate a disturbance in the food supply of the benthic animals in the aquatic system and the possible effects of pollutants.

Table 4.24 Species Composition and Distribution of Zooplankton

Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
PhylumCrustacea																			
Class I: Copepoda																			
Order i: Calanoida																			
Centropageshamastus (Lingberg)	+	+		+	+	+	+		+	+		+	+	+	+	+		+	
*Paracalanusparvus*Claus	+	+		+	+	+		+	+	+	+	+	+	+		+	+	+	+
*Paracalanus*sp.		+	+	+	+	+	+	+	+	+	+		+	+		+	+	+	+
Pseudocalanus elongatus (Boeck)	+	+	+		+	+	+	+	+	+	+	+		+	+	+	+	+	+
*Rhincalanusnasutus*Giesbrecht	+	+	+		+	+	+	+	+		+	+	+	+	+	+		+	+
*Temorastylifera*Dana	+	+	+	+		+	+	+	+	+	+	+	+			+	+	+	+
Order ii: Cyclopoida																			
*Corycaeusobtusus*Dana	+	+	+	+		+	+	+		+	+	+	+	+		+	+	+	
*Cyclopinalongicornis*Boeck	+	+	+		+	+	+	+		+	+	+	+	+	+		+	+	+
*Oithonaplumifera*Baird	+	+	+			+	+	+	+	+	+	+	+	+		+	+	+	+
*Oncaeavenusta*Phillipi		+	+	+		+	+		+	+	+	+	+		+	+	+	+	+
Order iii – Decapoda																			
*Lucifer foxonii*Borrad	+		+	+	+	+		+	+	+	+	+		+	+	+	+	+	+
Phylum – Chaetognatha																			
Order – Apharagmorpha																			
Sagitta enflataVogf	+	+	+	+	+	+	+	+	+	+		+		+		+	+	+	+
Phylum: Chordata																			
Class: Larvacea																			
*Oikopleura*sp.	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	
Juvenile Stages																			
Megalop larva	+		+	+	+	+	+	+	+		+	+	+		+	+	+	+	+
Gastropod larva		+	+	+	+	+		+		+	+	+	+	+		+	+	+	
Echinopleutus larva		+	+		+	+	+		+	+	+	+	+	+	+		+		+
Overall Taxa Richness	12	14	14	11	12	16	13	13	13	14	14	14	13	13	9	14	14	15	12

Source: Natural Eco Capital Fieldwork April 2024

Table 4.24 shows the checklist, abundance, and distribution of macrobenthic invertebrates in the sampling stations, while Figure 4.63 shows percentage contributions of the different taxa to species richness. The benthic macroinvertebrate fauna identified belong to three (3) Phyla (Mollusca, Annelida, and Nemertea). Mollusca constituted was represented by 11 species and constituted approximately 73% of the population of macrobenthic invertebrates in the study stretch. Annelida ranked second in species abundance, with four species represented, the group constituted about 27% of the population recorded. A single taxon of Nimertea worm was observed, it constituted about 7% of the total population. Appendix 4.9 shows Species Composition and Distribution of Marine Mammals

Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Phylum: Mollusca																			
Class: Gastropoda																			
Family: Turridae																			
Turris sp.	+	+		+			+			+	+		+		+			+	+
Turritella communis																			
Drilla sp.	+	+	+		+			+	+	+	+		+	+	+	+		+	+
Family: Nassidae																			
Nassa tritoniformis	+	+	+		+	+	+			+	+		+	+	+	+			+
Family: Conidae																			
Conus mediterraneus	+		+	+		+	+		+	+		+	+			+	+	+	
Order: Pteropoda (sea butterflies)																			
*Clio*sp	+	+	+	+				+	+	+	+		+	+		+			
Class: Scaphopoda (Tusk shells)																			
Dentalium sp.	+	+	+	+		+	+		+		+	+	+	+				+	+
Class: Bivalvia (Lamellibranchia)																			
Family: Arcidae																			
Arca sp.	+		+		+				+	+	+	+		+		+	+	+	
Family: Nuculanidae																			
Nuculana acuta	+	+		+	+		+	+	+	+	+	+	+	+	+	+	+		+
Family: Tellinidae																			
Macomalitoralis	+			+			+		+			+			+			+	+
Tellina gilchristi																			
Phylum: ANNELIDA																			
Class: Polychaeta																			
Family: Nephtyidae																			
Nephtys sp.	+	+	+		+	+	+		+	+	+		+		+	+	+	+	
Family: Nereidae																			
Nereis lamellose	+		+		+	+		+	+	+	+	+	+	+	+	+		+	+
Family: Capitallidae																			
Notomastus sp.	+	+		+		+	+	+		+		+		+	+	+	+	+	
Orbiniaangrapequensis																			
Phylum: NEMERTEA																			
Nemertine worm	+	+	+	+	+		+		+		+	+	+		+		+	+	+
Overall Taxa Richness	12	9	9	7	7	8	8	5	9	10	10	12	10	8	8	9	6	9	7

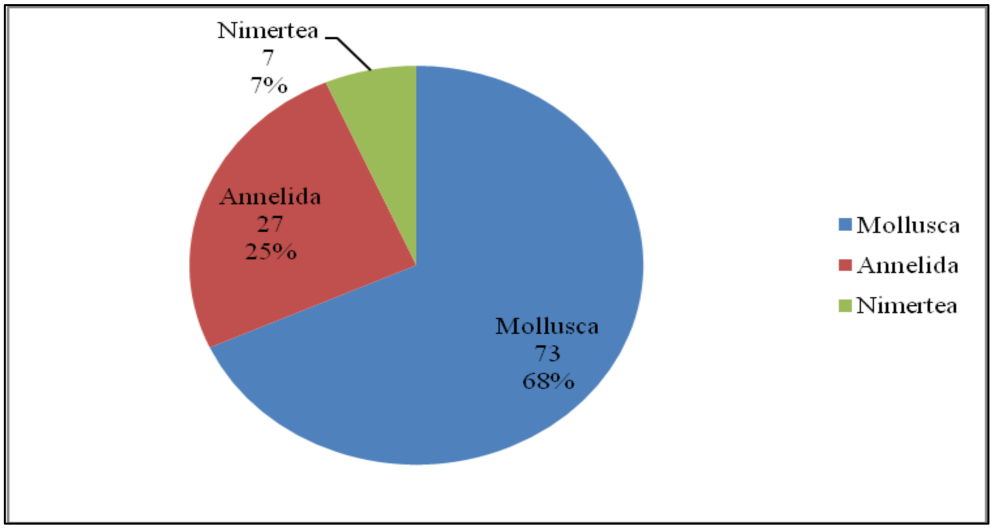


Figure 4.63: Percentage Contributions of Different Taxa to Species Richness

Mammals*:* Marine mammals are classified into four different taxonomic groups: Cetacean (whales, dolphins, and porpoises), Pinnipeds (seals, sealions, and walruses), Sirenians (manatees, and dugongs), and Marine Fissipeds (polar bears and sea otters). Threats to marine mammals are largely from human impacts including accidental capture in fishing gear, habitat destruction, poaching, pollution, harassment, and ship strikes. Mammals are protected under extant laws in different jurisdictions. For example, all Marine mammals in waters of the United States are protected under the Marine Mammal Protection Act (MMPA).

Several marine mammals have been reported in the Gulf of Guinea. These include the rough-toothed Dolphin (Steno bredaneusis), Atlantic Hump-backed Dolphin (*Sousa tenszii*), Atlantic spotted Dolphin (*Stenella frontalis*), Pantropical spotted Dolphin (*Stenella attenuate*), pygmy killer whale (*Feresa attenuate*), killer whale (*Orcinus orca*), dwarf sperm whale (*Kogia simus*) and fin whale (*Balaenoptera physalus*). The most varied wildlife in the area is the aquatic birds. Common species are the diving pelican (*Pelecanusrufescens*), the deep swimming shag (*Phalacrocorax africana*), the sacred ibis (*Threskiornis aethiopica*), the little egret (*Egrettagarzettai*), the great white egret (*Egrettaegretta*), the pygmy kingfisher (*Ceyxpicta*), the little African swift (*Apus affinis*), yellow-mantled whydah (*Euplectesmacrourus*), and the black-headed weaver (*Ploceusvelatus*).
The ecological significance of Nigerian Coastal waters for dolphins and whales has recently become the subject of scientific studies. There has been lack of population abundance estimates before now, and their natural history remains largely unknown. The conditions created by the seasonal upwelling in the northern Gulf of Guinea are likely to create conditions favourable for marine mammals as well as for fisheries.

Seabirds: This comprises group of endothermic vertebrates, characterized by feathers, toothless beak jaws, laying of hard-shelled eggs, a high metabolic rate, a four chambered heart, and a strong yet light weight skeleton. Birds are major components of marine wildlife. Along the Nigerian

Coast, a total of 45 bird species belonging to 13 families has been reported (Isebor *et al.*, 1999). Amongst these species are migratory and resident species of the mangrove community, with the later utilizing mangrove and mudflat areas for relatively short periods of the year. The most commonly recongnisedpalaeartic migrant shorebirds include *Charadrinushiaticula*, *Pluvial issquatorola*, *Tringa tetanus*, *T. nebularia*and *Actitis hypoleucos.* Egretta species (such as *E. intermedia*, *E. garzetta* and *E. alba*) are amongst the well-known water birds.

Reptiles: Several reptilaian species has been reported in the Nigerian Coastal zone. Amongst them are the Nile Crocodiles*Crocodylusniloticus*which are common in estuaries, protected Turtles species, such as the Atlantic Loggerhead (*Carreta carreta*), Pacific Riddley Turtle (*Lepidochelys olivacea*), Atlantic Hawksbill Turtle (*Eretmochelys imbricata*) and Leatherback Sea Turtle (Dermochelys Coriacea). They usually nest along the beaches and are mainly inhabitants of coastal waters. A number of reptilaian species has been reported in the Nigerian Coastal zone. Amongst them are the Nile Crocodiles *Crocodylus niloticus* which are common in estuaries, protected Turtles species, such as the Atlantic Loggerhead (*Carreta carreta*), Pacific Riddley Turtle (*Lepidochelys olivacea*), Atlantic Hawksbill Turtle (*Eretmochelys imbricata*) and Leatherback Sea Turtle (Dermochelys Coriacea). They usually nest along the beaches and are mainly inhabitants of coastal waters.

Marine wildlife

Marine environments are vast, open environments teeming with an enormous variety of plant and animal species. Destructive and unsustainable human activities pose serious threats to the wildlife community of aquatic systems. Marine wildlife can be grouped into fish, mammals, seabirds and reptiles. The record of wildlife investigation carried out in this study is presented below.

Plate 4:11 Typical Situation Along Section 1 Alignment
Source: Field Work

4.13.4 Ecotoxicological Assessment:

Ecotoxicology study was carried out on aquatic organisms in the project corridor. The samples collected were evaluated based on select **bioindicators**, biomarkers, and multi-response indicators to gauge health and integrity of aquatic ecosystems. In ecotoxicology studies, bioindicators are organisms or biological parameters that help assess environmental health and exposure to pollutants. Common bioindicators: algae and phytoplankton, macroinvertebrates, fish, microorganisms, plants and terrestrial bioindicators.

Biomarkers include measures of molecular, biochemical, cellular, and physiological responses in key species exposed to contaminants or stressors. Examples inlcude:

Behavioral biomarkers (changes in behavior due to exposure), reproductive biomarkers (assess reproductive health), energy metabolism biomarkers (indicate metabolic changes), lysosomal integrity biomarkers (reflect cellular health), immunotoxicity biomarkers (assess immune system responses) and genotoxicity biomarkers (detect genetic damage).

The choice of bioindicators and biomarkers depended on the specific ecosystem and pollutants being studied based on their sensitivity and relevance.

4.14 Ecosystem Services and Natural Capital

This section presents and assesses the key ecosystem service considerations relevant to the topics presented in other chapters of this ESIA Report. This includes key inter-linkages to ensure that the values which ecosystem service beneficiaries attach to ecosystem goods and services are appropriately considered and addressed throughout the ESIA process.

Ecosystem services are the benefits provided by ecosystems to humans. Ecosystem services is "the benefits that people, including businesses, obtain from ecosystems" (International Finance Corporation Performance Standard (PS) 6 (IFC,2012). They can be directly used or consumed, as well as used as inputs in the production of other goods and services. Examples include Air filtration by trees (improving human health) is an ecosystem service. Trees also provide timber (used in construction), which is an indirect ecosystem service.

The benefits of ecosystems are conferred at many scales and often to multiple different beneficiaries. At the local level, ecosystem services are frequently the basis for rural livelihoods and subsistence, particularly for the poor. Artisanal fishing, for example, provides both cash income and food for low-income families. Benefits can also be regional—such as the fisheries that contribute to the Gross Domestic Product (GDP) of various coastal countries—or national, such as sites that form part of a country's cultural heritage. At a global scale, ecosystems regulate climate and support the biodiversity which underpins all biological production.

Natural capital refers to the components of ecosystems (excluding humans and their contributions) that generate goods and services valuable to people. Examples include soil as natural capital. It contributes to the production of crops, which is an ecosystem service.

Natural Capital Accounting (NCA) measures ecosystems and their services, allowing them to be incorporated into national economic accounts. It treats nature as a form of capital, recognizing ecosystems as productive assets with tangible value.

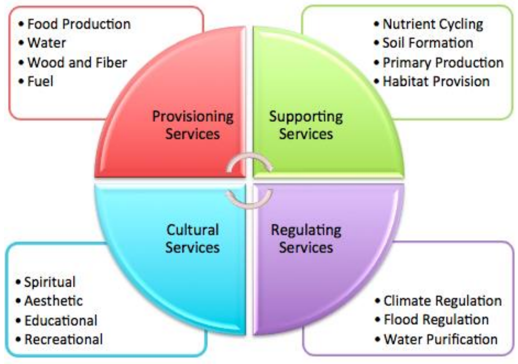


Figure 4.34: Ecosystem Services

Businesses and projects may also benefit from ecosystem services through, for example, the direct use of inputs, such as water, or through protection from natural hazards. Identifying and protecting such services can have further benefits such as avoiding punitive regulation and negative publicity, strengthening the organisation's reputation and, in some cases, providing effective natural alternatives to more expensive engineering solutions.

Specifically, the purpose of this section is to:

- Systematically identify and assess the likely impacts of project activities on Ecosystem Services (ESS) and the nature and significance of these impacts on ESS beneficiaries;
- Evaluate Project dependence on ESS to help manage risks and take advantage of opportunities related to ecosystem change; and
- Help inform, for unavoidable impacts, the selection of appropriate mitigation measures which aim to maintain the value and functionality of priority ESS and enhance the resource efficiency of Project operations.

The ecosystem services assessment process in the ESIVI tool comprises four stages:

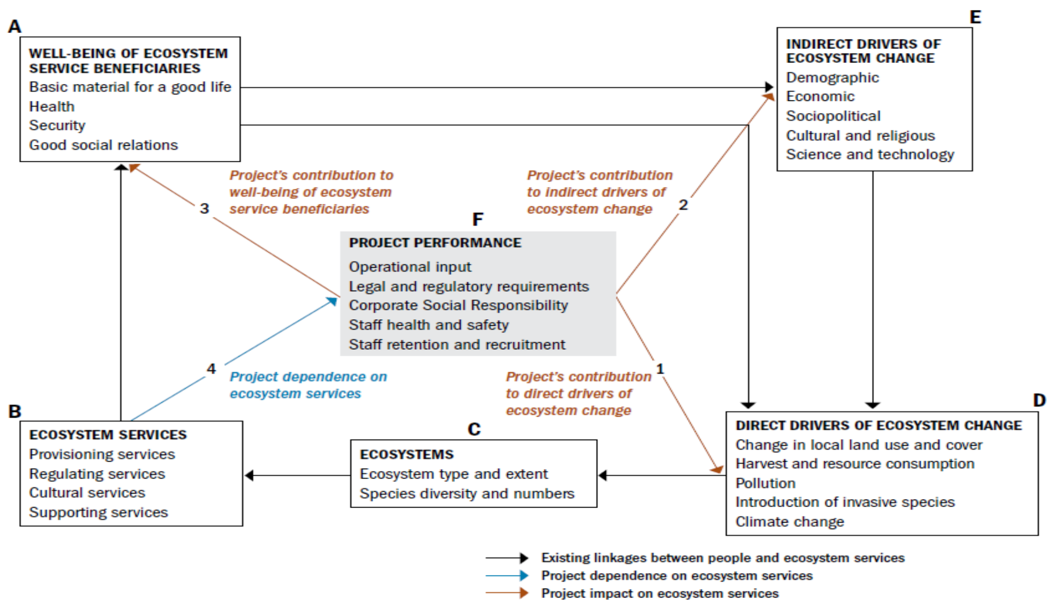
1. Scoping: to identify the key services provided by affected ecosystems that could potentially be impacted by the Project or that the Project may depend upon;
2. Baseline establishment: to assess the status of key services within the affected ecosystems in the absence of the Project, as well as the location of ecosystem service beneficiaries and the extent to which they benefit from the services provided;

Approach

There are different approaches to assessing the **Ecosystem Services (ES)** for the Lagos Coastal Road.

To complement the ESIA process and routinely addressed, considerations were given to ecosystem service (Figure 1, blue and black text respectively) using Ecosystem Services Review for Impact Assessment (ESR for IA). The ESR for IA helps identify measures to mitigate project impacts on ecosystem service benefits, ensuring a more comprehensive assessment. The ESR for IA can be used for two purposes. First, it identifies measures to mitigate project impacts on the benefits provided by ecosystems. Second, it identifies measures to manage operational dependencies on ecosystems.

The ESR for IA is a structured methodology developed by the World Resources Institute. A six-step method to address project impacts and dependencies on ecosystem services as part of the environmental and social impact assessment process. The steps build on assessments routinely conducted by social and environmental practitioners to better reflect the interdependence between project, ecosystems, ecosystem services, and people. It guides practitioners through six steps to incorporate ecosystem services into environmental and social impact assessments (ESIAs). These steps cover scoping, baseline analysis, impact assessment, and mitigation stages.
This is therefore anticipated to address project impacts and dependencies on ecosystem services and would help enhance our understanding of project impacts and their interdependence with ecosystems.
Fig. 4.36 relates to the Project Impact to Dependence on Ecosystem Services



Source: WRI, adapted from MA 2003.
Fig. 4.36: Project Impact and Dependence on Ecosystem Services

The ESR for IA provides a conceptual framework to link the project to ecosystems, ecosystem services, and the benefits derived from ecosystem services. It outlines six steps for conducting the ESR for IA throughout the ESIA scoping, baseline and impact analysis, and mitigation stages, including the use of Excel spreadsheets. Figure 4.34 illustrates the Standard Environmental and Social Impact Assessment Process, Complemented by the ESR for IA.

In terms of Valuation, there are Monetary Methods and Non-Monetary Methods: Monetary Methods include Market-Based Valuation (estimating ES value based on market prices, e.g., timber sales), Cost-Benefit Analysis (comparing costs and benefits of ES interventions), and Hedonic Pricing (analyzing property prices influenced by environmental quality). Non-Monetary Methods include Stated Preference Methods (surveys to assess people's willingness to pay for ES), Ecological Production Function (quantifying ES based on ecological processes), and Benefit Transfer (adapting existing valuation studies to new contexts).

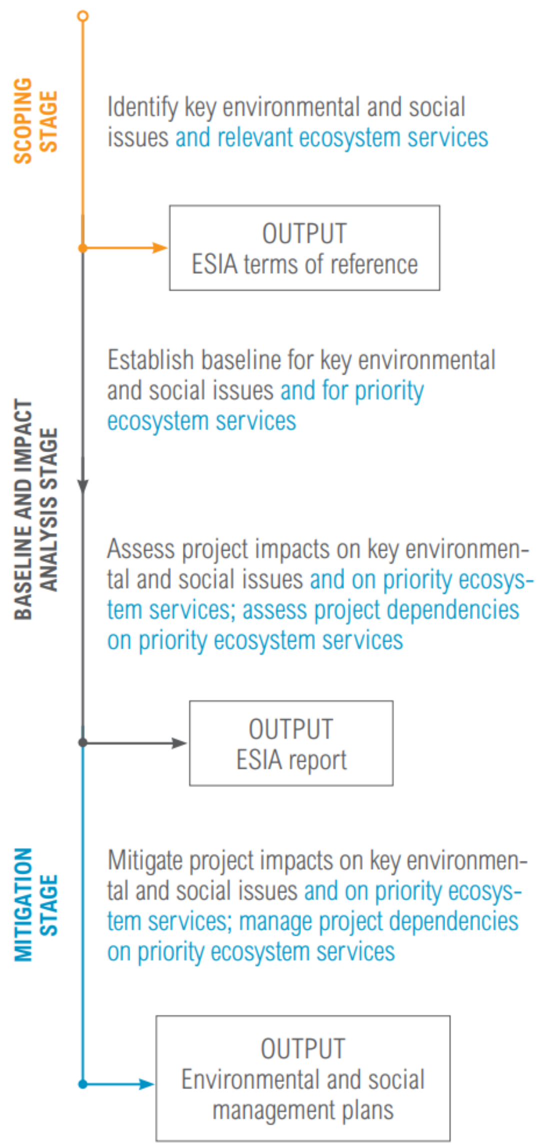


Figure 4. 34: Standard Environmental and Social Impact Assessment Process, Complemented by the ESR for IA

Table 4.24: Degree of Impact and Dependency of Ecosystem Services in the Project Areas

Ecosystem Service	**Degree of Impact (Type I)**	**Degree of Dependence (Type II)**	**Relevance to Affected Community (Type I)**	**Degree of Management Control (Type I/II)**
PROVISIONING				
Fisheries				
All fishes in the Area	High	High	High	Medium
Crops				
Zea mays	High	High	High	Medium
Ananas comosus	,,	‘’		
Elaeis guineensis	,,	‘’		
Manihot esculenta	,,	High		
Mangifera indica	,,	Moderate		
Carica papaya	Low	Low		
Musa sapientum	Low	Low		
M. paradisiaca	Low	Low		
Wild foods				
Maesobotrya arborea	Low	Low	Moderate	Medium
Spondia mombin	,,	,,		
Gambeya albida	,,	,,		
Irvingia gabonensis	,,	,,		
Sphenocentrum joliyanum	,,	“		
Artocarpus atilitis	“			
Timber				
Alstonia boonei	High	Low	High	
Milicia exelcia	,,			Low
Bombax sp.	Low			
Bambusa vulgaris	Low			
Gmelina arborea	Low			
Raphia hookeri	Low			
Fibers				Low
Elaeis guineensis	Low	Low	High	
Triumfeta rhomboldea	,,	,,		
T. cordifolia	,,	,,		
Cocos nucifera	,,	,,		
R. hookeri	“	“		
Biomass fuel				Medium
Alchornea cordifolia	Low	Low	High	
Elaeis guineensis	High	,,		
Anthonotha macrophylla	Low	,,		

Table 4.24: Degree of Impact and Dependency of Ecosystem Services in the Project Areas

Ecosystem Service	Degree of Impact (Type I)	Degree of Dependence (Type II)	Relevance to Affected Community (Type I)	Degree of Management Control (Type I/II)
Genetic Resources				Medium
Ananas comosus	High	High	High	
Dacryodes edulis		,,		
Persea americana				
Dioscorea rotundata				
Biochemicals, natural medicines, and pharmaceuticals				
Dioscorea rotundata	Low	Low	Moderate	Low
Momordica charantia	,,	,,		
Mangifera indica	,,			
Carica papaya		,,		
Alstonia boonei	Medium	,,		
Rauvolfia vomitoria	Low	,,		
Pcynanthus angolensis	,,	,,		
2. REGULATION				
Gmelina arborea				
Alchornea cordifolia	High	Low	Moderate	Low
Elaeis guineensis	Low	,,		
Anthonotha macrophylla	High			
Zea mays	Low	,,,		
Alstoniaboonei		,,		
Rauvolfia vomitoria	High	,,		
Pcynanthus angolensis	Low			
Air quality regulation All Plants In The Area	High	High	High	Medium
Local, Regional Global climate regulation All Plants In The Area	High	High	High	Medium
Water regulation All Plants In The Area	High	High	Moderate	Medium
Erosion regulation All Plants In The Area	high	Low	High	Medium
Water purification and waste treatment	Medium	High	Moderate	Medium
Pest regulation Plants in polyculture	High	Low	Low	Low

Table 4.24: Degree of Impact and Dependency of Ecosystem Services in the Project Areas				
Ecosystem Service	**Degree of Impact (Type I)**	**Degree of Dependence (Type II)**	**Relevance to Affected Community (Type I)**	**Degree of Management Control (Type I/II)**
Pollination All plants in the area	High	Low	Low	Low
Natural hazard regulation All Plants In The Area	High	High	Moderate	Medium
3. CULTURAL **Sacred or spiritual sites**	Low	Low	Low	Low
Areas used for religious purposes	None	Low	Low	Low
4. SUPPORTING **Nutrient capture and recycling** All Plants in The Area	High	Low	High	Low
Primary production All The Plants In The Area	High	High	High	Low

4.15 SOCIAL ENVIRONMENT

4.15.0 Focus of this Sub-Section

The social environment, also known as the socio-cultural environment, refers to the social and economic setting where the proposed project is developed. Specifically, the Lagos-Calabar Coastal Road section spans 47.5 kilometers from CH 0 + 000m to CH 47 + 474. It includes the cultural context, social interactions, and relationships that influence people's well-being and behaviour at the project location. Understanding and adapting to different social conditions are essential aspects for the project. The key components relevant to the project are described in this subsection.

4.15.1 Approaches and Methodology

For the socio-economic study, a mixed methods approach provided a robust foundation for understanding the complex interplay between the transport infrastructure development and socio-economic dynamics. The socio-economic study adopted the following comprehensive and well-structured approach/methodology:

Figure 4.64: Approach to Social Assessment

Stakeholder's engagement is crucial for improving social baseline data collection. It ensures accuracy and relevance (Box 4.3). The relevant topics considered during baseline data collection for the social environment are described below.

- Local Knowledge and Context: - Insightful Perspectives: Community members provide valuable insights into their environment, history, and social dynamics.
- Cultural Nuances: Communities explain cultural practices, norms, and traditions that influence their daily lives, essential for interpreting data. Data Validation and Verification:
- Ground Truthing: Community members verify existing data and provide additional information.
- Cross-Checking: Engaging the community ensures data alignment with their lived experiences. Identifying Vulnerable Groups:
- Inclusivity: Community engagement helps identify marginalized or vulnerable groups not adequately represented in official records.
- Hidden Issues: These groups often face unique challenges not apparent without direct engagement. Participatory Mapping and Storytelling: -
- Mapping Workshops: Communities create participatory maps marking important locations enriching spatial data.
- Narratives: Storytelling sessions allow community members to share their experiences, memories, and concerns providing qualitative insights. Prioritizing Needs and Aspirations:
- Community Prioritization: Engaging in discussions helps identify community priorities.
- Project Alignment: Data collection focuses on areas directly related to community well-being. Building Trust and Ownership:
- Trust-Building: Engaging early fosters trust between project implementers and the community, crucial for successful project outcomes.
- Ownership: Active community participation fosters a sense of ownership over the data and subsequent decisions. Conflict Resolution and Social Impact Assessment:
- Conflict Identification: Community engagement reveals existing tensions or potential conflicts related to the project.
- Social Impact Assessment: Community input informs impact assessments, ensuring potential negative effects are considered. Capacity Building and Empowerment:
- Skills Development: Engaging community members in data collection builds their capacity to participate in decision-making processes.
- Empowerment: Communities contributing to data become active stakeholders rather than passive recipients.

Box 4.3: How community engagement enhances the Socio-economic Baseline Data Collection Process

For the project an effective stakeholder engagement methodology was used which involved (a) identification of stakeholders, (b) consulting identified stakeholders to evolve information about their socio-economic development and environmental knowledge, (c) developing a grievance mechanism to address stakeholders' concerns and challenges and (d) ensuring transparency of process by sharing information , progress and decisions with stakeholders, has been adopted for this ESIA for the Lagos-Calabar Road. It is an ongoing process and the following are some of the preliminary results from the stakeholders' engagement through administration of survey instruments and direct consultation and participation in meetings at different days (Table 4.55). The list communities in which the survey questionnaire for the stakeholders' engagement was administered is given in Table 4.56

Table 4.25: Dates of Stakeholders' Meetings

S/NO	Audience	Date
1.	Affected Individuals along the alignment	Different dates
2.	Utility/Service providers	May 14, 2024
3.	Communities Along 1-24Km	MAY 16, 2024
4.	Communities Along 24-47.5Km	MAY 17, 2024
5.	Group of Fishermen	MAY 17, 2024
6.	CSOs with Conservations Sanctuaries in the project area, which included Nigeria Conservation Foundation (Lekki Conservation Centre) and others – meeting with the ESIA Lead, Dr. Eugene Itua and Teams	May 17, 2024
7.	3rd General Public Stakeholder Engagement meeting	May 23, 2024
8.	High-level Official Project Flag Off by President Tinubu (See Appendix 1)	May 26, 2024
9.	Held a Meeting with the Ibeju Lekki LGA Chairman and council members	May 29, 2024
10.	Assessment of Project Affected documents before payment	May 31, 2024
11.	Meeting with Valuers	

Table 4.26: Survey Instruments were administered across the Host Communities Accordingly

S/no	Community	Latitude	Longitude
1	Eko Atlantic	6.419877	3.426037
2	Oniru	6.422716	3.446513
3	Marwa	6.424273	3.468469
4	Elegushi	6.424118	3.493347
5	Jakande	6.428088	3.516501
6	Ilasan	6.426124	3.547175
7	Lafiaji	6.426026	3.558781
8	Okun-Ajah	6.427751	3.585086
9	Mopo Ijebu	6.427817	3.63556
10	Sangotedo	6.43116	3.63556
11	Mosere Ikoga	6.429814	3.65526
12	Eko-Akete	6.436439	3.683681
13	Iwereku	6.429687	3.688339
14	Lakowe	6.431308	3.728184
15	Solu	6.435072	3.739767
16	Alade	6.439422	3.763529
17	Enukumi	6.440636	3.791136
18	Igando	6.441356	3.797401
19	Oguntimehin	6.44215	3.819811
20	Debojo	6.44178	3.823579
21	Badore	6.440752	3.83636
22	Idado	6.44178	3.83922
23	Eleko	6.4402	3.83636
	Total		

Source: Natural Eco Capital Fieldwork April, 2024

4.16 NIGERIA IN BRIEF

Nigeria is in West Africa, bordered by the Sahel to the north and the Gulf of Guinea to the south. It covers 923,769 square kilometers and shares borders with Niger, Chad, Cameroon, and Benin. Nigeria is the most populous country in Africa, with over 230 million people. The estimated population in 2021 was 213,401,323, with 51.7% living in rural areas and 48.3% in urban areas. The population density is approximately 167.5 people per square kilometer. Nigeria has a diverse population with over 250 ethnic groups speaking 500 distinct languages. Appendix 4.19 provides a Country's Comparative Socio-Economic Indicators.

Nigeria is a federal republic comprising 36 states and the Federal Capital Territory (FCT), where the capital city, Abuja, is located. Nigeria is divided into six geopolitical zones **(Figure 4.65)**:

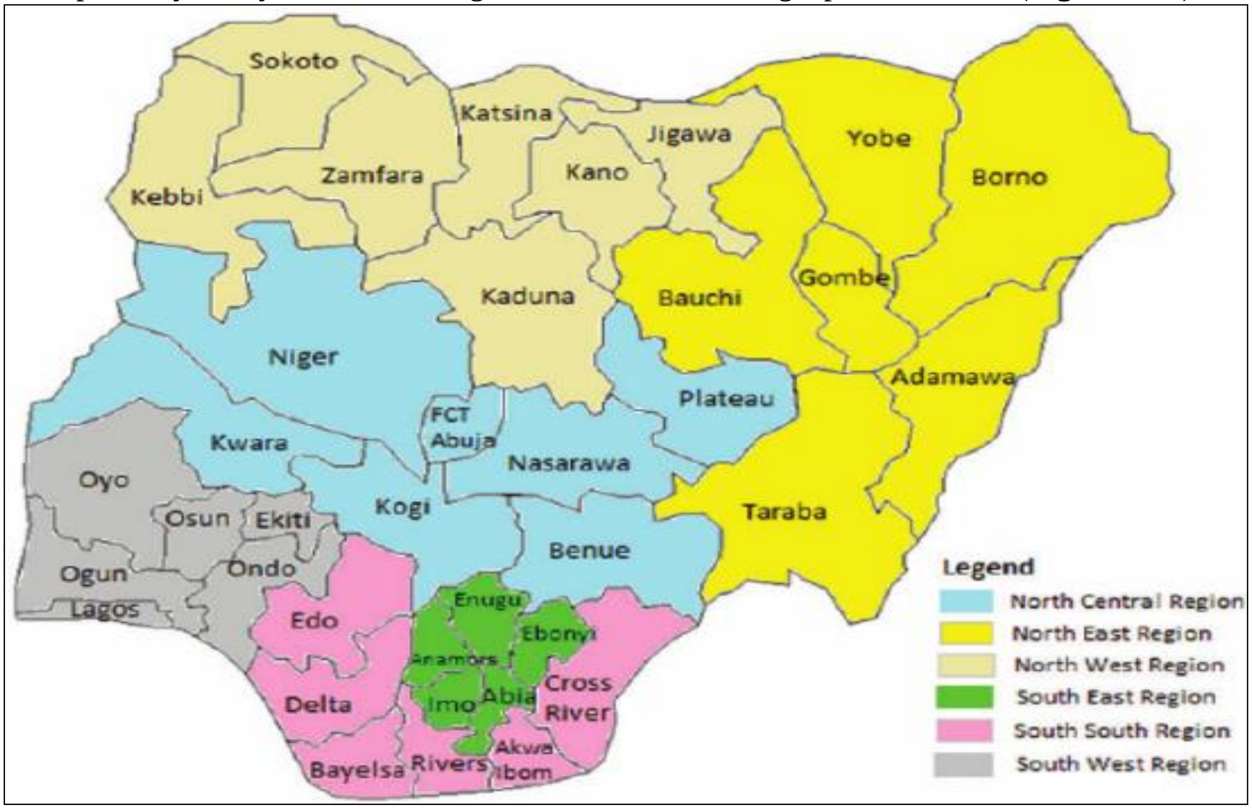


Figure 4.65: Map of Nigeria

The proposed Lagos Coastal Road Section 1 is in Lagos in the Southwest. Thus, this aspect of this report focused on the Lagos State and the host local government area of the proposed project location, interspersed with some information on Nigeria.

4.16.1 Proposed Project Host State - Lagos

1. Geography and Boundaries

Lagos State is in southwestern Nigeria, along the narrow coastal floodplain of the Bight of Benin. It is bounded to the south by the Atlantic Ocean and to the west by the international border with Benin. Lagos State shares its northern and eastern boundaries with Ogun State. Its geography includes coastal areas along the Gulf of Guinea, islands, and a mainland characterized by lagoons, creeks, and rivers. Lagos is known for its diverse ecosystems, including mangrove swamps, sandy beaches, and urban areas. The state is home to Lagos Lagoon, which connects to the Atlantic Ocean, and several smaller rivers and water bodies that crisscross its landscape. The state stretches over 180 kilometers along the Guinea Coast of the Bight of Benin.

2. Administrative Areas

The Lagos conurbation encompasses several administrative areas, each playing a distinct role in the city's development, namely:

- **Municipality (Lagos Island)**:

This area covers the extent of present-day Lagos Island. Historically, it served as the headquarters of the Lagos Colony. It remains the core of the modern metropolis and houses the central business district.

- **Lagos Metropolis**:

Encompasses 16 local governments within the city. These local governments contribute to the overall governance and management of Lagos.

- **Lagos State**:

Lagos State comprises 20 local government areas. These include the 16 urban local governments mentioned earlier, as well as four rural local government areas. Additionally, there are 37 local council development areas (LCDAs) created in 2003 by the Lagos state government. However, these LCDAs are yet to be constitutionally recognized. The LCDAs handle local taxation, schooling, and health services.

- **Lagos Megacity**:

Encompasses Lagos State and its peri-urban interface. This broader area includes towns and villages in four local government areas. Due to overlapping administrative jurisdictions, data collection can be challenging.

3. Lagos Administrative Structure

Lagos State is divided into five administrative divisions: Ikeja, Badagry, Ikorodu, Lagos (Eko), and Epe. These divisions were created in 1968 and are responsible for local governance within the state. These divisions collectively comprise 20 Local Government Areas (LGAs) and 37 Local Council Development Areas (LCDAs). The LCDAs include areas like Agbado/Oke-Odo, Agboyi-Ketu, Ayobo-Ipaja, Bariga, Egbe-Idimu, Ejigbo, Igando-Ikotun, Ikosi-Isheri, Isolo, Mosan-Okunola, Odi Olowo-Ojuwoye, Ojodu, Ojokoro, Onigbongbo, and Orile Agege. Each of these LGAs and LCDAs plays a crucial role in local governance and development within Lagos State.

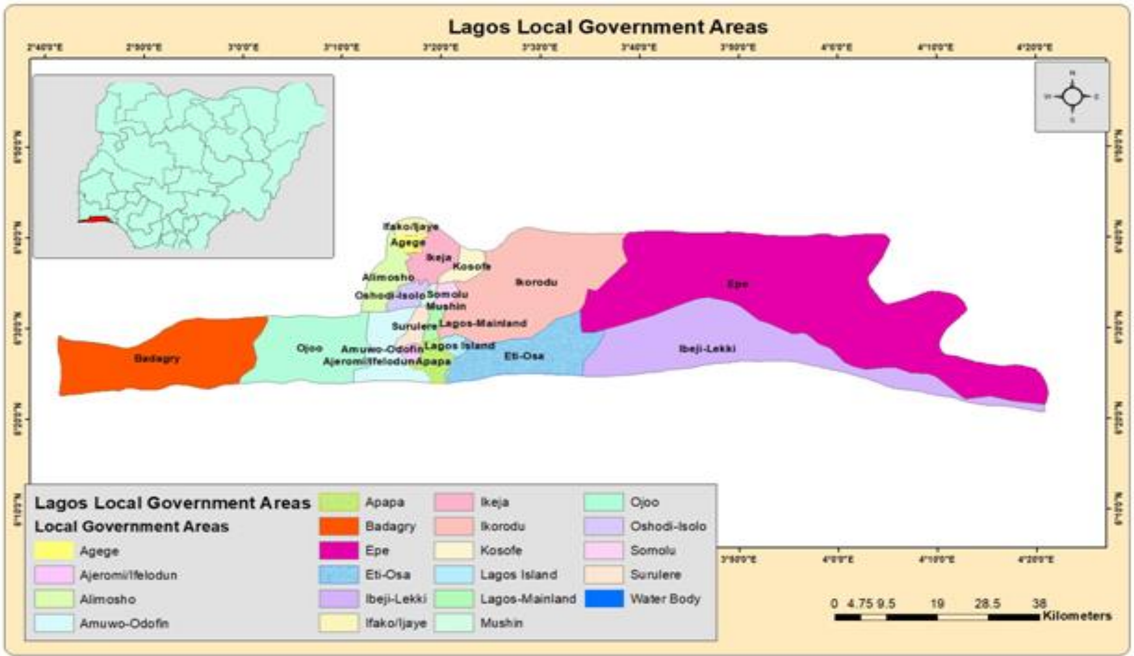


Figure 4.66: Administrative Map of Lagos State

4. Administrative Governance in Project State

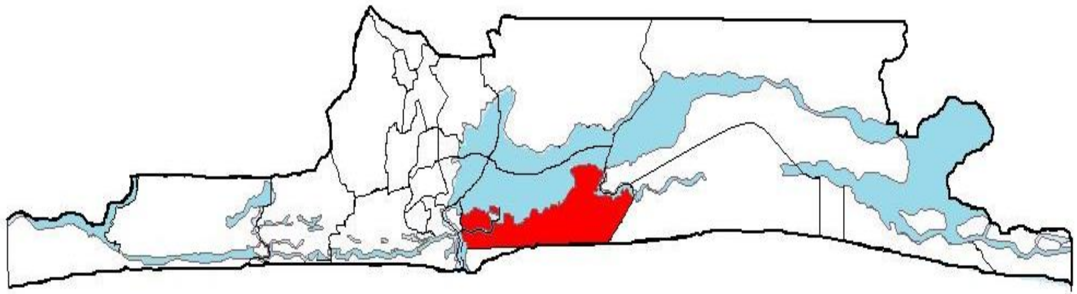
Lagos State is governed by an Executive branch led by the Governor. The current Governor is Babajide Sanwo-Olu. The Governor is assisted by a team of Commissioners and Permanent Secretaries who oversee various ministries and departments. The Lagos State House of Assembly constitutes the Legislative arm of the government. It plays a crucial role in lawmaking, oversight, and representing the interests of the people. The Judiciary in Lagos State is headed by the Chief Judge. It ensures justice, interprets laws, and resolves legal disputes.

5. Traditional Influence

Lagos blends modern administrative structures with the rich tapestry of traditional governance. While modern governance structures exist, traditional institutions continue to play a role. Obas (traditional rulers) and Baales (local chiefs) hold cultural and community leadership positions. They provide guidance, mediate disputes, and maintain cultural heritage.

4.16.2 Proposed Host Local Government Areas

The proposed project spans two local government areas out of the 20 in the State. These areas are Ibeju Lekki and Eti-Osa Local Government Areas (LGAs), as illustrated in **Figure 4.67.**



Eti-Osa LGA in Red Colour

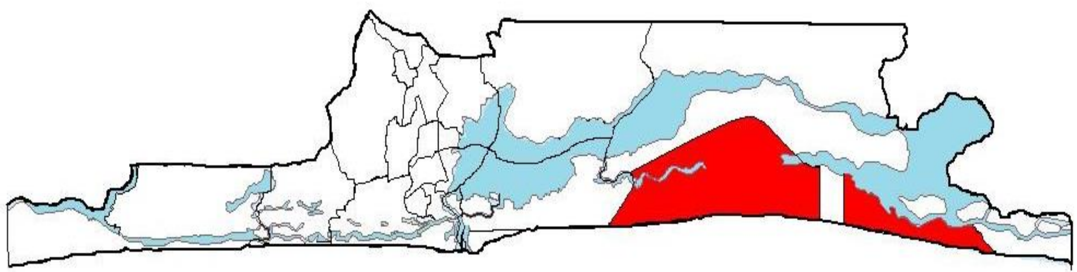


Figure 4.67: Lagos Coastal Road Section 1 Host LGAs - Ibeju-Lekki LGA in Red Colour
Source : https://en.wikipedia.org/wiki

4.16.3 Project Affected/Host Communities

The Project impacted communities along the Lagos coastal road section, including Eko Atlantic, Oniru, Marwa, Elegushi, Jakande, Lafiaji, Okun Aja, Mopo Ijebu, Sangotedo, Igando, Badore, Eleko, Oguntimehin, Solu Alade, Solu Orunmija, Debojo, Eko Akete, Idado, Lakowe, Iwesolu, Okunsolu, MosereIkoga, Iwereku, Akinlade, and Elesan, as depicted in (Figure 4.68).

Some of the communities have the same rural outlook with very few infrastructures and evolving from rural setting to urban ones, others are fully urban. However, they are all developing communities experiencing urbanization. They all also have similar culture, tradition, and belief system. There are however some differences mostly in the levels of infrastructural acquisitions. Thus, the profile presented below is akin to all the communities and where conditions defer these are presented as such.

4.16.4 Demographic

a. Nigeria Population

Nigeria is the most populous country in Africa, with over 230 million people. According to the United Nations, the estimated population in 2021 was 213,401,323.M The population is distributed as 51.7% rural and 48.3% urban. The population density is approximately 167.5 people per square kilometer. Age distribution: 42.5% of the population are 14 years or younger, 19.6% are aged 15–24., 30.7% are aged 25–54, 4.0% are aged 55–64, 3.1% are aged 65 years or older with median age in 2017 of 18.4 years (Figure 4.68). Nigeria's Population pyramids show the age and sex distribution of a population, indicating dependent and non-dependent groups. The working population is economically active, while the dependent population relies on them for support.

Nigeria has a low dependency ratio, indicating a growing demographic dividend. The expanding potential workforce contributes to economic development.

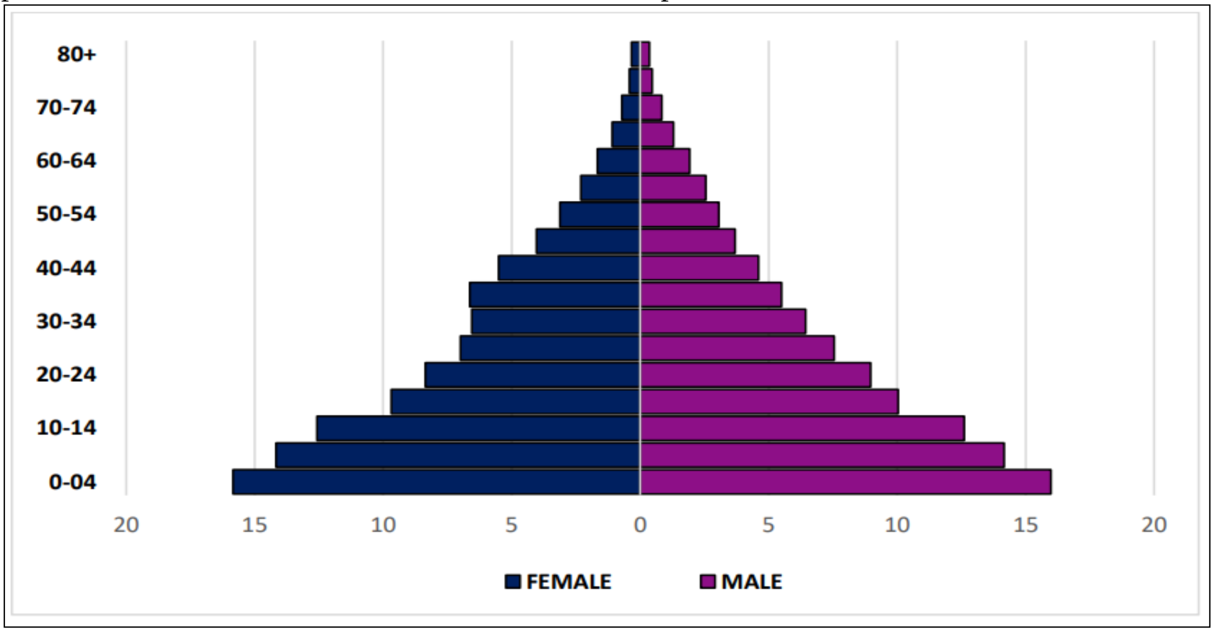


Figure 4.68: Nigeria Population Pyramid 2019 (Percentage)
Source : National Population Commission, 2020

Globally, the urban population has steadily increased from 33.6% in 1960 to 56.6% in 2021. In Sub-Saharan Africa (SSA), the urban population has grown from 14.7% to 41.8% during the same time. At the country level, Nigeria's urban population has risen from 15.4% in 1960 to 55.6% in 2022, with a rapid urbanization rate of 4% in 2022. Nigeria has exceeded the annual average urban population growth rate of SSA since 1982.

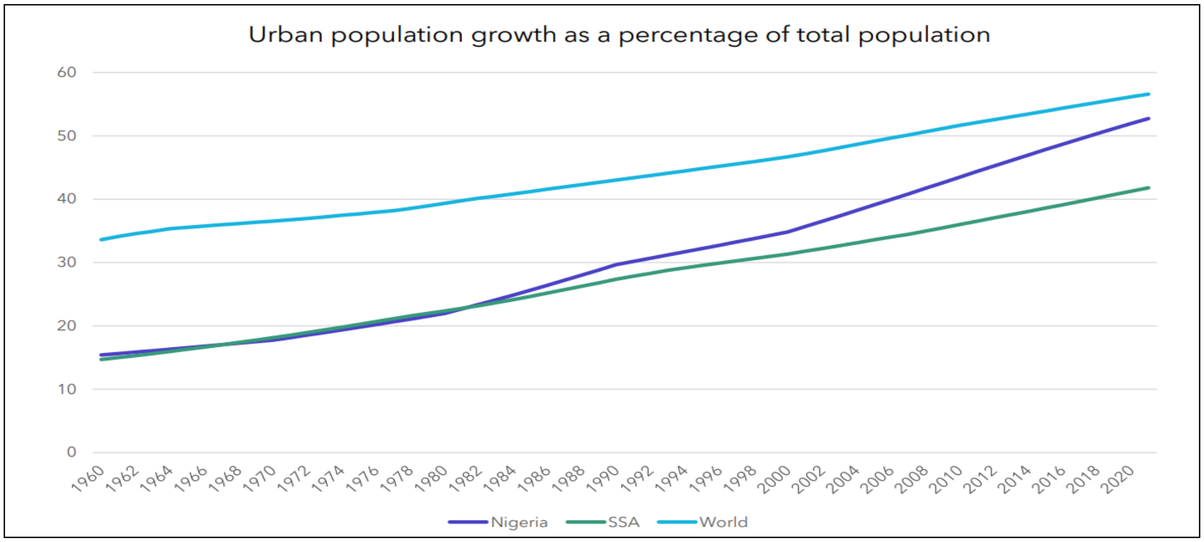
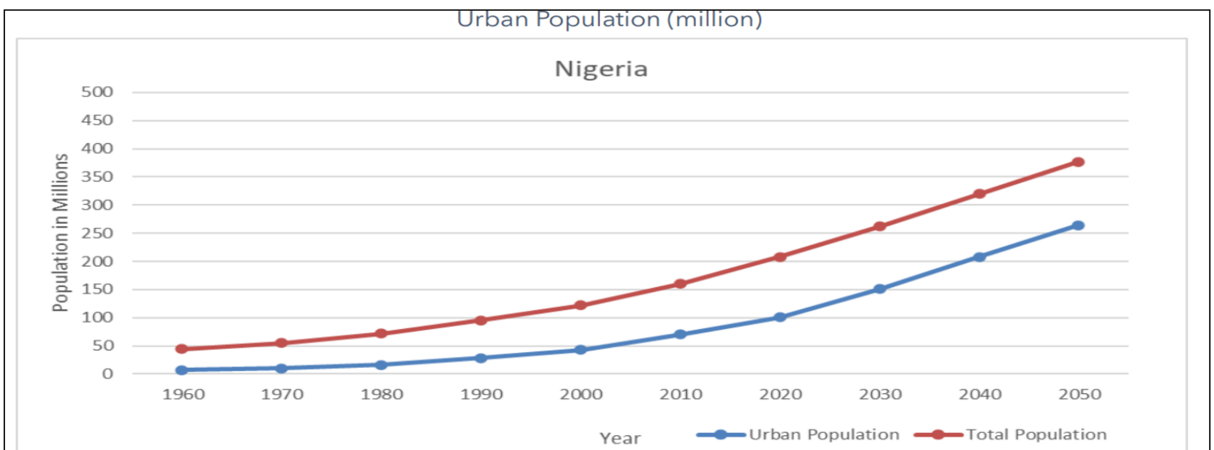


Figure 4.69: Urban population growth

It should be noted that from less than 7 million people in 1960 to over 100 million in 2020. Nigeria's urban population is projected to reach nearly 264 million in 2050 as depicted in (Figure 4.70).



Source: World Bank Group Population Database 2023

Nigeria	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
Urban population	6.9	9.8	16.0	28.2	42.8	69.9	100.8	150.5	208.0	263.9
Population, total	44.0	55.0	72.0	95.0	122.0	160.0	208.0	262.0	320.0	377.0

Figure 4.70: Nigeria's urban population projected.

b. Lagos State Population

Nigeria is in West Africa and shares borders with Niger, Chad, Cameroon, and Benin. According to the National Bureau of Statistics, the projected population for 2018, 2019, and 2020 was 196,042,933, 201,135,262, and 206,283,338, respectively. Lagos, a fast-growing city, had a population of 15,388,000 in 2022 and is projected to reach 16.5 million by 2024. The population density in Lagos state is approximately 3304.55 people per square kilometer. Children (0-14 years) make up 30.3% of the population, while individuals aged 15-44 make up 49.3%. The Lagos state government projects the overall population of Lagos State to be 29,753,282.35 by 2030 and an estimated 36,592,784.37 by 2050.

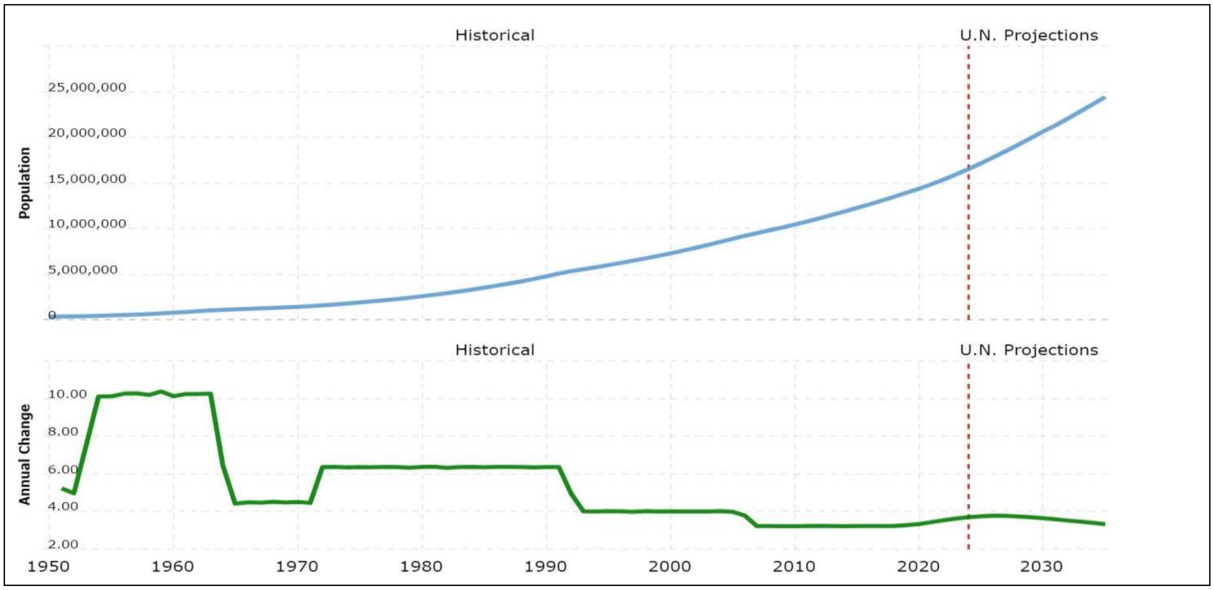


Figure 4.72: Projection of the Lagos State Population
www.macrotrends.net (2024) drawn from United Nations - World Population Prospects

c. Population of the Project Host Local Government Area

The estimated population of the Eti-osa local government as at 2023 is 1,667,116.50 compared to Ibeju Lekki of 168,726.23 while Lagos State population is projected to 29,753,282.35. By 2030, Eti Osa is projected to grow further to 2,050,343.02 compared to Ibeju Lekki of 207,511.98 with the population of Lagos at 36,592,784.37 by 2050 as depicted in (Figure 4.73).

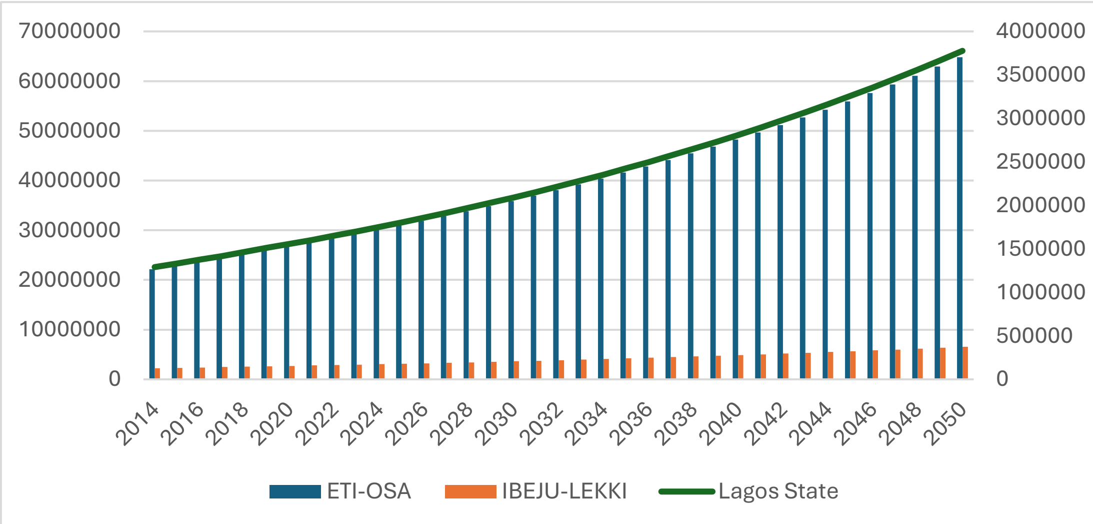


Figure 4.73 Population Projections of the Host LGAs

4.16.5 Land Mass and Land Use Analysis of Lagos State

Lagos State is the smallest state in Nigeria, with a land mass of 3,345 km2. With a population density of 4,713/ km2, rising to 12,000 in some low-income areas. Lagos also has the densest population conurbation in Nigeria. Its urban area has expanded at an average annual rate of 2.6% since 2000. The Area of land mass/water area of the two local government's areas and that of Lagos state are shown in Table 4.27.

Table 4.27: Land Mass and Land Use Analysis of Lagos State.

Place	Landmass in Sq Km	Water area in Sq Km	Total In Sq Km
Eti-Osa LGA	154.1	145	299.1
Ibeju-Lekki LGA	643	10	653
Lagos State	2,797.72	779.56	3,577.28

Source: Natural Eco Capital Fieldwork April 2024

Lagos State's dynamic land use reflects its growth, challenges, and efforts toward sustainable development as outlined below:

a. **Residential Areas:** Lagos has a diverse range of residential areas, from high-end luxury estates to informal settlements (often referred to as slums). These residential areas accommodate a mix of residents, including wealthy individuals, middle-class families, and low-income earners.
b. **Commercial Hubs:** Lagos is a bustling commercial hub with numerous business districts, markets, and commercial centers. Areas like Victoria Island, Ikeja, and Apapa are known for their concentration of office buildings, banks, and corporate headquarters.
c. **Industrial Zones:** Lagos State is home to various industrial zones and manufacturing clusters. The Ikeja Industrial Estate, Oshodi Industrial Area, and the Apapa Port Complex

are notable industrial areas. Ibeju Lekki, one of the proposed project's host local government areas, is growing with notable industries today with the presence of Deep-

d. Lagos boasts extensive transportation infrastructure, including roads, bridges, ports, railways, and airports. The city's land use includes areas dedicated to transportation hubs such as bus terminals, train stations, ports, and airports.

e. **Green Spaces and Recreation:** Despite its urban density, Lagos also features recreational parks, gardens, and waterfront promenades. These green spaces provide residents with areas for relaxation, leisure activities, and outdoor recreation.

f. **Educational Institutions*:*** Lagos is home to numerous educational institutions, including universities, colleges, schools, and research centers. These institutions occupy significant land areas across the city and contribute to its intellectual and cultural vibrancy.

g. **Mixed-Use Developments:** A growing trend in Lagos is mixed-use developments, which combine residential, commercial, and recreational spaces within the same area. These developments aim to create more sustainable and liable communities. The proposed project corridor typifies mixed-use developments in Lagos.

h. **Changes in ecosystems**: Available statistics show that the freshwater vegetation has significantly depleted (from 14.21% to 8.85%). There is depletion in the water body (from 21.69% to 20.96%). The changes are likely due to increased building development projects in the state.

Figure 4.74 shows the projected land use change in the year 2030, it showed that the area where high percentage ecosystem change will be noticed in the project area will be around the upper Ikorodu axis.

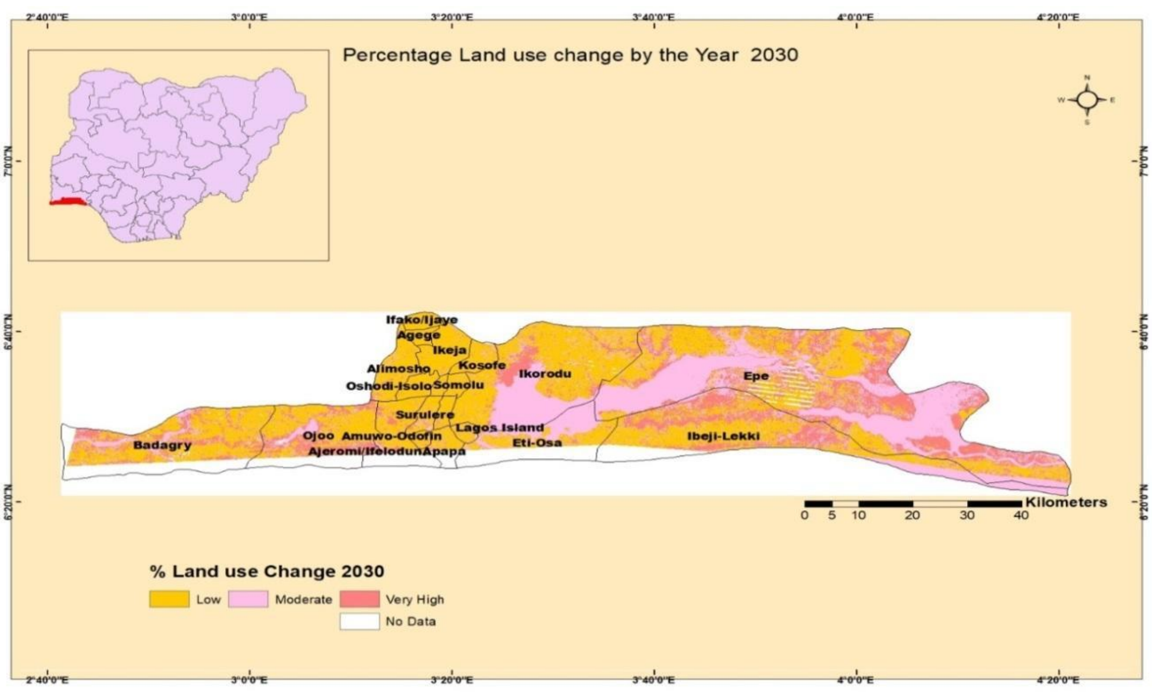


Figure 4.74: Percentage projected change in Lagos state 2030

4.16.6 Rapid Population Growth and Uncontrolled Spatial Expansion of Lagos

Lagos is experiencing rapid population growth and uncontrolled spatial expansion. About 90% of the population live and work in the Lagos metropolitan area, which consists of 16 out of the 20 local government areas (LGAs) of the state. The population is most dense in the central core, with extensive peri-urban growth over the past twenty years. Lagos has the smallest landmass but is the most densely populated state, with 8,000 persons/km^2, 40 times Nigeria's average of 200 persons/km^2. The greatest number of out-of-state immigrants arrives in the LGAs surrounding the core.

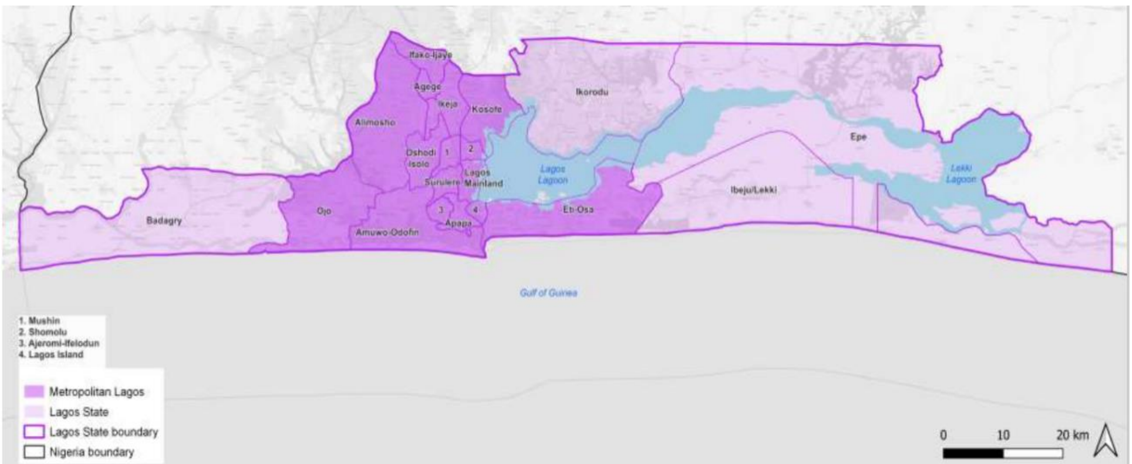


Figure 4.75: Lagos Metropolitan Area

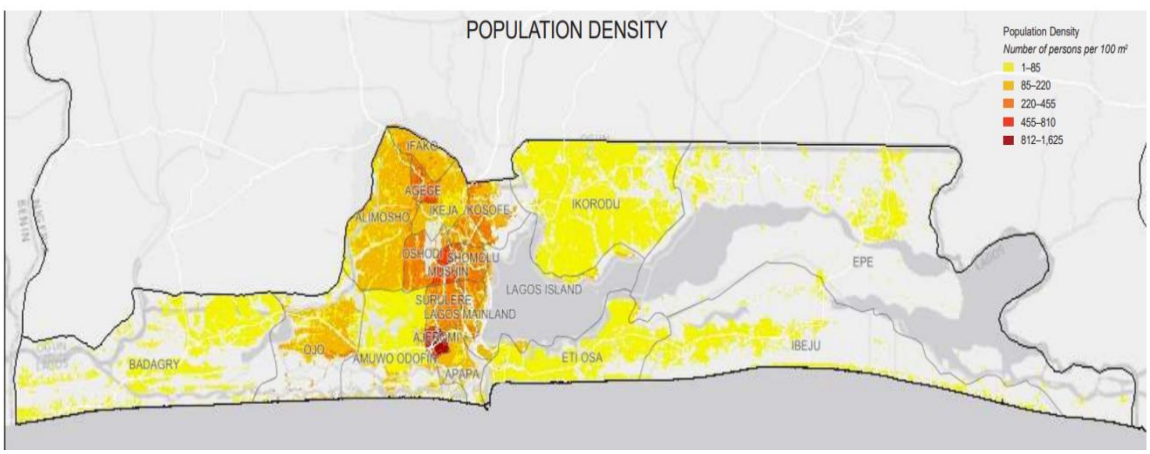


Figure 4.76 Lagos Population Density

Lagos' urban expansion extends into Ogun state, particularly along the Sango-Ota axis and Sagamu Interchange. The 2052 LSDP targets underutilized land in Badagry, Ojo, Ibeju/Lekki, and Epe LGAs for new urban development. Developing peri-urban areas with cheaper land may help accommodate the growing population, but the government should assess the costs of extending infrastructure.

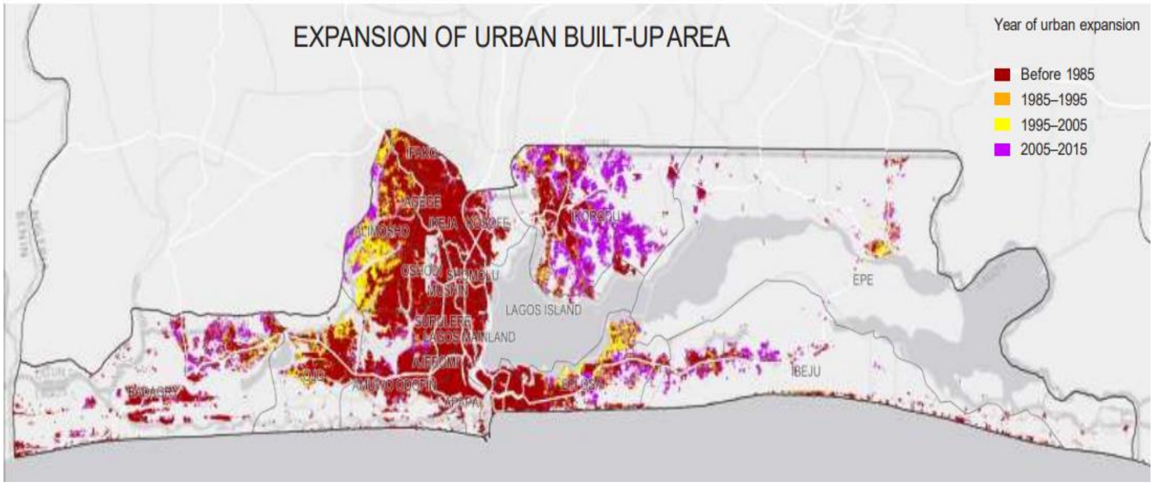


Figure 4.77: Expansion of Urban Built-Up Area

4.17 Socio-Economic Factors

4.17.1 Economic Growth and Influence

Lagos is central to Nigeria's economy. 75% of Nigeria's imports passing through Lagos' ports. With its rich history and dynamic economy, Lagos State plays a pivotal role in Nigeria's overall development. Lagos State was created on May 27, 1967, emerging from the Western Region and the former Federal Capital Territory.

Currently, Lagos State holds the 7th position in terms of GDP among African countries. Its contribution to Nigeria's overall GDP exceeds 20%. Under Governor Babajide Sanwo-Olu's administration, Lagos State's GDP has surged from N27 trillion to N41 trillion within four years. This remarkable growth demonstrates positive momentum and economic resilience despite challenges. In the National Context, the highest peak with concentration of economic activities around cities is Lagos (**Figure 4.78**)

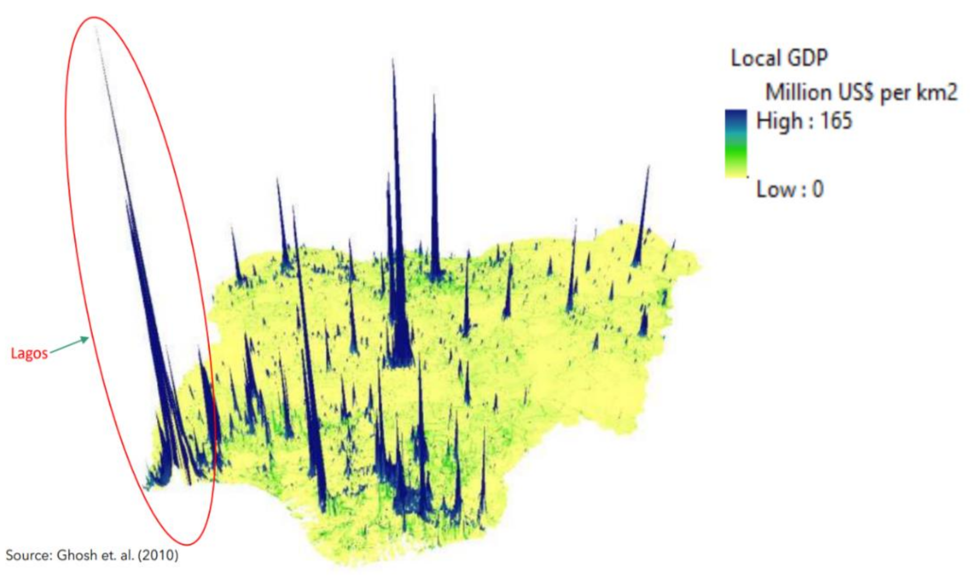


Figure 4.78: National GDP across States

World Bank, SURGE, and SECO (2023)

Lagos economy is steered by non-agriculture sectors, with dominant specialization in services (Consumer, Transport, ICT, Financial & Business) relative to benchmark cities. The Tech industry has become a significant competitive area for Lagos in the past decade. Financial Technology is also growing rapidly. Lagos is a major African financial centre and the economic hub of Lagos State and Nigeria. It influences various sectors, including commerce, entertainment, technology, education, politics, tourism, art, and fashion. Notable areas include Lagos Island, Victoria Island, Ikoyi, and Lekki. Lagos hosts significant industries, including finance, manufacturing, and services. It is home to Nigeria's stock exchange, major banks, and multinational corporations. The state is also constructing Eko Atlantic City on the coast, a new business district coterminous with the proposed Lagos Coastal Highway.

4.17.2 Development of Businesses

Lagos's key role in fostering formal economic activities and underlines the need for targeted strategies to sustain and replicate such success in other states. The diversity in enterprise categories in Lagos suggests a well-rounded economic environment, setting a precedent for inclusive growth and development in other states.

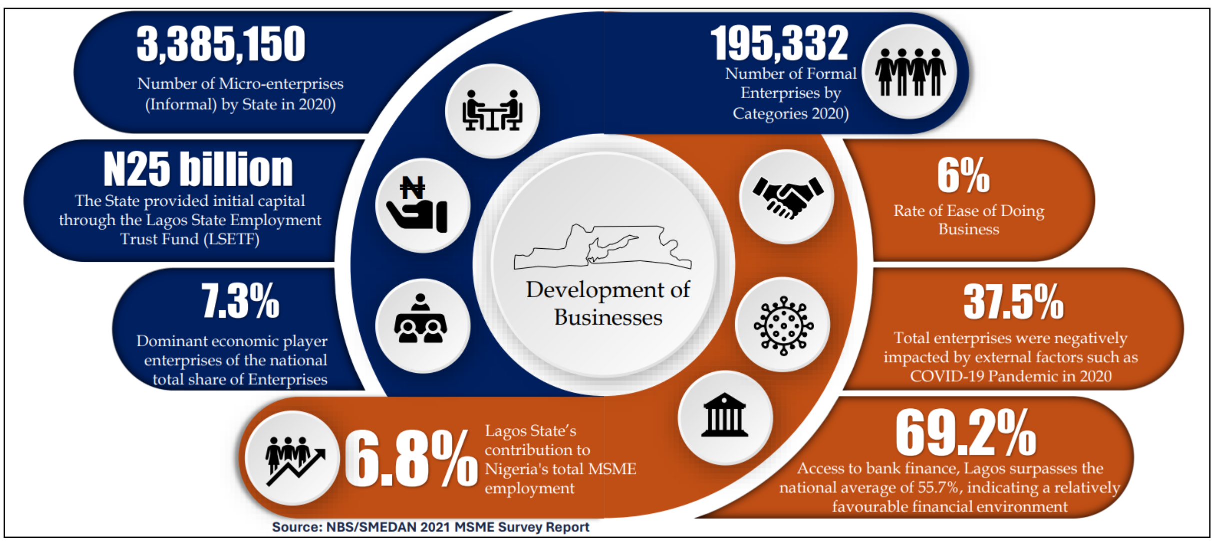


Figure 4.79: Micro Small and Medium Enterprises

Figure 4:80 Key Sector Priorities Achievements for Lagos in 2023

4.17.3 Key Features of the Project Host LGAs

The LGAs contribute significantly to Lagos State's economic landscape, and their unique features shape their development trajectories. As mentioned earlier, Eti-Osa LGA and Ibeju-Lekki LGA is the host LGAs to the proposed project. It is important to also note the following about the LGAs.

a. Eti-Osa Local Government Area (LGA):

1. **Economic Activities**: Eti-Osa Local Government Area (LGA) has diverse economic landscape and cultural vibrancy make it a dynamic part of in Lagos State, Nigeria. Eti-Osa is a bustling area with a mix of formal and informal economic activities. It hosts several commercial and financial institutions, including banks, insurance companies, and

investment firms. Victoria Island within Eti-Osa is a major hub for corporate offices and financial services.

2. **Real Estate Development*:*** The Lekki Peninsula in Eti-Osa experiences rapid urbanization and significant real estate development. Luxury apartments, shopping malls, hotels, and office complexes contribute to the area's growth.
3. Real estate developers, property owners, and landlords derive income from renting out residential and commercial properties. This sector contributes to wealth accumulation and income generation for property owners.
4. **Transportation Hub**: Eti-Osa is a major transportation hub in Lagos State. It has road networks, ports, and terminals connecting it to other parts of the state.
5. ***Informal Sector****:* Alongside formal economic activities, the informal sector plays a significant role. Informal traders, artisans, street vendors, and entrepreneurs contribute to employment and income generation.

b. **Ibeju-Lekki Local Government Area (LGA)**

1. **Economic Development**: Ibeju-Lekki is a rapidly developing area with a diverse range of economic activities, both formal and informal.
   It is experiencing a boom in real estate and property development driven by projects like the Lekki Free Trade Zone and the Dangote Refinery.
   The real estate sector includes residential, commercial, and industrial developments, contributing to job creation and economic growth.
2. **Agriculture**: Despite rapid urbanization, agriculture remains an important economic activity in Ibeju-Lekki. Farmers cultivate crops such as cassava, vegetables, and fruits. Agribusinesses engage in processing, packaging, and distribution activities. The area's fertile land and proximity to markets make it conducive to agricultural production.
3. **Fishery:** fishery plays a significant role as is essential for livelihoods, food security, and economic growth. Traditional fish processing technologies are widely used in Ibeju-Lekki. These include methods such as smoking, drying, and salting. The capacity of kilns and ovens used for smoking and drying fish ranges from 20-50 kg per day. Energy sources for traditional fish processing equipment are fuel wood and charcoal. Major fish species processed in Ibeju-Lekki include *Ethmalosa fimbriata*, *Caranx senegallus*, *Sardinella maderensis*, *Drepane africana*, and others. Women play a significant role in traditional fish processing, with 95% involvement.
   Anthropogenic activities, such as urban and industrial land use changes, have impacted fishery sustainability. Water quality issues, heavy metal pollution, and inadequate chlorophyll-levels affect fish habitats.

c. **Transportation and Logistics**:

- Individuals engaged in transportation and logistics (e.g., taxi drivers, bus operators, freight handlers) earn income by providing transportation services within and outside Eti-Osa.
- Income levels vary based on factors like vehicle ownership and route profitability.

4.18 Liveability Standards

Lagos ranked 212 out of 231 global cities and 28 among 42 cities in Sub-Saharan Africa according to the Mercer Quality of Living Ranking 2019. • Lagos is the second least liveable city out of 172 global cities according to the Economist Intelligence Unit Global Liveability Index 2022. The rapid development of Lagos has led to multiple challenges that impact liveability, with substantial deficits in housing and infrastructure as major contributing factors.

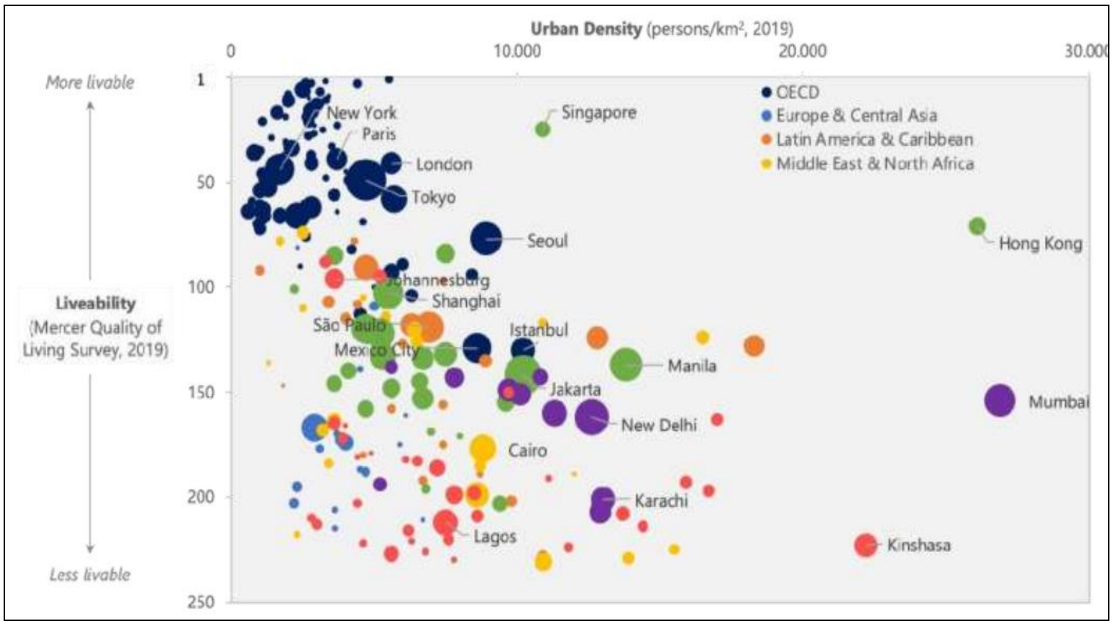


Figure 4.81: Global Liveability Index

The UN-Habitat report projects a rise in urban population to 5 billion by 2030. A study in Lekki, Lagos, Nigeria, found a strong link between urban liveability indicators and residents' well-being and health. The study suggests the importance of urban liveability for residents' overall quality of life with five key aspects of liveability which include:

Ensuring a healthy environment and sufficient amenities, promoting walkability, cycling, and efficient public transportation, supporting economic activities within the community, Creating vibrant social spaces for residents, and Ensuring housing and services are accessible to all. There is no doubt that Lagos faces cross-cutting challenges to tapping its full development potential such as listed in Box 4.3, the proposed project stands to support in dealing with these challenges.

a. Employment Formal and Informal) and Income

Both LGAs exhibit a mix of formal and informal employment opportunities, contributing to their economic vibrancy.

1. **Eti-Osa LGA**:

- ***Formal Employment:***
    - Many residents in Eti-Osa are engaged in formal employment across sectors such as finance, commerce, real estate, and professional services. These sectors provide stable incomes, access to benefits, and opportunities for career advancement.

Employees in these sectors contribute to the middle to high-income bracket within the community.
    - The formal employment sector in Eti-Osa includes jobs in corporate offices, financial institutions, and other organized sectors. These contribute to the local economy and provide stable income.
    - However, specific formal employment statistics for Eti-Osa are not readily available in the provided sources.
- Informal Employment:
    - The informal sector in Eti-Osa is vibrant. It includes street vendors, artisans, traders, and entrepreneurs. These individuals engage in various economic activities, often without formal contracts.
    - Informal employment provides livelihoods for many residents, but exact statistics are not explicitly mentioned.
- Income:
    - The income levels in Eti-Osa vary significantly due to the diverse economic landscape. High-income earners from formal employment and real estate investments coexist with those in the informal sector.

2. **Ibeju-Lekki LGA**:

- Formal Employment:
    - Ibeju-Lekki experiences rapid development, driven by real estate projects, industrialization, and economic growth.
    - Formal employment opportunities arise from the Lekki Free Trade Zone, Dangote Refinery, and other ventures.
    - However, specific formal employment statistics for Ibeju-Lekki are not explicitly provided.
- Informal Employment:
    - A significant portion of the population relies on informal employment. Informal jobs include street vending, artisanal work, domestic services, and small-scale entrepreneurship. Individuals in informal employment often face irregular incomes, limited job security, and minimal social protections. Lower-income households commonly engage in informal work.
    - The informal sector in Ibeju-Lekki includes agriculture, fishery, and small-scale businesses. Many residents engage in informal activities to sustain their livelihoods.
    - Informal employment contributes significantly to the local economy, but exact figures are not specified.
- Income:
    - Income levels in Ibeju-Lekki vary based on occupation, education, and economic activities.
    - Real estate developers, traders, farmers, and artisans all contribute to the income distribution.
    - Unfortunately, precise income data for Ibeju-Lekki is not explicitly mentioned in the available sources.

4.18.1 Social Organization, Equity, and Inclusion

Eti-Osa and Ibeju-Lekki exhibit diverse community structures, social hierarchies, and decision-making processes. Both Ibeju Lekki and Eti-Osa LGAs contribute to local governance, development, and community welfare. Their roles extend beyond administrative functions, impacting economic growth, infrastructure, and quality of life for residents.

4.18.2 Community Structures and Social Hierarchies

Eti-Osa, situated on the Lagos Peninsula, is a rapidly urbanizing area. It includes Victoria Island and the Lekki peninsula. The community is characterized by diverse economic activities, including banking, retail and wholesale trading, commercial transportation, and significant real estate development. Social hierarchies in Eti-Osa may vary based on factors such as wealth, occupation, and education. The presence of multinational corporations, financial institutions, and prestigious organizations contributes to a dynamic social fabric.

Ibeju-Lekki is a thriving coastal community with a rich history. It was founded over 500 years ago and has become a hub of real estate activities in Lagos. The area is rapidly developing, attracting investments and economic growth. Community structures in Ibeju-Lekki likely include traditional leadership, family units, and local institutions. Social hierarchies may be influenced by factors like lineage, occupation, and cultural practices.

4.18.3 Decision-Making Processes and Leadership Roles

Decision-making in Eti-Osa involves a mix of traditional and modern approaches. Local chiefs, elders, and community leaders play essential roles in resolving disputes, allocating resources, and shaping policies. Leadership roles may include the Oba (traditional ruler), council members, and influential individuals within the community. Ibeju-Lekki’s decision-making processes likely involve consultations with community elders, chiefs, and other stakeholders. Traditional institutions play a significant role in governance.

Leadership roles may include the Baale (local chief), council members, and community representatives.

4.18.4 Disparities in Access to Resources

- **Education:**

Disparities in educational access exist across social groups. Factors such as income, location, and infrastructure affect access to quality schools and educational opportunities.

Vulnerable populations may face challenges in accessing formal education, especially in rural areas.

- **Healthcare:**

Healthcare disparities are common in both LGAs. Urban areas like Eti-Osa may have better healthcare facilities, while rural parts of Ibeju-Lekki may lack adequate medical services.

Vulnerable groups, including women, children, and the elderly, may experience unequal access to healthcare.

- **Employment:**

Employment opportunities vary based on education, skills, and social status. Eti-Osa’s urbanization attracts job opportunities, while Ibeju-Lekki’s economic growth creates employment prospects.

4.18.5 Gender-Specific Impacts and Social Vulnerabilities

Gender-specific impacts include unequal access to education, healthcare, and economic opportunities. Women may face cultural norms that limit their mobility and participation.

Vulnerabilities related to climate change, such as coastal erosion and flooding, affect both men and women. However, women may bear additional burdens due to care giving responsibilities and social role.

The gender-specific impacts and vulnerabilities related to climate change in Eti-Osa and Ibeju-Lekki LGAs are as follows:

1. **Eti-Osa LGA**:
   Education: Women may face challenges accessing quality education due to cultural norms or economic constraints, affecting their career prospects and empowerment. - Healthcare: Women’s access to healthcare services may be influenced by societal expectations, especially in maternal health and reproductive care.
   Economic Opportunities: Women may encounter barriers in accessing certain job sectors or leadership roles.
   Climate Vulnerabilities: - Coastal Erosion: Eti-Osa is vulnerable to erosion, impacting women's livelihoods due to caregiving responsibilities.
   Flooding: Women bear the brunt of disruptions caused by frequent flooding, especially in household management.

2. **Ibeju-Lekki LGA**:
   Education: Cultural norms and household duties can hinder girls' schooling and educational attainment.
   Healthcare: Access to healthcare services remains unequal, particularly in maternal health and reproductive care.
   Economic Opportunities: Women may face limitations in accessing certain sectors or leadership positions despite economic growth.
   Climate Vulnerabilities: - Coastal Erosion: Women may struggle more due to caregiving roles and limited resources when Ibeju-Lekki is exposed to erosion.
   Flooding: Women’s vulnerability increases as they manage household needs during frequent flooding.

   In summary, addressing gender disparities and enhancing resilience to climate change are essential for sustainable development in both LGAs. Empowering women and promoting gender equality contribute to stronger communities.

4.18.6 Social Infrastructure:

The existing social infrastructure and its accessibility in Eti-Osa and Ibeju-Lekki LGAs are given below:

In **Eti-Osa LGA,** Social Infrastructure includes community facilities such as primary and secondary schools, worship centres, shopping centres, and open spaces. Healthcare facilities, community centres, and other essential services contribute to residents' well-being.

The accessibility of social infrastructure in Eti-Osa varies. Urban areas like Victoria Island likely have better access to schools, healthcare, and community centres. However, there is significant potential for improvement in less-developed parts of the Lekki peninsula, especially due to rapid growth and infrastructure challenges.

For **Ibeju-Lekki LGA**, the available social infrastructure includes schools, healthcare facilities, and community centres. These are vital for community well-being and cohesion. Accessibility to social infrastructure in Ibeju-Lekki may vary. Urban centres within the LGA likely have better access, while rural areas face challenges. Coastal communities may experience limitations due to their proximity to the shoreline and potential erosion risks.

The expansion of the Lekki peninsula in Eti-Osa poses challenges to infrastructure due to coastal erosion and development. It is crucial to maintain and improve existing facilities to address coastal vulnerability in Ibeju-Lekki. Climate change impacts such as sea-level rise and erosion can disrupt these facilities. The proposed project aims to balance development with environmental resilience, addressing infrastructure gaps and ensuring equitable access to social infrastructure. This is essential for the well-being of residents in both LGAs, given the impact of coastal erosion, development, population growth, climate change.

4.19 Education and Schools

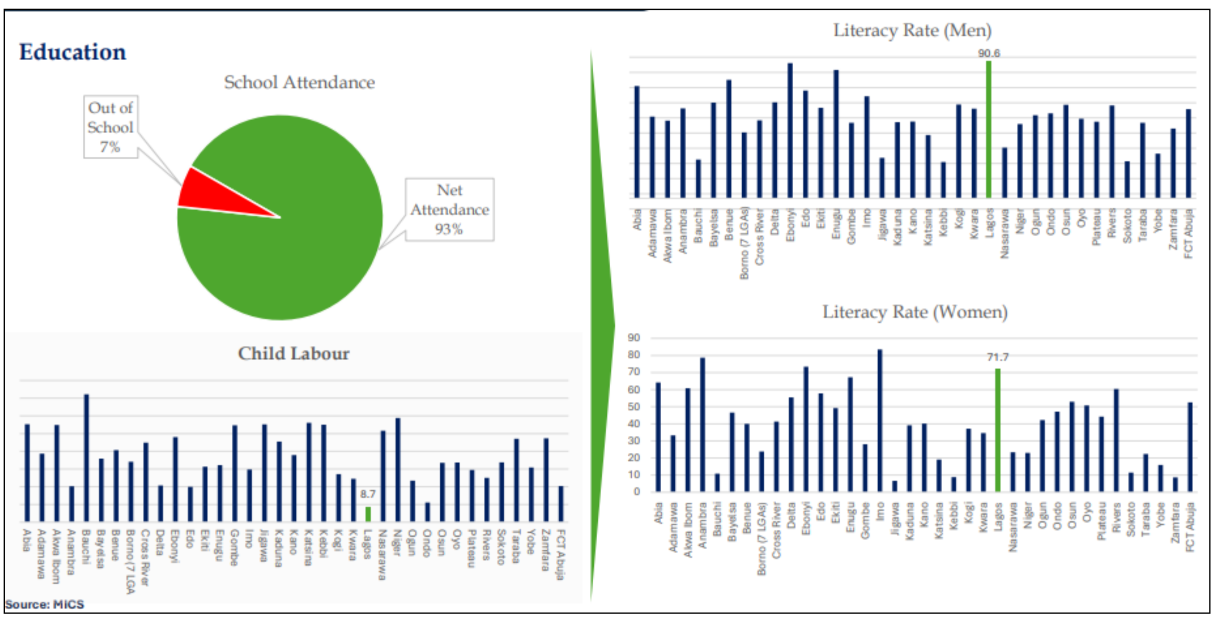


Figure 4.82: Education in Eti Osa and Ibeju Lekki Local Government Areas (LGAs) in Lagos State

Education in Eti Osa and Ibeju Lekki Local Government Areas (LGAs) in Lagos State, Nigeria, consists of a mix of public and private institutions. Education plays a crucial role in shaping the future of these LGAs as they continue to develop. Both LGAs have several private primary schools that provide foundational education to children in the area, same thing with secondary schools.

Table 4.40 records the enrolment statistics of primary pupils by gender in the LGA.

Table 4.28: number of public primary schools, pupils, and teachers by gender according to the Two LGAs

Local Govt. Area		Total no of Schools	Total No of Classroom	No of Pupils			No of Teachers			Average No of pupils per		
				M	F	Total	M	F	Total	School	Teacher	Classroom
Eti-Osa	Eti-Osa East	8	85	2,337	3,759	6,096	30	50	80	762	76	72
	Eti-Osa	7	176	1,922	1,917	3,839	128	124	252	548	15	22
	Iru Victoria Island	9	125	1,353	1,366	2,719	19	41	60	302	45	22
	Ikoyi-Obalende	11	256	1,399	2,040	3,439	75	166	241	313	14	13
Ibeju-Lekki	Ibeju	25	226	7,130	8,272	15,402	57	83	140	616	110	68
	Lekki	14	97	2,906	2,780	5,686	53	34	87	406	65	59

Source: *Lagos State Bureau of Statistics (2020)*

Figures 4.83 - 4.85 illustrate the number of enrolments in public primary, junior secondary school, and senior secondary school within the given period respectively.

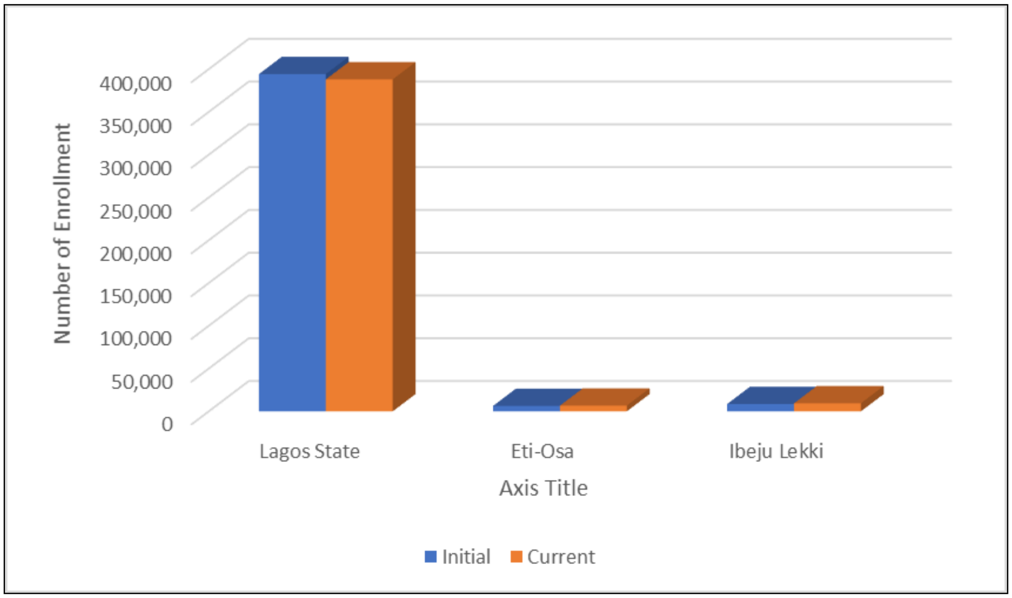


Figure 4.83 Number of Enrolment in Public Primary Schools

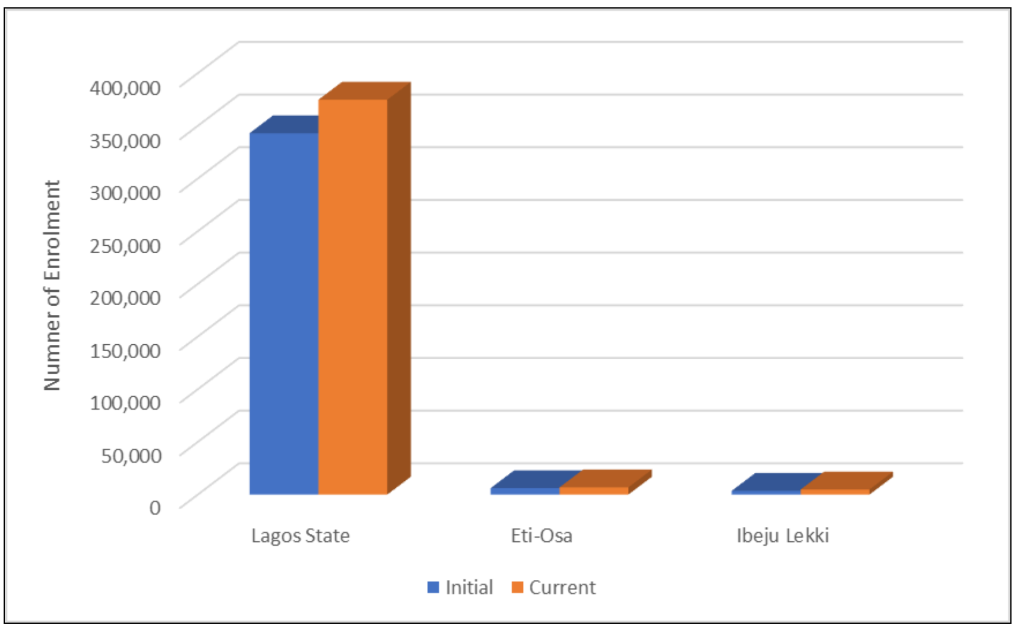


Figure 4.84 Number of Enrolment in Public Junior Secondary Schools

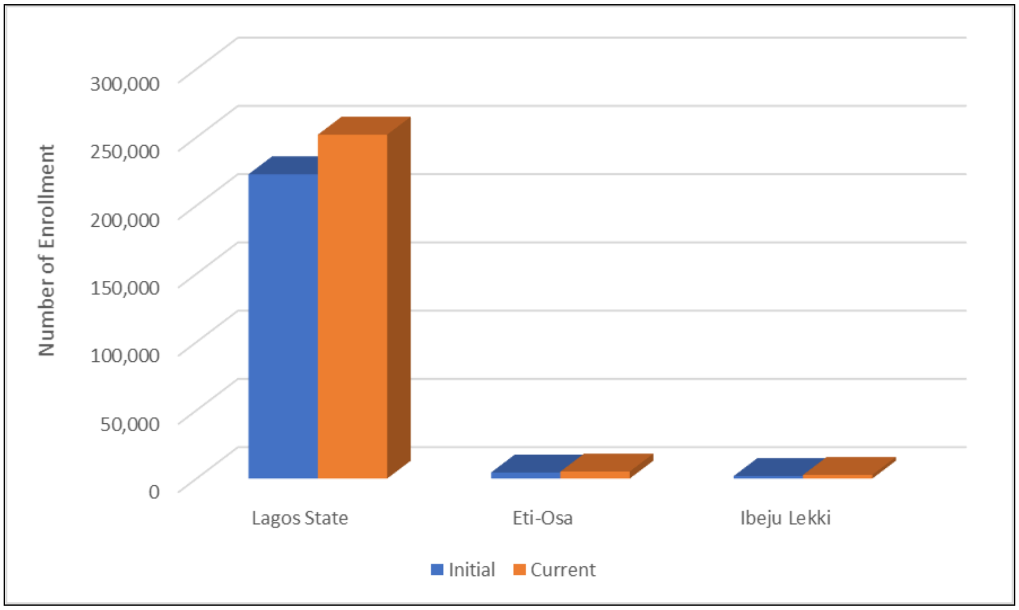


Figure 4.85: Number of Enrolment in Public Senior Secondary Schools

Both Eti Osa and Ibeju Lekki are undergoing rapid urbanization and development. This presents opportunities for: - Establishing more educational institutions to meet the growing population's needs. - Improving existing schools to enhance educational quality.

4.19.1 Special Needs Children

There are a total of 50 public special needs schools in Lagos State, which consist of 5 non-inclusive special needs schools and 45 inclusive (31 primary and 14 secondary) schools. **Table 4.41** records the enrolment statistics of special needs children in public primary and secondary schools by their disability.

Table 4.41: Enrolment of Special needs students in public primary and secondary school by disability from 2016/2017 to 2019/2020 academic session

Types of Disability	2016/2017		2017/2018		2018/2019		2019/2020	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
Blind/visually impaired	159	226	250	101	139	159	152	51
Physically challenged	276	246	276	220	510	155	562	134
Hearing/Speech impaired	884	584	820	554	851	418	938	364
Mentally challenged	557	34	424	55	289	23	319	16
Sub Total	**1,876**	**1,090**	**1,770**	**930**	**1,789**	**755**	**1,971**	**565**
Grand Total	2,966		2,700		2,544		2,536	

Academic Sessions

Source: Lagos State Ministry of Education

4.19.2 Technology and Innovation

Technology and Innovation help improve a state's economy, thereby improving the standard of living. One of the agendas of the Lagos State Government is 'Making Lagos a 21st Century, so they intend to enhance network and internet connectivity in Lagos schools and Government offices in Lagos State. Table 4.42 records the number of fibre and wireless connectivity in Lagos State institutions and the rate of email usage among Lagos State Staff.

Table 4.29: Statistics of internet connectivity in Lagos State institutions and Lagos State staff email registration and usage from year 2018 to 2020.

Description	Year 2018	Year 2019	Year 2020
Internet Connectivity			
Number of Schools with Internet	25	25	34
% Wireless connection in all state campuses	8%	10%	10%
% Fibre connection in all state campuses	92%	97%	100%
% Network connectivity in all lasg institution	100%	100%	100%
Lagos State Staff Email Usage			
No of LASG staff with official email address	59,468	60,984	57,200
Official usage of the LASG email	37%	70%	80%

Source: Lagos State Ministry of Science and Technology

4.19.3 Cultural Heritage and Identity

4.19.4 Cultural Practices, Traditions, and Historical Significance of the Area

Eti-Osa and Ibeju Lekki have unique cultural identities shaped by their historical past, traditions, and interactions with neighbouring communities.

The cultural practices, traditions, and historical significance of Eti-Osa and Ibeju Lekki LGAs are briefly descried.

a. Eti-Osa LGA:

i. **Ikate-Elegushi Kingdom**:
- Ikate-Elegushi (or Ikate Kingdom) is in Eti-Osa Local Community Development Area (LCDA) in the Eastern District of Lagos.
- The Eastern District covers communities such as Victoria Island, Ikate, Mayegun, Mayegun, Langbasa, Ikota, Ilasan, Ajiran, Agungi, Okun Alfa, Okun Mopo, Olukotun, Badore, Moba, Oke-Ira, Ologolo, Ajiwe, Sangotedo, Ogombo, Alasia, and more.
- The traditional occupation of the people in Ikate-Elegushi is fishing and, to some extent, farming.
- The Idejo Chieftaincy holds the title to a domain where it exercises authority. Historically, some Idejo Chiefs wielded political powers before the Benin monarchical system was established in Lagos.

ii. **Elegushi Royal Ancestry:**
- Olofin, the progenitor of Lagos, established a ruling clan (not just land gentries) in Ikate-Elegushi around 1632.
- The Elegushi royal lineage has firm claims to Ikate-Elegushi's history and authority.

b. Ibeju Lekki LGA:

i. Migration and Settlement:
- Kaje, Sobokunrin, Sifiyon, and Ogbe migrated from Idi-Ewon in Ijebu-Ode.
- They first settled at Aro Quarters in Ibeju Agbe before moving to Orimedu.
- Ibeju Lekki's history is intertwined with migration, settlement, and cultural practices.
- The area's rich heritage includes stories of origin, communal life, and traditional customs.

4.20 Archaeological Sites and Historical Landmarks

There are no archaeological sites and historical landmarks in Eti-Osa and Ibeju Lekki Local Government Areas (LGAs). However, you can access the Osun-Osogbo Sacred Groves and Idanre Hills from these LGAs. The Osun-Osogbo Sacred Groves and Idanre Hills are UNESCO World Heritage Sites. Additionally, the Ogbunike Caves are in Anambra State.

4.20.1 Festivals Celebrated in the Project Location

The following information pertains to the special festivals celebrated in the project location:
- Festival Diversity: The community commemorates various festivals, including Jigbo, Ogodo, Kilajolu, Kilajor, Katanipo, Ololo, Ado-Olomo, Katanpo, Eepa, Okoro, and Oyinbo-gi. Each festival is characterized by unique rituals, symbolism, and historical significance.
- Traditional Roots and Restrictions: These festivals are deeply entrenched in tradition, with some imposing gender and non-indigene restrictions, underscoring their exclusivity and cultural significance. Typically celebrated once a year within a 1 to 7-day timeframe, these events foster anticipation and communal spirit.

- Sponsorship and Ancestral Connections: While some festivals are community-sponsored, others receive support from friends and family members. The ancestral nature of most festivals links them to historical roots and ancestral reverence.
- Publicity and Beliefs: Modern communication channels such as town criers, radio stations, television, and social media are utilized for publicity. The festivals are believed to appease water goddesses or kings for peace, safe childbirth, and river safety, reflecting the spiritual and protective aspects of these celebrations.
- Challenges for Sustainability: Financing and evolving societal dynamics present challenges, making the maintenance of these traditions increasingly complex as civilizations progress. Striking a balance between tradition and practical considerations is paramount to ensure the continuity of these festivals.

4.20.2 Socio-Cultural Heritage and Coastal Tourism

Coastal tourism not only promotes local culture but also plays a vital role in preserving and sharing cultural heritage. In a study by Metilelu (2021), identified factors related to socio-cultural heritage and coastal tourism which in essence described the prevailing condition of project area. These are highlighted below:

- The cultural richness of the host community contributes to the overall tourism experience.
- Commercialization of Local Culture which include the production and sale of souvenirs and local crafts help promote the community's culture.
- Standardization in Tourist Satisfaction: Ensuring consistent quality and meeting tourist expectations.
- Adaptation to Tourist Demand: Designing souvenirs and arts that reflect local culture.
- Cultural Clashes: Addressing conflicts arising from differences in behaviour between tourists and locals.
- Cultural Exchange: Encouraging interaction between guests and hosts.
- Preservation of Cultural Traditions: Efforts to safeguard historical and cultural practices.
- Tourist Activities and Community Image: Tourism activities positively impact the community's culture and image.
- Integration of Foreign Culture: Balancing foreign influences with local cultural heritage.
- Commercialization of Local Culture: The production and sale of souvenirs contribute to preserving the host community's cultural heritage.
- Cultural Sharing and Learning: Tourism opens doors for cross-cultural exchange and learning.
- Existing socio-cultural heritage complements coastal tourism.

4.20.3 Tourism and Entertainment

The location of the proposed coastal road is not only about transportation; it provides an opportunity for combining natural beauty, culture, and adventure. The Lagos coastal tourism map is shown in Figure 4.86. The host LGAs have a thriving hospitality industry that includes hotels, guesthouses, and restaurants catering to tourists and visitors.

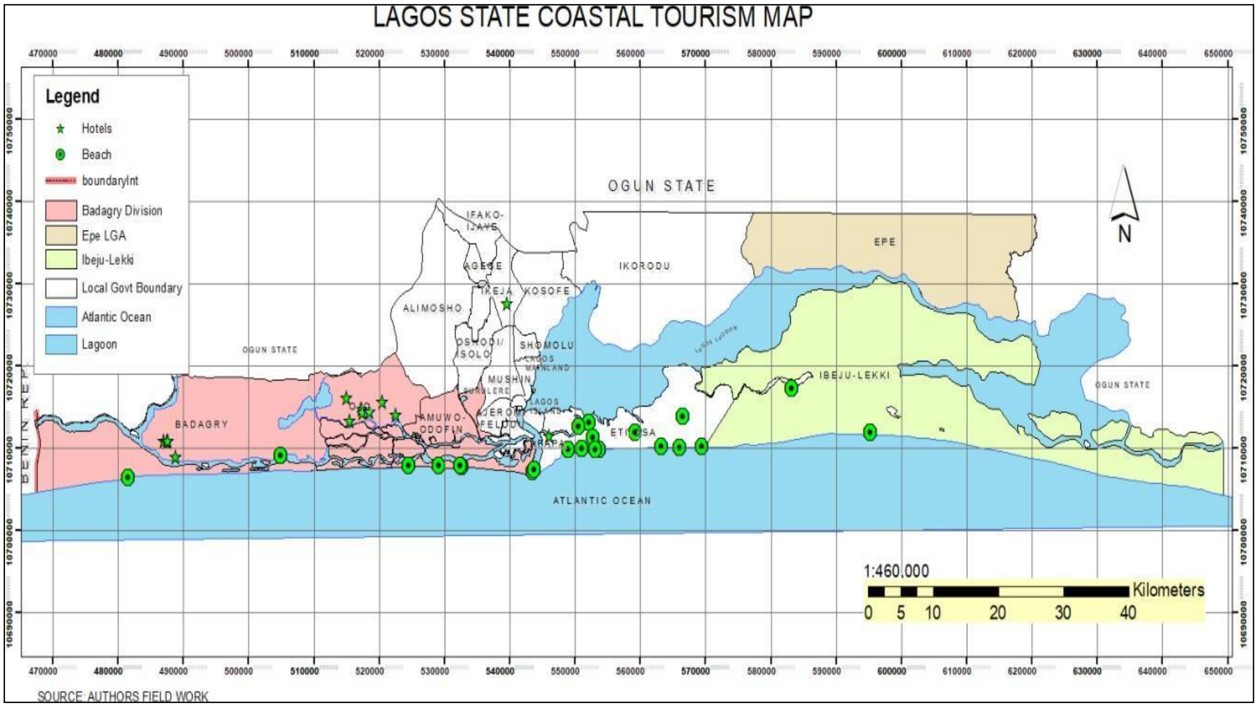


Figure 4.86: Points of Scenic Beauty and Tourism with Coastal Views
Source: Lagos State Bureau of Statistics (2022)

Scenic Beauty and Coastal Views: This stretch of the coastal road offers breathtaking views of the Atlantic Ocean and the coastline. Tourists and travellers can enjoy picturesque sunrises and sunsets over the water. The proximity to the ocean makes it an ideal route for those seeking a scenic drive.

Beach Access and Recreation: Along this coastal highway, there are several access points to beautiful beaches. Tourists can explore beaches such as Eleko Beach, Tarkwa Bay, and Lekki Beach. These beaches provide opportunities for swimming, sunbathing, picnics, and water sports. Both Eti-Osa and Ibeju Lekki provide scenic views of the Atlantic Ocean. These beaches are perfect for relaxation, sunset watching, and connecting with nature. Notable beaches in Eti-Osa include: **Atican Beach**: A serene beach where visitors can relax, swim, and enjoy the ocean view. **Alfa Beach Road:** Another accessible beach for leisure and relaxation and **Okunraye Beach**: A picturesque spot for beachgoers.
Ibeju Lekki also boasts lovely beaches and recreational spots: Eko Tourist Resort (Akodo Beach).

Pictures of some notable beaches in Eti-Osa and Ibeju Lekki are shown in Plates 4.12-4.17 below:

Plate 4.12: Eko (Akodo) Beach showing Beach Relaxation Points and Flowering Plants

Plate 4.13: Swimming Activities at Eleko

Plate 4.14: Serene View of Eko Tourist Beach

Plate 4.15: Recreation at Atican Beach

Plate 4.16a: Aerial View of Atican Beach Resort

Plate 4.16b: Rexalation Spots at Lekki Beach

Local Cuisine and Restaurants: Travelers can experience local flavors by stopping at roadside eateries and restaurants. Seafood is a highlight, with fresh catches from the ocean. Tourists can savor dishes like grilled fish, seafood platters, and traditional Nigerian cuisine.

Eco-Tourism and Nature Reserves: The coastal road runs through areas with diverse ecosystems. Lekki Conservation Centre is nearby, offering nature trails, birdwatching, and canopy walks. Tourists can appreciate the mangroves, wetlands, and wildlife along the route.

Eti-Osa has attractions like the Lekki Conservation Centre and Lekki Beach which draw both local and international tourists. Ibeju-Lekki is home to several tourist attractions, including pristine beaches, resorts, and the Lekki Conservation Centre.

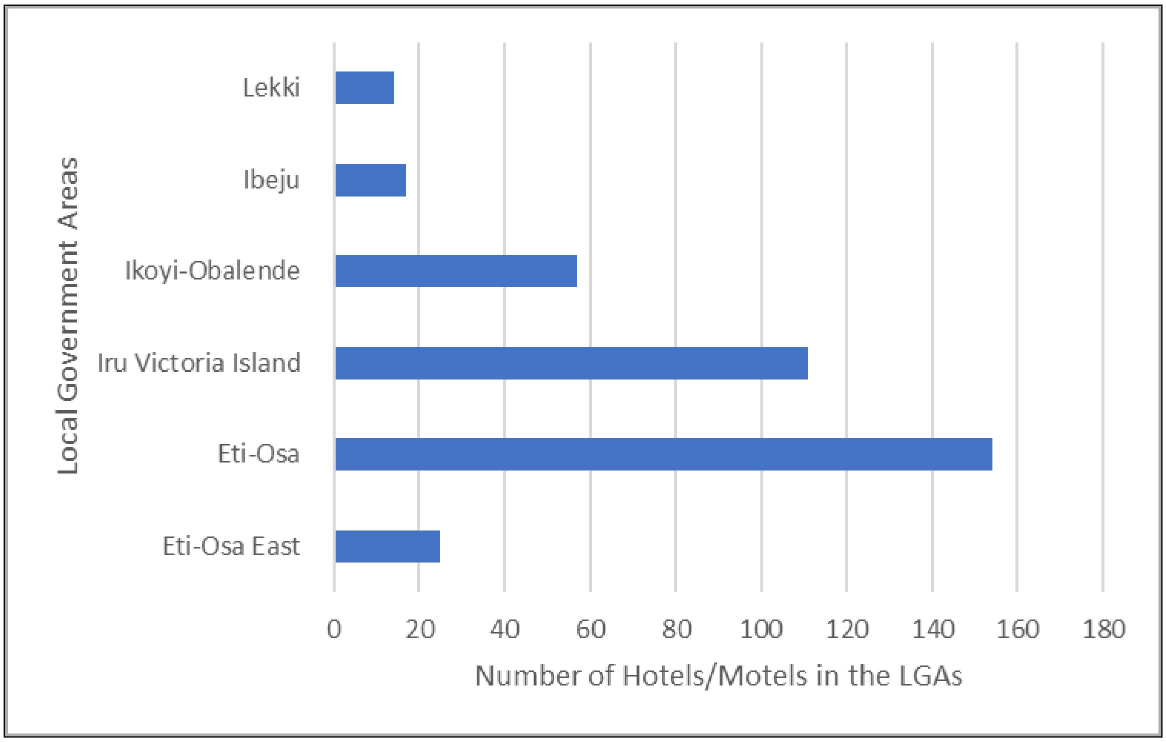


Figure 4.87: Number of Hotels/Motels in the LGAs
Source: Lagos State Bureau of Statistics (2020)

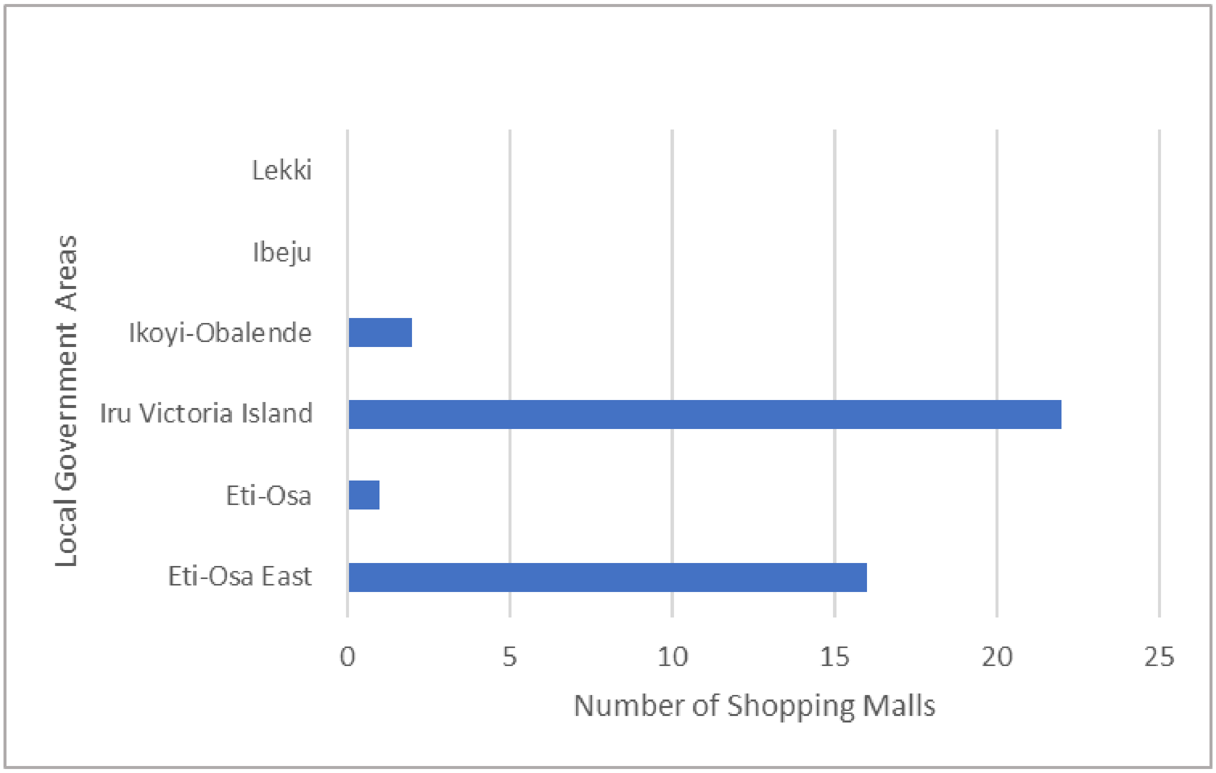


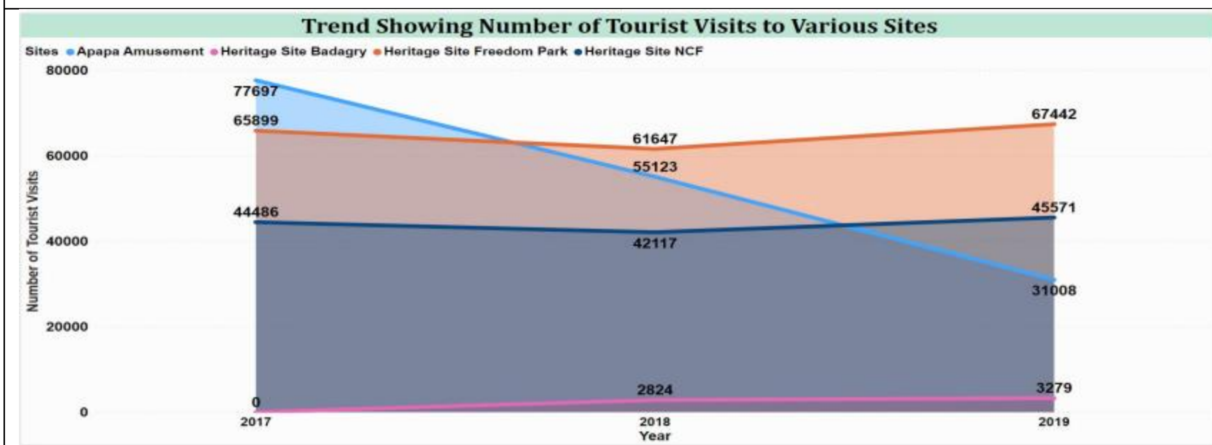
Figure 4.88: Number of shopping malls in the LGAs
Source: Lagos State Bureau ofStatistics (2020)

Art and Craft Markets: Local artisans often set up stalls along the highway. Tourists can shop for handmade crafts, souvenirs, and artwork. Its's a chance to support local businesses and take-home unique mementos.
Photography Opportunities: From the elevated sections of the road, tourists can capture stunning photographs. Whether its's the ocean, lush greenery, or cultural landmarks, there's plenty to frame.
Historical and Cultural Sites: The Lagos-Calabar Coastal Highwway passes through regions with rich historical and cultural significance. Tourists can explore nearby landmarks, museums, and heritage sites. For example, Badagry (not far from this route) has historical sites related to the transatlantic slave trade.
The number of relaxation parks/churches/mosques/shrines by local government/ local council development areas: year 2019 shown in Table 4.45.

Table 4.30: Relaxation Parks/Churches/Mosques/Shrines in the LGAs

Local Govenment Area		Places				Total
		Relaxation Parks	Churches	Mosques	Shrines	
Eti-Osa	Eti-Osa East	0	380	220	0	600
	Eti-Osa	0	226	148	36	410
	Iru Victorial Island	1	25	7	1	34
	Ikoyi Obalende	15	52	41	1	109
Ibeju-Lekki	Ibeju	0	No Response			0
	Lekki	2	0	0	0	2
Grand Total		113	13,623	5,093	888	19,717

Source: Lagos State Bureau of Statistics (2022)



Number of Relaxation Parks, Churches, Mosques, Shrines in the LGAs

Number of Tourist Visit

Figure 4.89: Trend of visits to some tourist and Heritage Sites

4.21 Infrastructure and Utilities

4.21.1 Infrastructure Development

The rapid growth of population and infrastructure along the Lagos coast presents challenges. The pressure to provide adequate infrastructure and services for residents is significant.

Lagos State has been investing in infrastructure to support its growing population and economic activities. One of such development, the Lekki-Epe Expressway has undergone rehabilitation and upgrade, improving transportation networks upgrade in capacity and pavement structure, provision of reinforced concrete drains, culverts, and median barriers, and more.

The Eti-Osa-Lekki-Epe Expressway has undergone significant reconstruction and upgrading. The first phase of the road project, spanning 18.75 kilometers from Eleko to Epe T-Junction, has been completed. The road was transformed from a two-lane rural roadway to a six-lane rigid concrete carriageway. The second phase of the project will extend from Eleko to Abraham Adesanya Roundabout. The development aims to enhance transportation, ease traffic, and support industrial growth in the Lekki Free Zone.

4.21.2 Telecom and Utilities

In 2023, the Lagos State government noted as part of its Key Sector Priorities. It specifically took note of the Digital Infrastructure (Figure 4.91)

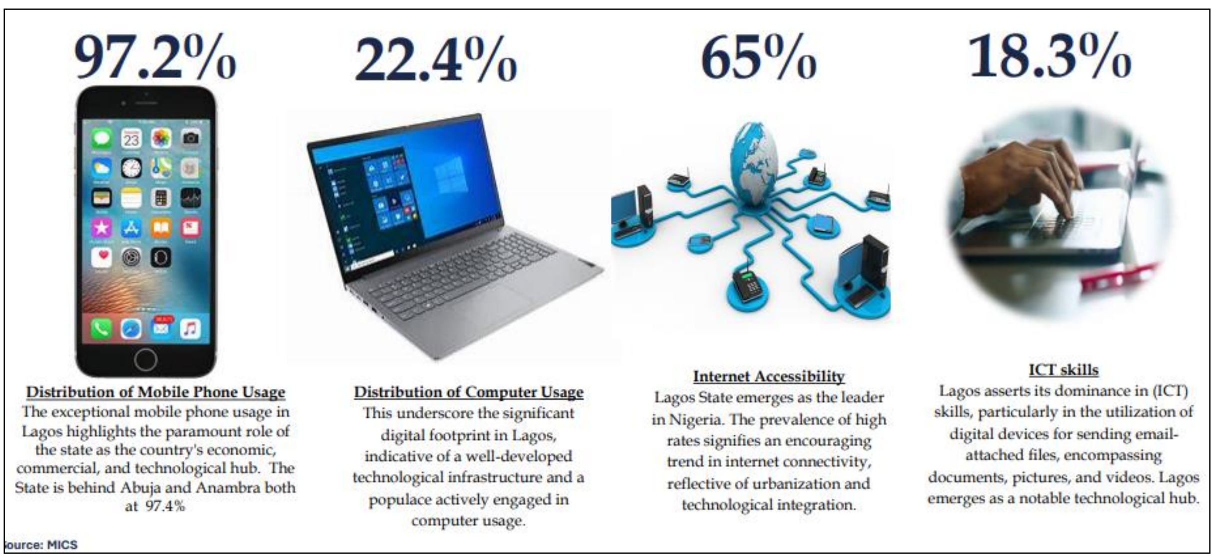


Figure 4.91: Digital Infrastructure Performance by Lagos State Government in 2023

The Lagos State government is unifying fibre infrastructure for telecom companies to enhance Internet connectivity across the city. Fibre optic cables are being laid to provide Internet connectivity. The project aims to prevent fragmented digging of state roads by different telecom operators and service providers. This initiative will potentially lead to better and faster Internet connectivity throughout Lagos. This will benefit both residents and businesses. Several telecom companies operate in Lagos, providing services such as Internet, mobile communication, and data services. Some of the notable Telecom providers in Lagos include MTN, Globacom, Airtel, Ringo, EIL Telecom Limited, and ATC Nigeria. Interactions, engagement and consultation with the telecom and other utilities services provide were very helpful in identifying and mapping the locations of the facilities along the corridor as depicted in Figure 4.92 and Appendix 4.12.

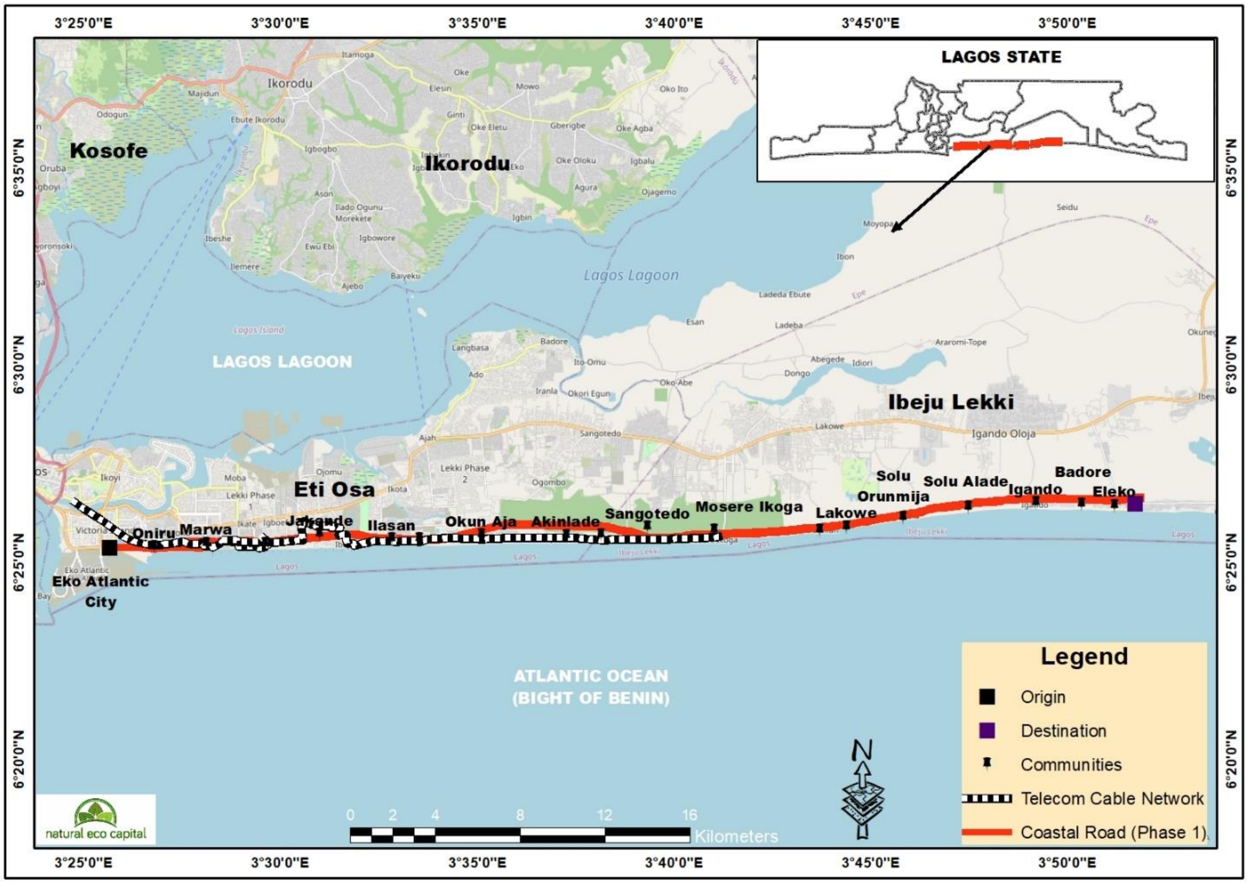


Figure 4.92: Telecom Cable Network

4.21.3 Energy

For energy, the government saw this signifying a well-developed infrastructure and widespread accessibility of clean energy (Figure 4.94). It further noted that this was indicative of concerted governmental efforts to promote clean energy and cultivate an environment conducive to the prosperity of Lagosians.

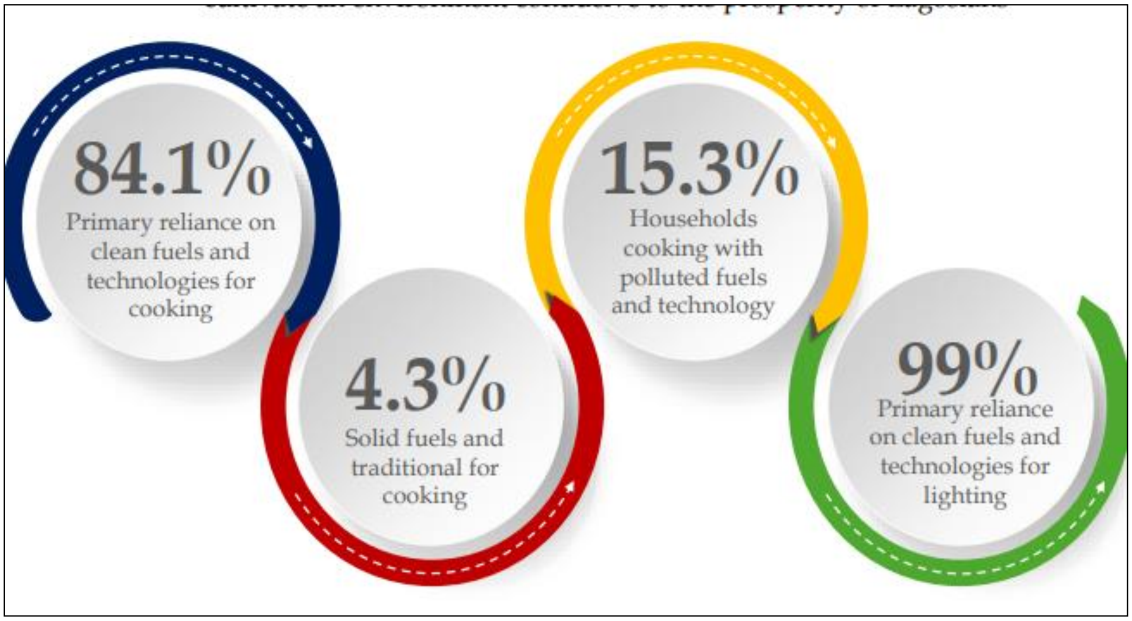


Figure 4.93: Energy Performance by Lagos State Government in 2023

The area's economic growth, natural beauty, and cultural diversity make them a promising part of Lagos State. They also host vibrant markets and commercial hubs, such as the Lekki Free Trade Zone, Ajah Market, and Ikota Shopping Complex

4.21.4 Transport Infrastructure

Lagos Road Transportation: A Snapshot:

Lagos, as Nigeria's economic hub, relies heavily on road transport. The state launched the first phase of its Bus Reform Initiative in 2020, planned to introduce 700 high-capacity buses along 46 routes throughout the city. The existing routes are in the city core while proposed routes extend into Ibeju and Ikorodu to the east and Badagry, Ojo, and the western region of the core. Key features include:

- BRT (Bus Rapid Transit): Dedicated lanes provide efficient bus services within the city.
- Private Buses and Taxis: Common modes of daily commuting.
- Water-Based Transportation: Lagos utilizes state ferries for water transport.

Despite these efforts, severe traffic congestion remains a pressing issue, resulting in significant economic losses due to lost work hours. Transportation investments are ongoing, but funding issues have caused delays. A multimodal system is necessary to improve mobility and livability. Two phases of BRT have been successfully implemented, and investments in waterway transport, rail mass transit, and buses are underway. However, an integrated, multimodal urban mobility system is needed to address the problem effectively.

Figure 4.95: Route of LAMATA Bus Reform

Plans and policies that govern transportation in Lagos include the LSDP, the Lagos State Strategic Transport Master Plan, the Lagos Road Traffic and Administration Law 2012, and the Lagos State Transport Sector Reform Law 2018. There are also two policies that are yet to be fully initiated the Draft Non-Motorised Transport Policy (2017) and the Draft Transport Policy (2019). Implementation of plans and policies has been a major challenge across the board.

Roads Constructed in Lagos

Figure 4.96 depicts the roads constructed in Lagos State, as recorded by the Ministry of Works and Infrastructure. It illustrates the completed road projects within both the Lagos Metropolis and suburban areas from 2017 to 2020. The year 2017 was the peak with about half of the total number of roads constructed (49%), within the4yearscontrast, and the year 2019 had the least number of roads constructed.

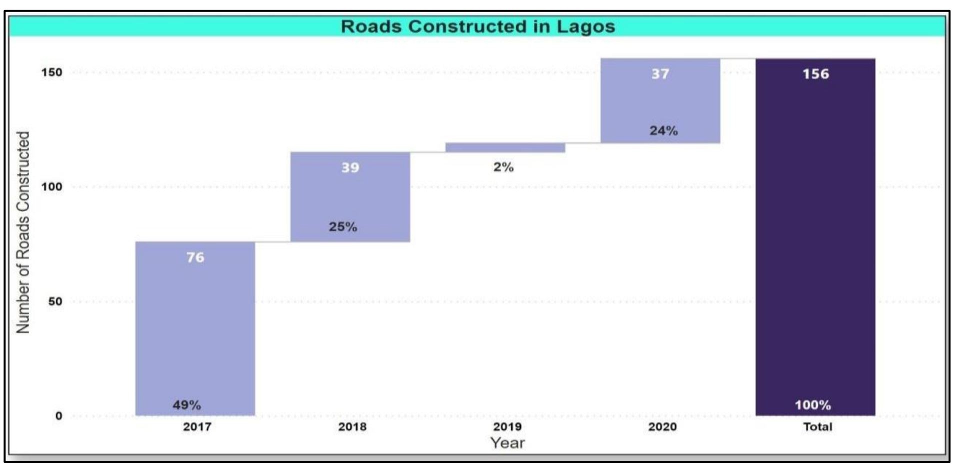


Figure 4.96: Trend of Road Constructed in Lagos State from 2017-2020
Source: Lagos State Bureau of Statistics (2022)

6. **Overhead Link Bridges Constructed in Lagos State.**

Figure 4.97 details the completed overhead link bridges constructed in Lagos State. It illustrates the number of overhead link bridges constructed, as documented by the Ministry of Works and Infrastructure from 2017 to 2020. These bridges connect various roads to alleviate traffic congestion. The year 2017 was the peak with more than two-thirds percent of the number constructed (70%)

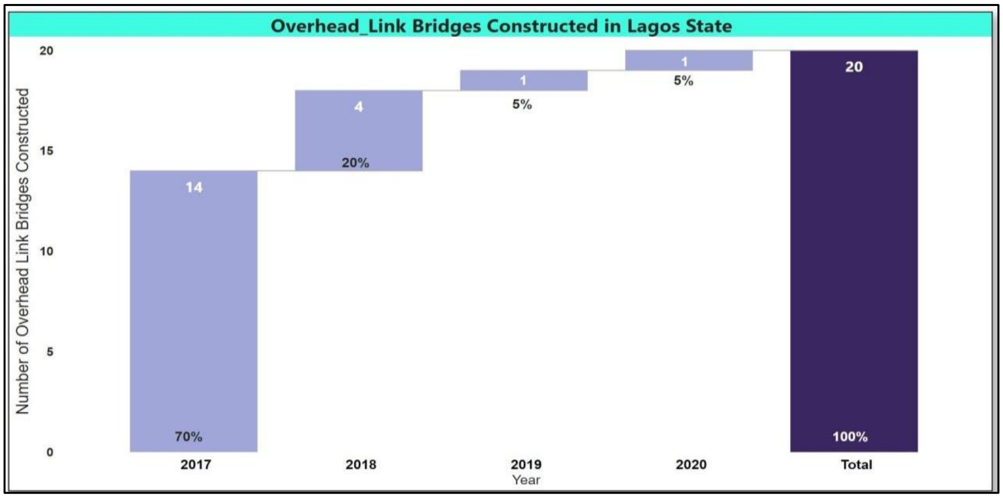


Figure 4.97: Trend of Overhead link bridges constructed from 2017-2020
Source: Lagos State Bureau of Statistics (2022)

4.21.6 Transport Fare

Transport fare trends for March 2024 in Lagos, Nigeria. Intra-city and intercity bus fares have experienced upward trends, impacting commuters' transportation costs.

1. **Bus Journeys Within the City (Per Drop)**:
    - The average fare paid by commuters for bus journeys within the city increased by 1.85%.
    - In February 2024, the fare was N951.76, which rose to N969.32 in March 2024.
    - On a year-on-year basis, the fare increased by 49.55%, compared to N648.16 in March 2023.

   Bus Journeys Intercity (State Route) (Per Person):
    - The average fare paid by commuters for intercity bus journeys per drop was N7,152.97 in March 2024.
    - This shows an increase of 2.14% compared to N7,002.97 in February 2024.
    - On a year-on-year basis, the fare rose significantly by 79.17%, compared to N3, 992.36 in March 2023.

4.22 Road Accidents

With an average of 41753 traffic fatalities per year (2013–2019), road traffic in Nigeria is considered rather mixed. This corresponds to 21.3 accident fatalities per 100,000 inhabitants per year. By comparison, Road accident statistics record the number of people involved in road accidents, including minor, serious, and fatal cases, as well as the gender of the casualties.

Figure 4.98 shows the annual road accident statistics from 2017 to 2020 as recorded by the Lagos State Traffic Management Authority.

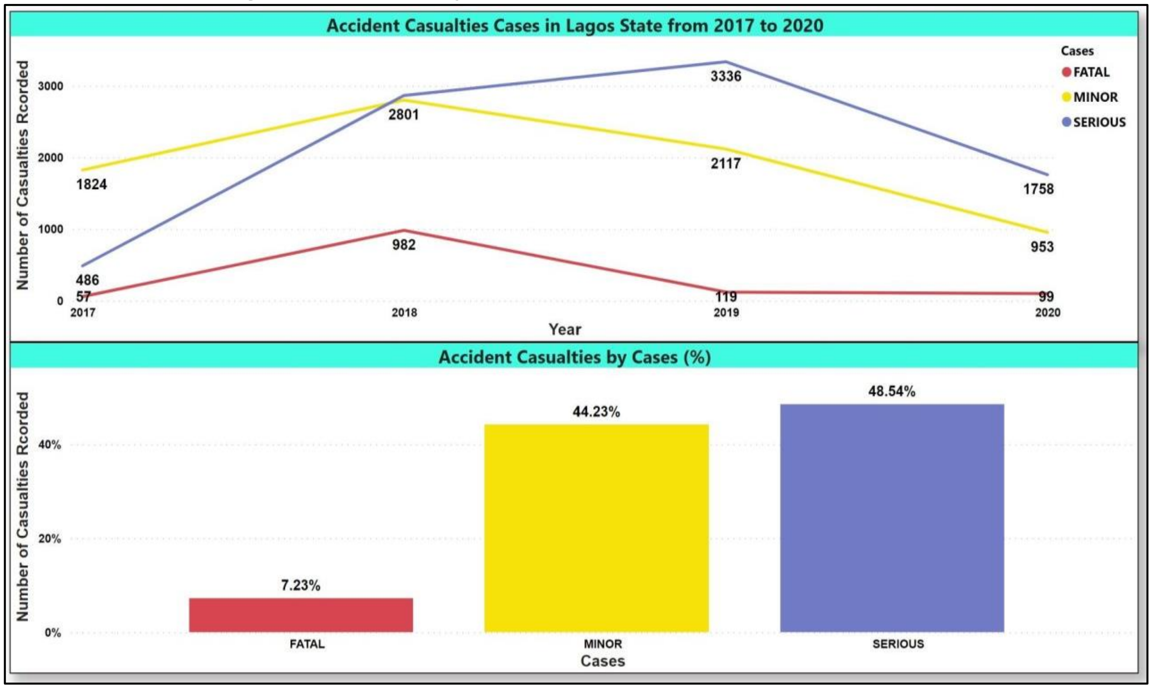


Figure 4.98: Road Accidents recorded in Lagos State from 2017 - 2020
Source: Lagos State Bureau of Statistics (2022).

From **Figure 4.96**, the number of accidents recorded peaked in 2018, having a180% increase from 2017, with a decline in 2019 and 2020.

4.22.2 Road Accidents by Casualty Cases

Accident cases by casualty record the number of casualties cases (minor, serious, fatal) in road accidents as recorded by the Lagos State Traffic Management Authority. **Figure 4.99** illustrates the number of casualties cases of road accidents recorded over 4 years.

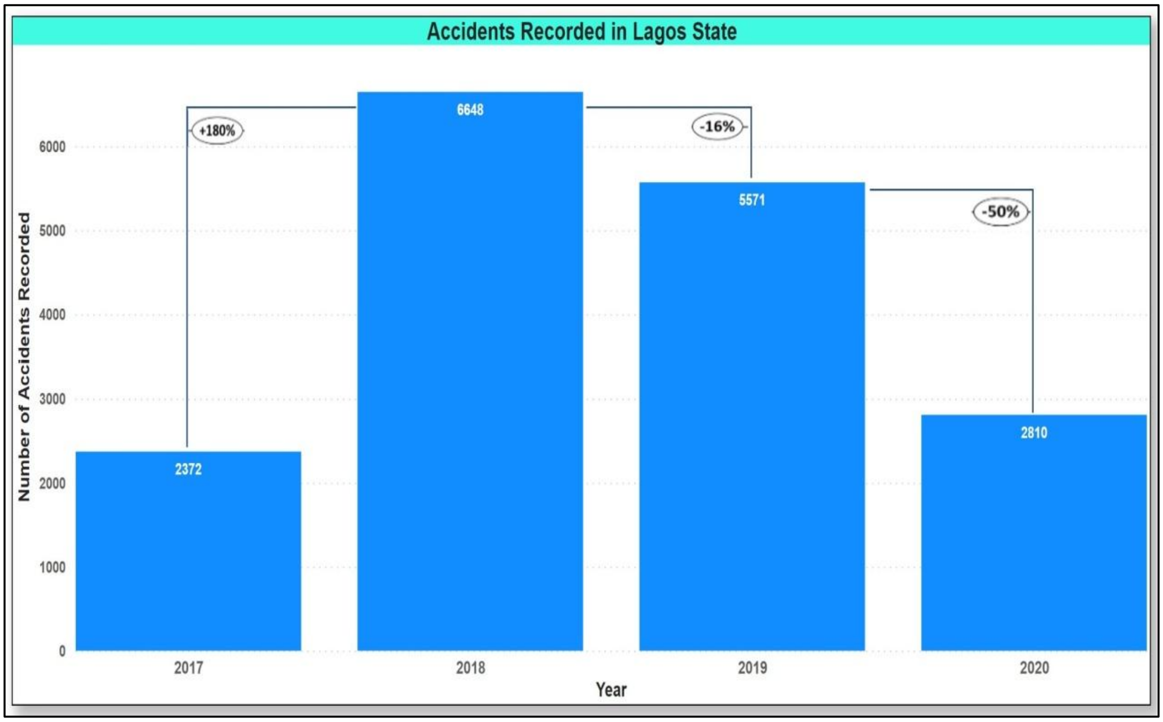


Figure 4.99: Trend of Accidents Casualty cases from 2017-2020

Figure 4.99 shows that we have more records of serious accident casualty cases with a percentage of (49%), followed by minor cases (44%) with only a few fatal cases (7%).

4.22.3 Road Accidents by Gender

The records of accident casualties by cases document the number of casualties (minor, serious, and fatal) in road accidents based on gender, as documented by the Lagos State Management Authority. These records are outlined in Figure xxviii which illustrates the number of casualties in accidents recorded each year.

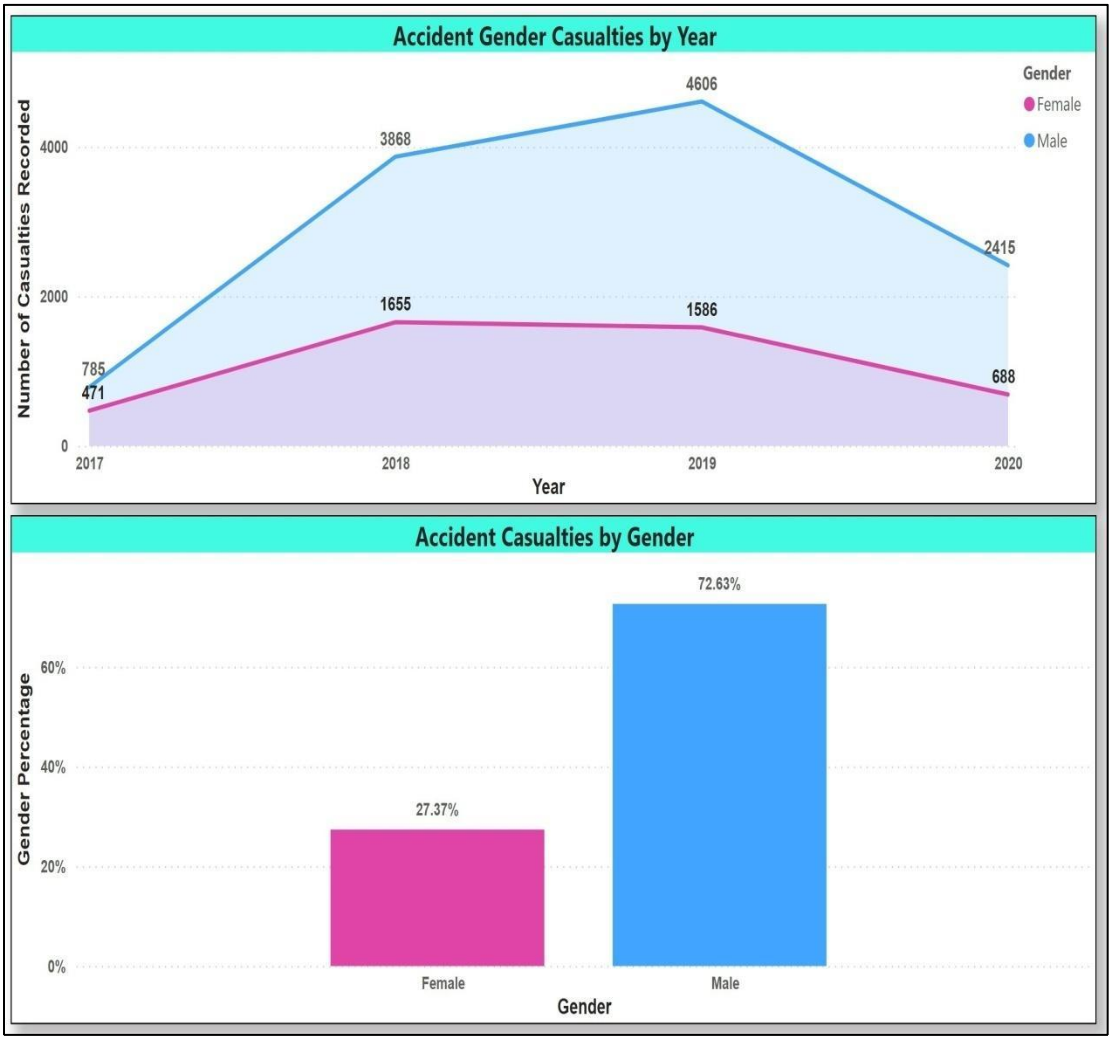


Figure 4.100: Trend of Accidents Casualty by Gender from 2017 - 2020
Source: Lagos State Bureau of Statistics (2022)

Figure 4.100 illustrates a broad difference in the result recorded in accidents by gender, with the males having a higher percentage of (73%) in comparison to females (27%).

4.22.4 Traffic Count

A comprehensive survey was meticulously carried out to identify the traffic conditions on the road. Strategically placed screen lines were manned by field assistants who diligently captured the traffic flow for a significant period. The traffic count was 12 hours each for three days, ensuring a robust data set. This meticulous approach allowed us to capture different streams of traffic moving in and out of this area, providing a comprehensive view of the traffic conditions. Our observations reveal that the traffic situation along the corridor is characterized by a high-speed flow of traffic, a testament to the efficiency of the road. Currently, the service offered by this road is considered good as traffic appears high, indicating a well-managed traffic system.

Vehicles of different types usually require different road spaces due to variations in their performance and sizes. To determine the adequacies of roads, the capacity measurements for roads and junctions traffic volumes are expressed in PCU per hour, which may be the same from one vehicle to another and, at the same time, vary from one vehicle to another. The hour with the highest volume of traffic during the morning peak period at the subject site is used to convert traffic volume to passenger car units. The data shows that cars always ply the route more, a crucial insight for road planners and policymakers. Appendix 4.11 summrises the traffic assessment in the project area.

4.22.5 The Railway System

Nigeria's railway system is vital in connecting regions, fostering economic development, and enhancing transportation options for its citizens. The railway system is currently undergoing expansion and electrification efforts which promise a brighter future for rail travel in Nigeria.

A prominent railway system in the project area concerns the Lagos Rail Mass Transit (LRMT). The LRMT is a modern railway milestone that is managed by the Lagos Metropolitan Area Transport Authority (LAMATA). Currently, two lines are operational (i) Blue Line: Okokomaiko to Marina (35 kilometres, electrified with a 750 V DC third rail); and (ii) Red Line: Agbado to Marina via Oyingbo (electrification planned with a 1500 V DC overhead catenary). Its future extension to Epe may pass through parts of the project area, but it is not likely to be impacted by the road project.

Lagos State Government Transport Statistics (2020) revealed that in Q1 2023, rail transport experienced a 66.63% increase, the highest in two years. The Lagos suburban railway alone transported 583,000 passengers in its first four months, making it the largest inner-city rail service provider in Africa.

Tables 4.30 depict the railway passengers and freight traffic for years 2013–2019. Both show that Lagos had the highest in terms of passengers and freight movement.

Table 4.31: Railway Passengers Traffic (2013-2019)

S/N	District	Passenger							
		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
1	Lagos District (Ld)	3,619,002	4,037,650	2,079,226	2,346,101	1,888,997	1,940,496	1,268,867	17,180,339
2	Western District (Wd)	211,300	173,420	88,132	76,771	44,502	34,542	29,636	658,303
3	Northwestern District (Nwd)	169,336	195,712	205,456	96,301	12,038	23,867	16,439	719,149
4	Northern District (Nd)	329,086	276,114	186,927	162,933	80,383	30,076	14,361	1,079,880
5	North Central District (Ncd)	-	-	5,398	-	-	-	-	5398
6	Northeastern District (Ned)	-	-	721	-	-	-	-	721
7	Eastern District (Ed)	-	2,674	15,186.00	328,193	214,678	258,707	213,675	1033113
8	Abuja Kaduna TrainService (A)	-	-	-	143,137	353146	732016	1,382,364	2610663
9	WarriItakpe TrainService (W)	-	-	-	-	-	57		57
Total (Nigeria)		4,328,724	4,685,570	2,581,046	3,153,436	2,593,744	3,019,761	2,925,342	23,287,623

Source: Nigerian Railway Corporation

Table 4.32: Railway Freights Traffic (2013–2019)

S/N	**District**	**Freight (Tonnes)**							
		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	Total
1	Lagos District (LD)	33,363	62,278	15,162	31,250	99,350	259,075	172,218	672,696
2	Western District (WD)	28,655	30,929	42,635	44,500	21,200	40,571	6,880	215,370
3	North Western District (NWD)	3,416	19,221	6,620	303	150	513	57	30,280
4	Northern District (ND)	12,417	11,875	12,709	42,639	14,963	28,475	11,852	134,930
5	North Central District (NCD)	17,305	40,530	47,234	-	-	-	-	105,069
6	North Eastern District (NED)	-	25,336	22,033	-	-	-	-	47369
7	Eastern District (ED)	1,584	20,477	15,303.00	1,150	3,015	-	737	134,930
8	Abuja Kaduna Train Service (A)	-	-	-	-	-	-	348	42,266
Total (Nigeria)		96,740	210,646	161,696	119,842	138,678	328,634	192,092	1,248,328

b

Table 4.33: Types of Rail Accidents in Lagos State (2015 – 2019)

Type of Accident	Year				
	2015	2016	2017	2018	2019
Collision with road vehicles	11	13	2	17	8
Collision with others	-	3	1	-	2
Derailment	13	10	30	54	55
Fire and Explosions	2	3	2	2	2
Falls from trains	-	-	2	-	3
Runaway	-	-	-	-	1
Obstruction on Track	-	-	13	-	-
Level crossing crashes	7	6	4	-	1
Train Detachment	-	-	3	21	18
Loco Failure	-	-	6	-	-
Train accidents	-	-	6	-	-
Damage on Track	-	-	11	-	-
Death on train/Destitute			11	9	1
Others (various)	62	72	4	1	8
Total	95	107	95	104	99

Source: Nigerian Railway Corporation

Table 4.49 shows the quarterly report of the number of accidents that have taken place in Lagos state between 2014 to 2019.For the 4 quarters, a total of 575 incidences were recorded. The 2nd quarter has the highest number of incidences.

Table 4.34: Quarterly Number of Rail Accidents In Lagos State (2014 – 2019)

Quarter	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
1stQuarter	23	15	15	27	9	26	115
2ndQuarter	18	34	34	22	14	45	167
3rdQuarter	16	22	22	23	43	25	151
4thQuarter	16	24	38	23	38	3	142
Total	73	95	109	95	104	99	575

Source: Nigerian Railway Corporation

Figure 4.102 illustrates the number of accidents that have taken place between 2014 and 2019 in Lagos State within the four quarters of the year.

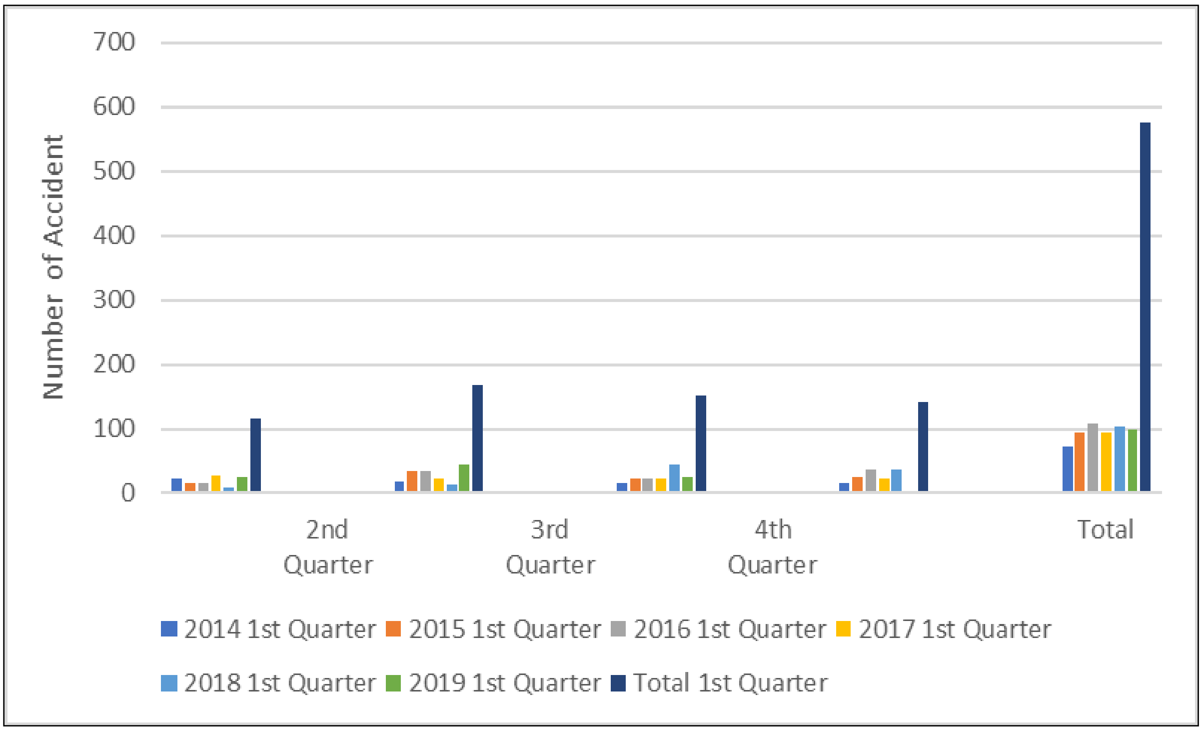


Figure 102: Number of Accidents between 2014 and 2019

Table 4.50 depicts the number of deaths recorded in terms of persons killed by rail accidents. In 2015, it recorded 17 deaths and this reduced to 8 persons in 2019.

Table 4.35: Quarterly Number of Persons Killed in Rail Accidents in Lagos State (2014 – 2019)

Quarter	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1stQuarter	4	3	1	2	-	0
2ndQuarter	5	7	6	6	-	4
3rdQuarter	2	5	2	1	5	4
4thQuarter	8	2	4	1	5	0
Total	10	17	13	10	10	8

Source: Nigerian Railway Corporation

Figure 4.103 illustrates the number of persons killed in rail accident between 2014 and 2019 in Lagos State.

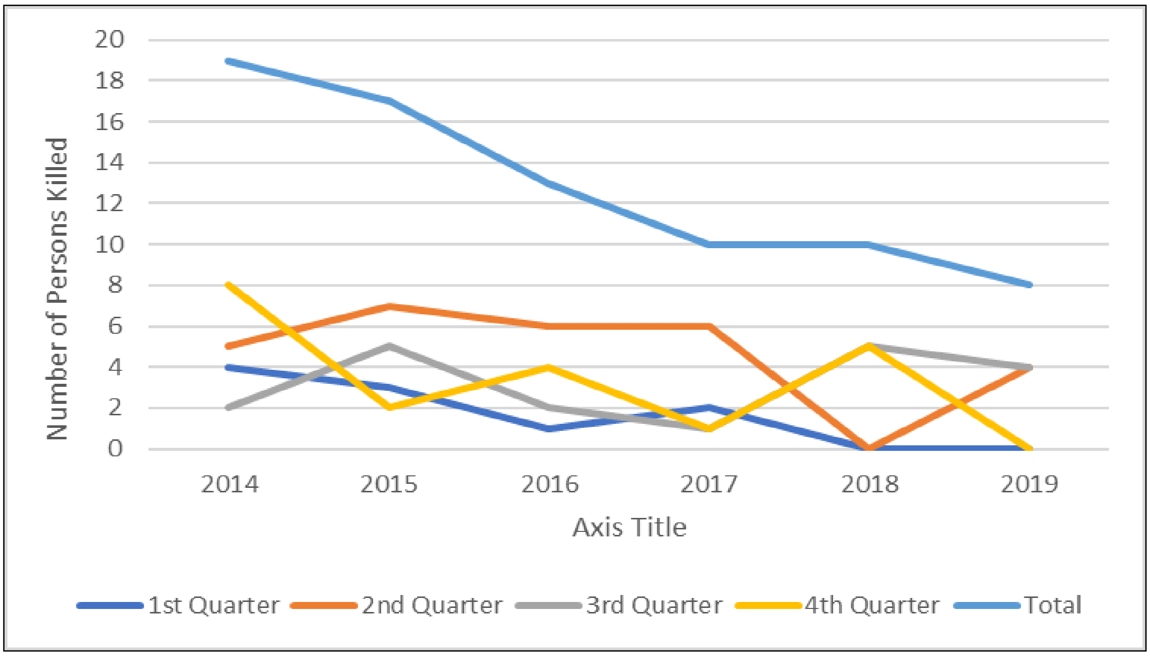


Figure 4.103: Number of Persons killed between 2014 and 2019
Sources: Natural Eco Capital (2024)

Table 4.51 shows the different types of rail accidents in the State. This ranges from fatal, serious, and minor. These different types were summed to give a total of 575 accidents.

Table 4.36: Type of Rail Accidents In Lagos State: Year 2014 - 2019

Year	Types of Accidents			
	Fatal	**Serious**	**Minor**	**Total**
2014	23	32	18	73
2015	28	34	33	95
2016	30	38	41	109
2017	35	15	45	95
2018	10	73	21	104
2019	8	5	86	99
TOTAL	134	197	244	575

Source: Nigerian Railway Corporation

Figure 4.104 illustrates the type of rail accidents between 2014 and 201 in Lagos State

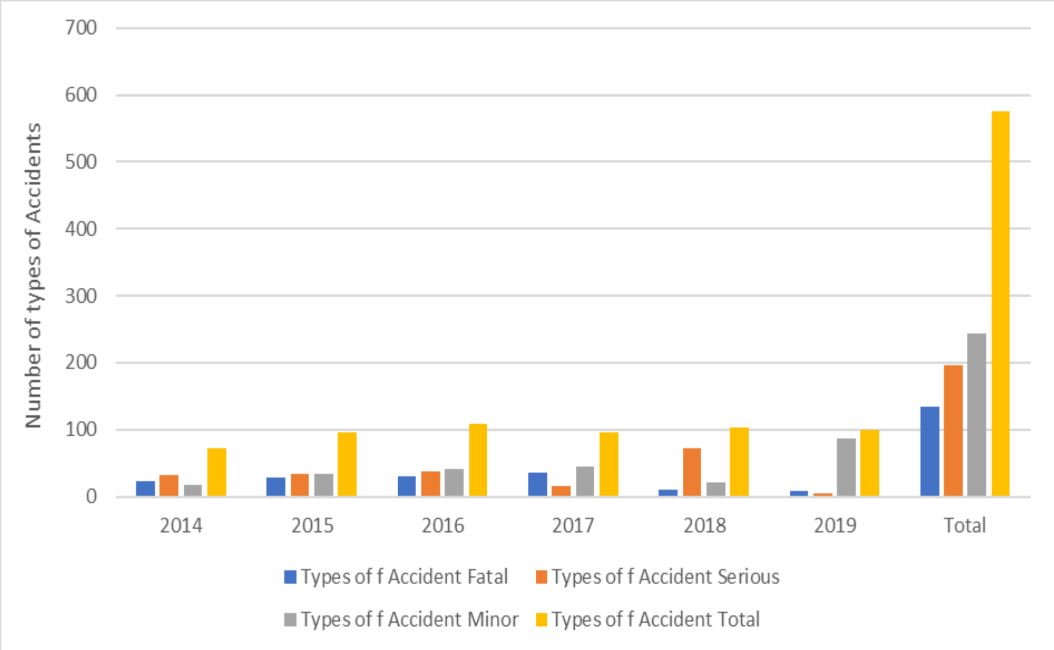


Figure 4.104: Types of Accidents between 2014 and 2019
Sources: Natural Eco Capital (2024)

4.23 Social Environment

This section presents held and planned consultations, demographic profiles and data obtained from the community and household engagements. The obtained data were compared with NBS 2012 report and other publicly available literature works. The essence is to develop a trend and possibly social causal factors for deviations.

4.23.1 Consultation of stakeholders

4.23.1.1 Invitation to consultation sessions and Notification of Project

Table 4.37 outlines the letter introducing the Project proponents (Ministry of works and housing), the Project and inviting attendance and participation in scheduled engagements. These letter notifications were distributed to key stakeholders' groups identified.

Table 4.37: Identified Stakeholder's Invitation for all consultation rounds

Stakeholder Group and Interest in the Project	Stakeholder Name	Stakeholder Level			Engage ment Activity	Mode of Invitation
		National	State	Local	Meeting	Letter
Government Authorities: National, State and local government of primary importance to the Project with permitting Requirements that the Project must meet.	Federal Ministry of Environment	X			X	X
	Lagos State Ministry of The Environment		x		X	X
	Lagos State Ministry of Works and Housing (LGMWH)		x		x	X
	Ibeju Lekki and Eti-osa LCDA			x	x	X
	Ibeju Lekki and Eti-osa Local Government Area and LCDA, respectively.			x	x	X
Project Affected Communities	26 affected communities				X	verbal

4.23.1.2 Stakeholder Information and Consultation Rounds

Five rounds of stakeholder consultation are planned, of which the first three have been conducted. These included the inception meeting engagement (1st round) and the scoping (2nd round) socio-economic and health engagement during the ESIA process (3rd round).

The fourth round of consultations is scheduled for the disclosure of the ESIA (4th round). The fifth round is the panel review. Table 4.38 presents details of the first three rounds that have taken place.

Table 4.38: Details of the first three rounds of consultations

Site	Consultation Date	Venue	Stakeholder Type	Name of Stakeholder	No of persons	Issues discussed	Outcome
ROUND 1: INCEPTION MEETING ENGAGEMENT							
Virtual	5th May 2024	Zoom conference	Institutional	FMEnv, State Ministry of Environment, FMWH, LGMWH Natural Eco Capital	11	The inception meeting involved discussing the scope of the Environmental Impact Assessment (EIA), identifying key environmental and social concerns, and setting objectives for stakeholder engagement.	Agreement on the EIA scope, identification of key environmental issues, and a plan for further stakeholder engagement.
ROUND 2: AUTHORITY VISIT AND SCOPING WORKSHOP							
Lagos	6th May 2024	All Project Affected Communities	Institutional	FMEnv Rep, Natural Eco Capital , Community Reps.	5	The authority visit and scoping workshop focused on the potential environmental and social impacts of the road project, community concerns about displacement, compensation, and access to resources.	Consensus on conducting thorough environmental and social impact studies, commitment to fair compensation, and strategies for minimizing disruption to communities
Lagos	7th May 2024	Ibeju Lekki and Eti-osa LCDA Secretariat, Lagos State	Scoping Workshop	Institutional, traditional, PACs, PAPs	43	Discussions focused on land acquisition processes, compensation for displaced persons, environmental conservation, and impact on local livelihoods.	Agreements to conduct detailed assessments on environmental and socio-economic impacts, ensure transparent communication regarding compensation, and involve communities in planning mitigation measures.
ROUND 3 CONSULTATION: DATA GATHERING EXERCISE							
Lekki	8th May 2024	Lekki Kabiyiesi Palace	Institutional and PACs	FMEnv, State Ministry of Environment, FMW, LGMW Natural Eco Capital Community Reps	41	Focused on gathering data regarding local biodiversity, cultural heritage sites, and socio-economic conditions of affected communities.	Established a comprehensive data collection framework to ensure all environmental and cultural factors are considered, and agreed to prioritize areas with significant ecological and cultural importance in impact assessments.
Ise	6th May 2024	Palace of the Kabiyiesi of Ise	Institutional and PACs	FMEnv, State Ministry of Environment, FMW, LGMW	28	Discussed local environmental concerns, traditional land use, and potential disruptions to community life due to the proposed road project.	Identified key environmental areas and cultural practices to be preserved, and established a communication channel for

Site	Consultation Date	Venue	Stakeholder Type	Name of Stakeholder	No of persons	Issues discussed	Outcome
				Natural Eco Capital Community Reps			ongoing community input during the project planning phase.
Ibeju	9th May 2024	Palace of the Kabiyiesi of Ibeju	Institutional and PACs	FMEnv, State Ministry of Environment, FMW, LGMW Natural Eco Capital Community Reps	25	Examined the potential impact of road construction on local ecosystems, water resources, and community access to farmlands.	Agreed on mitigation strategies to protect water resources, and identified alternative routes to minimize the impact on farmlands. Established a committee to monitor environmental compliance throughout the project.
Eti-Osa	9th May 2024	Palace of the Olumegbon of Ajah	Institutional and PACs	FMEnv, State Ministry of Environment, FMW, LGMW Natural Eco Capital Community Reps	38	Concerns about noise and air pollution from construction, disruption to local businesses, and cultural site preservation.	Agreed to implement noise-reduction measures, schedule construction during off-peak hours, and protect identified cultural sites. A local business support plan was also discussed.
Igando	10th May 2024	Palace of the Kabiyiesi of Igando	Institutional and PACs	FMEnv, State Ministry of Environment, FMWH, LGMWH Natural Eco Capital Community Reps	20	Impact of road project on local housing and property values, compensation for land acquisition, and access to local services during construction..	Commitment to fair compensation for affected property owners and measures to maintain access to essential services during construction. A housing impact assessment was planned..
ESIA COMMUNITY /HOUSEHOLD ENGAGEMENT							
Kingdoms	Date of interview	Average household size	Number of houses	questionnaires issued	Questionnaires retrieved	Issues discussed	Outcome
Lekki	16-17/05/2024	8	713	1406	1400	The team informed community members, including men, women, and youths, about the project and engaged with community leaders through focus group discussions	The community engagement collected data on various aspects including the community governance structure, historical
Ise	18/05/2024	9	209	356	351		

Site	Consultation Date	Venue	Stakeholder Type	Name of Stakeholder	No of persons	Issues discussed	Outcome
Ibeju	19/05/2024	8	416	760	689	(FGD), key informant interviews (KII), and household surveys using questionnaires.	context, grievance redress mechanisms, cultural heritage, belief systems, gender issues, and household social, cultural, and health infrastructures.
Eti-Osa	20/05/2024	8	298	405	405		
Igando	21/05/2024	8	313	406	405		
Total			1949	3333	3250		





Plate 4.17: Excerpts from stakeholder consultations at the various communities

Summary of Issues from Stakeholders

Cultural Heritage Preservation

Stakeholders strongly emphasize the preservation of cultural heritage and respect for sacred sites and shrines along the project areas, as these are vital for community identity and well-being. This includes sacred sites, shrines for traditional festivals and practices, and sacred forests. There are concerns about whether the government will provide alternative land for the displaced sites. Additionally, stakeholders' feedback highlights the need for careful enumeration, compensation, and property realignment to avoid accidents.

Enumeration, Compensation, and Property Realignment

- Emphasis on careful realignment to minimize the impact on affected properties.
- Concerns about discrepancies between the initially communicated meter width before Jakande Estate and the observed reality.
- Stakeholders requested more time to relocate from affected properties.
- The fate of properties on the right-hand side of the corridor remains a valid concern.
- Obstruction of telecommunication cables on land, swamp and subsea

Environment and Social

- Stakeholders stressed that compensation should not overshadow the project's impact on the environment, biodiversity, and ecosystem within the corridor.
- Immediate action is necessary, as the project may displace animals like pythons and crocodiles. Contractors must be trained to recognize and rescue these organisms.
- Environmental pollution affects both close and distant communities, so all impacted communities should be compensated accordingly.
- Fishing is the primary means of livelihood in these communities. Fishermen use the water for fishing.
- Emissions and noise from truck movements and vibrations due to ongoing construction are affecting community members, especially around Eleko.
- The road's height should not be higher than the nearby community level, making it vulnerable to erosion and flooding during the rainy season.

Host Communities Infrastructure Urgent Need

The residents of the host communities have recognized the urgent need for infrastructure improvements within their localities. Their expressed desire for basic facilities highlights the challenges they face in their daily lives. By addressing these infrastructure needs, they can contribute significantly to community development and well-being.

Among the recurring infrastructure needs are:

- Access to clean and safe drinking water is essential for their community health and well-being. The provision of reliable water sources should be a priority.
- Affordable healthcare facility is crucial for addressing medical emergencies, providing healthcare services, and improving overall health outcomes.Residents require access to quality healthcare within their community.
- Well-maintained roads are essential for transportation, economic activities, and connectivity especially with the proposed road. They want road around them to be tarred to improve mobility, reduce travel time, and enhance safety.
- Creating job opportunities within the community is vital for economic growth and poverty reduction and look forward to the project supporting in this area. Thus it is important that

employment prospects from the project improve livelihoods and enhance the overall quality of life.

4.23.2 Social Environment

4.23.2.1 Political context

The Federal Republic of Nigeria comprises 36 States and a Federal Capital Territory. Nigeria became an independent state in 1960 and a republic in 1963. It started with three regions, namely Eastern, Northern and Western, until a fourth, the Mid-West region, was created in 1963. Nigeria experienced the first military coup in 1966 and a thirty-month civil war from 1967 to 1970. The military government created 12 states from the four regions in 1967. Between 1967 and 1996, the 12 states were further divided into 19, then 21 and finally 36 states. Lagos State was created on 27 May 1967 according to the State Creation and Transitional Provisions Decree No. 14 of 1967. Lagos State currently has 20 LGAs, including Eti-Osa and Ibeju- Lekki LGAs. These LGAs as in all others in the State, is run by an elected Executive Chairman and elected Counselors (Table 4.22). The Chairman appoints a cabinet to assist in performing the executive functions of the Local Government.

Table 4.39 Administrative structure of Nigeria and the project affected area

<table>
<tr><td colspan="3">System of Government
Nigeria operates Three-tier arms of government. Federal, State and Local Government Area. She runs a Presidential System of Government.</td></tr>
<tr><td rowspan="5">Federal Arm</td><td colspan="2">Executive - Implementation of laws, maintaining law and order, and initiating bills into parliament. A President heads it.</td></tr>
<tr><td colspan="2">Legislature- Nigeria operates a bicameral (Senate and House of Representatives) legislature. They make laws, approve the annual budget, ratify treaties negotiated by the executive and conduct oversight functions on government activities. Senate President heads the senate, and a Speaker presides the House of Representatives.</td></tr>
<tr><td>Senatorial District</td><td>House of Representative</td></tr>
<tr><td>There are 109 senatorial districts in Nigeria. The project area is represented by a senator representing the Lagos East Senatorial district.</td><td>There are 360 House members in the national assembly. Lagos State has twenty-four members. The proposed project will transverse along the following communities Eko Atlantic, Oniru, Marwa, Elegushi, Ilasan Iroko Awe, Aro/Ologolo, Jakande, Lafiaji, Okun Aja, Mopo Ijebu, Sangotedo, Igando, Badore, Eleko, Oguntimehin, Solu Alade, Solu Orunmija, Debojo, Eko Akete, Idado, Lakowe, Iwesolu, Okunsolu, Moser Ikoga, Iwereku, Akinlade.</td></tr>
<tr><td colspan="2">Judiciary - The supreme court, appeal court, federal courts, Industrial court, customary courts of appeal and magistrate court. They Interpret laws that protect the right of individuals, and a Chief Justice heads it.</td></tr>
<tr><td>State Arm of Government</td><td colspan="2">Executive- There are 36 states in Nigeria and the Federal Capital Territory, and an elected Governor heads the executive arm of the state government. The proposed project is located in Lagos State.</td></tr>
</table>

	Legislature - Each State operates a unicameral system headed by a Speaker.
	Judiciary - As in other States, the judiciary arm of government in Lagos State comprises the High court, customary courts, and Magistrate Courts. The head of the state judiciary arm is the Chief Judge.
Local Government Arm of Government	Executive- A Chairman heads the executive arm, and this arm performs similar functions to that of the President and Governor at the Federal and State levels, respectively.
	Legislature - The legislature is formed by at least ten wards in each LGA, and they make bye-laws for the LGA, and the Leader of the House heads it. Each Local Government is represented at the State House of Assembly by an elected member of the Local Government.
	Community- The communities have a well-defined hierarchical political structure with traditional leadership through Kings (Kabiyesi) and Chiefs/ Community Heads (Baale). The traditional authority structures are similar in all the communities as the traditional head (Kabiyesi), and chiefs jointly administer their political, economic and social affairs. The administration also recognizes the Community Development Association (CDA), comprising an elected Chairman and some Executive Members. All CDAs operate under the leadership of one Community Development Secretary (CDS), who coordinates the activities of all CDAs in the area. Three broad groups are identifiable in each community – male elders, youths and women. The role of male elders is the traditional governance of the communities. They dominate the political arena and the decision-making positions, while the youth leaders are usually at the bottom of the ladder of authority. The traditional role of the youths includes constituting a labour force in development projects, security of the community and enforcing law and order.

4.23.2.2 Demography

The demographic Details of the project LGA, State and federal data is presented in Table 4.23

Table 4.40 Demographic information of the Project LGAS, State and Nigeria.

Parameter	General statistics in Nigeria	Lagos State	Ibeju-Lekki LGA	Eti-Osa LGA
Total population (2006 Census)	140,431,790	9,113,605	117,481	287,785
Projected population (2022)	232,455,908	15,085,696	194,466	476,664
Total Area of Land	923,768 km²	3,577.28 km²	455 km²	192 km²
Population Density	228.85/km²	3304.55/km²	390.0/km²	2483.67/km²
Men	71,345,488	4,719,125	60,729	148,360
Women	69,086,302	4,394,480	57,064	139,425
Children (age 0-18)	41.8%	30.4%		30.4%
19–39	25.4%	28.8%		28.8%
40- 64	18.0%	21.0%		21.0%
Elderly (>65)	3.2%	4.6%		4.6%
Population (2010)	159,608,173	10,694,915		337,550

Literacy rates	82.6	80.5		80.5
Infant mortality level	64.8/1000 live births	45/1000 live births		45/1000 live births
Life expectancy	55 years	51 years		51 years
Youth Literacy (Male)	86.0	99.4		99.4
Youth Literacy (Female)	79.0	99.3		99.3
Adult literacy in English (Male)	72	95.8		95.8
Adult literacy in English (Female)	78	92.3		92.3

Source: National Population Commission of Nigeria, 2012

The Table provides a comprehensive overview of demographic and socio-economic statistics for Nigeria, Lagos State, Ibeju-Lekki LGA, and Eti-Osa LGA.
This information helps assess the potential impacts of the project on the local population, including effects on population growth, urbanization, community resources, and social services. It also informs strategies to mitigate adverse impacts and maximize benefits for the affected communities, ensuring that the project is tailored to meet the needs of the local population.

4.23.2.3 Community and Household Consultation

Community consultation is an inclusive and culturally appropriate process that involves sharing information and knowledge, seeking to understand the concerns of other project affected persons and building relationships based on collaboration. It allows the community to understand the project's risks, impacts, and opportunities to achieve positive outcomes. It involves information dissemination and interaction/dialogues with the host community of the proposed project.

4.23.2.4 History and Culture of the Communities.

The Baale of each community provided their socio-cultural history (Table 4.24) to the study team. They welcomed the study team and were obliged to provide Household, FGD and KII to the field crew.

Table 4.41: Host communities' socio-cultural history

Parameters	Lekki kingdom	Ise kingdom	Ibeju kingdom	Eti-osa kingdom	Igando kingdom	Remarks
Origin	Member of Ile-Ife in Osun State,	Members of ijebu	Members of Osun state, Ijebu ode, Oyo state	Members of Awori Yoruba and the Edo	Decendants of Awori	-
Migration	Ijebu Ode- Ilara – Epe – Ileke (Lekki)	Ijebu- Epe - Ise	Ile-Ife - Benin – Epe- Ise- Ibeju	Ile - ife	Ile-Ife- Bini	-
No of families	There are about eleven families	There are about eight families	There are about thirty-two families	There are about nine major families.	There are twenty-nine major families	These families have subs, and each controls community resources mainly from agriculture and royalties from companies operating in their domain.
Traditional governance system	The communities are headed by the Kings (Kabiyesi), and Chiefs/ Community Heads (Baale)					
GRM	Household → Family → Baale → kabiyesi					
Festivals	The Ileya, Imale, Jigbo, Abonigogo and Akira festivals are conducted annually.	-	The Jigbom, Osun, Aje, Oru Obaluwaye, Ojuloke, and Eesun festivals (usually lasting fourteen days).	The Egungun and Igunuko festivals,	The Oru, Obaluwaye, Ogun, Eeshun festivals	Most festivals are celebrated annually, and their significance is to bring peace, love and harmony.

Shrines	Ogun shrine Efun-Ilese shrine Iju-Etsu shrine	-	Ojuloke shrine, orie-esu shrine	-	-	Employees in all phases of the project shall be sensitized to the locations of these sacred places to avoid them.
Land ownership systems	The major land ownership systems in the communities are inheritance, purchase, and lease.					
Taboos	The kingdom forbids someone not from the royal family and non-indigene to go to their shrine and designated areas of the community. The kingdom also forbids adultery.	-	The kingdom does not condone stealing and adultery.	The kingdom forbids cultism, adultery, stealing, etc	The kingdom does not allow cultism and stealing	This section is for contractors' and employees' guidance to prevent cultural overlap and conflict across all project phases.
Major occupation	Fishery, Farming, trading and public service					
Potential conflict sources	Borderland disputes Land ownership disputes	Land delineation and desecration Land ownership disputes	Land ownership disputes	Borderland disputes	Land ownership disputes	-

4.23.2.5 Socioeconomic Sampling Approach

To collect socioeconomic data, a multi-method approach was employed, comprising Key Informant Interviews (KII), Focus Group Discussions (FGD), and Household Questionnaires. KII sessions were conducted with chiefs and elders from the 26 sampled communities at their respective town halls. FGD meetings were held with representatives from various groups, including youths, women, traders/business owners, farmers/hunters, and fisherfolks, in the same 26 communities.

A total of 3,333 household questionnaires were administered to a total of 1,949 willing homesteads across the 26 communities. Respondents helped estimate households per community, validating the random estimation count done by the study team. Assistance was provided to respondents in completing the questionnaires, primarily in pidgin and local dialects. A total of 3250 questionnaires were retrieved, representing a success rate of 97.5% (Table 4.25).

Table 4.42: Socio-Economic Sampling Protocols

S/N	Communities	Number of households per community	Sampled questionnaire per community	No of retrieved questionnaire	% Retrieval
1.	Eko Atlantic	109	82	80	97.6%
2.	Oniru	76	52	47	90.4%
3.	Marwa	81	58	58	100%
4.	Elegushi	84	56	56	100%
5.	Ilasan Iroko Awe	82	61	59	96.7%
6.	Aro/Ologolo	75	66	64	97%
7.	Jakande	72	51	51	100%
8.	Lafiaji	73	51	51	100%
9.	Okun Aja	76	63	53	84.1%
10.	Mopo Ijebu	78	56	47	83.9%
11.	Sangotedo	76	53	49	92.5%
12.	Igando	87	61	60	98.4%
13.	Badore	83	56	51	91%
14.	Eleko	84	61	58	95.1%
15.	Oguntimehin	77	51	51	100%
16.	Solu Alade	83	59	51	86.4%
17.	Solu Orunmija	85	64	61	95.3%
18.	Debojo	75	51	51	100%
19.	Eko Akete	86	63	63	100%
20.	Idado	78	53	53	100%
21.	Lakowe	75	51	51	100%
22.	Iwesolu	78	61	61	100%
23.	Okunsolu	79	55	55	100%
24.	Moser Ikoga	79	59	51	86.4%
25.	Iwereku	80	57	57	100%
26.	Akinlade	75	51	51	100%

4.23.2.6 Age demography and Gender of household head

Understanding the age distribution and gender of household heads is crucial for comprehending the demographic structure and social dynamics within a community. This section explores the age and gender profiles of household heads, providing insights into the generational and gender-based patterns that influence household management and community life.

Age of Respondents

The age distribution of the respondents, depicted in Figure 4.22 indicates a diverse range of ages within the community along the project corridor. About 38.46% of the respondents are in the age group of 31-40 years, followed by those in the age bracket of 18-30 years (25.64%). Next are those in the age group of 41 – 50 years (20.51%), while those aged 51-60 account for 12.82%. The smallest age group is those above 60 years, with only 2.56%. This distribution suggests a predominantly young, active, and productive labour population, a crucial consideration for the project's planning and implementation.

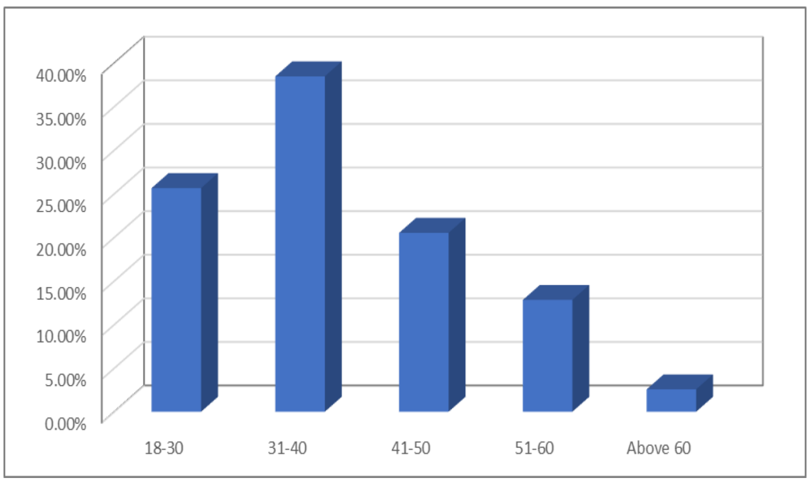


Figure 4.22: Population among the various age groups in the communities

Source: *Natural Eco Capital (2024)*

Figure 4.23 indicates that the majority of the respondents are male (69.23%), while 30.77% are female. , demonstrating a lower representation of women in the surveyed Population. This distribution underscores the need to consider gender dynamics and potential impacts on both men and women in the planning and implementing of the Lagos-Calabar Coastal Road project.

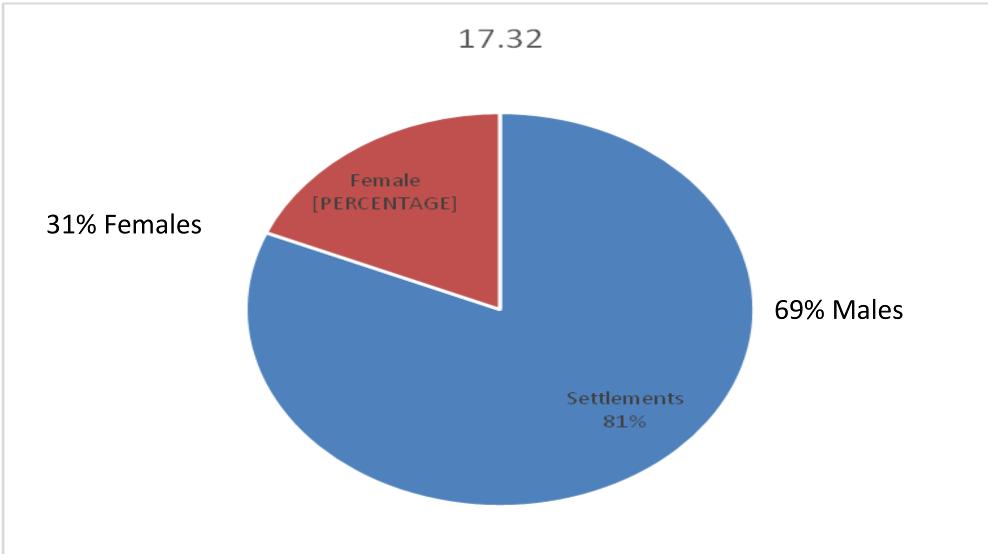


Figure 4.23: Summary of Sex Distribution among the Sampled Population
Source: *Natural Eco Capital (2024)*

Marital Status and Number of Children of Respondents

Figure 4.24 shows that most respondents (78%) are married, while 10% are single. The remaining 12% of respondents are widows or widowers. Additionally, **Figure 4.24** indicates that the predominant number of respondents have 3 to 4 children (26%) or 5 to 6 children (also 26%). Meanwhile, 14% of respondents have either 1 to 2 children or six or more children. Finally, 11% of respondents have no children.

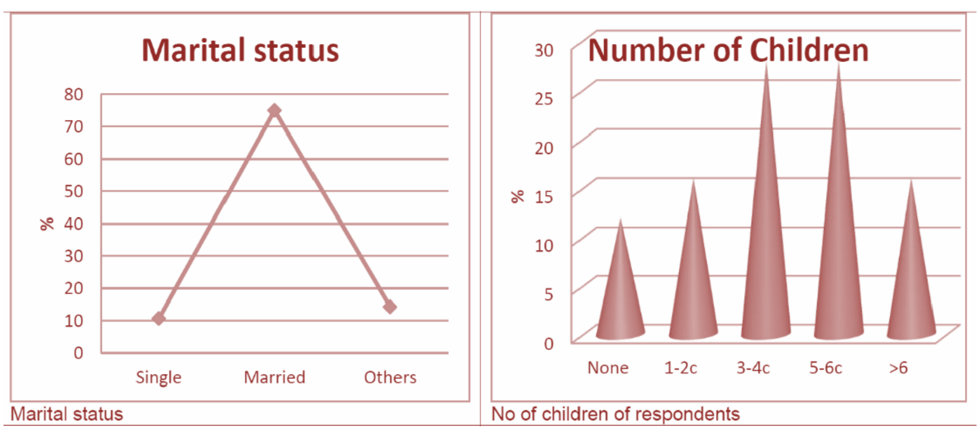


Figure 4.24: Marital Status and Number of Children of Respondents.
Source: *Natural Eco Capital (2024)*

4.23.2.7 Household Size

The average household size of about eight (8) among the respondents (Table 4.26) is above the six (6) recorded by NBS 2012 for Lagos State.

Table 4.43: Household Size of Respondents

Communities	Average Household Size	Number of Households

Eko Atlantic	8	786
Oniru	7	258
Marwa	7	436
Elegushi	9	317
Ilasan Iroko Awe	6	352
Aro/Ologolo	8	430
Jakande	9	402
Lafiaji	7	278
Okun Aja	6	491
Mopo Ijebu	8	375
Sangotedo	9	292
Igando	7	418
Badore	6	305
Eleko	10	235
Oguntimehin	8	448
Solu Alade	7	382
Solu Orunmija	9	410
Debojo	8	265
Eko Akete	7	398
Idado	6	322
Lakowe	9	288
Iwesolu	8	435
Okunsolu	7	351
Moser Ikoga	9	420
Iwereku	8	250
Akinlade	10	380

The average household size in the communities ranges from 6 to 10 people per household. Most communities have an average household size of 7 or 8 people, while Eleko and Akinlade have the largest average household size of 10 people. In contrast, Ilasan Iroko Awe, Okun Aja, Badore, and Idado have the smallest average household size of 6 people.

The number of households varies greatly among communities, ranging from 235 to 491. Okun Aja has the highest number of households (491), while Eleko has the lowest (235). The majority of communities have between 250-400 households.

There is no clear correlation between average household size and number of households. For example, some communities with larger average household sizes have fewer households (e.g., Eleko), while others with smaller average household sizes have more households (e.g., Okun Aja). The data suggests that household sizes and numbers vary significantly among communities, indicating potential differences in population density, family structures, and socioeconomic factors.

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4.23.2.8 Ethnic Composition

The study observed three (3) main ethnic groups (Table 4.27) among the respondents. As in almost all studies, the aboriginal folkloric entity, the Yoruba people (of Ijebu extraction), dominated other tribal groupings in the project area.

Table 4.44 Ethnicity of the respondent population in the Project Area

Communities	Yoruba	Hausa	Ibo	Others
Eko Atlantic	57.6	2.2	22.5	17.7
Oniru	61.5	2.4	21.7	14.4
Marwa	53.2	2.7	26.1	18
Elegushi	58.5	1.5	23.1	16.2
Ilasan Iroko Awe	56.2	1.3	27.1	15.4
Aro/Ologolo	58.3	2.1	26.4	13.2
Jakande	55.1	2.5	24.9	17.5
Lafiaji	59.2	1.8	25.5	13.5
Okun Aja	54.8	2.3	26.8	16.1
Mopo Ijebu	57.9	1.9	24.2	16
Sangotedo	56.5	2.2	27.3	14
Igando	58.1	1.6	25.9	14.4
Badore	55.5	2.4	26.5	15.6
Eleko	59.5	1.4	23.8	15.3
Oguntimehin	57.3	2.1	25.1	15.5
Solu Alade	56.8	1.9	26.9	14.4
Solu Orunmija	58.2	1.7	24.5	15.6
Debojo	55.9	2.3	26.2	15.6
Eko Akete	57.5	1.8	25.3	15.4
Idado	56.1	2.2	27.4	14.3
Lakowe	59.1	1.5	24.1	15.3
Iwesolu	58.4	1.9	25.7	14
Okunsolu	55.3	2.4	26.6	15.7
Moser Ikoga	57.2	1.7	26.1	15
Iwereku	56.9	2.1	25.5	15.5
Akinlade	59.3	1.4	23.9	15.4

The ethnic distribution across communities shows that Yoruba is the dominant ethnic group, with percentages ranging from 53.2% in Marwa to 61.5% in Oniru. Ibo is the second most prevalent ethnic group, with percentages ranging from 21.7% in Oniru to 27.4% in Idado. Hausa and Others have relatively smaller percentages, ranging from 1.3% in Ilasan Iroko Awe to 2.7% in Marwa, and 13.2% in Aro/Ologolo to 18% in Marwa, respectively.

There are notable variations across communities. Oniru stands out with the highest percentage of Yoruba (61.5%) and the lowest percentage of Others (14.4%). In contrast, Marwa has the lowest percentage of Yoruba (53.2%) and the highest percentage of Others (18%). Ilasan Iroko Awe has the lowest percentage of Hausa (1.3%).

An analysis of correlations reveals a negative correlation between Yoruba and Ibo percentages. This means that communities with higher Yoruba percentages tend to have lower Ibo percentages, and vice versa. However, there is no clear correlation between Hausa and Others percentages.

The data suggests significant ethnic diversity across communities, with varying levels of representation for each ethnic group. The population density and distribution, as well as ethnic diversity, are crucial factors to consider. Understanding these aspects can help the ministry design a road network that efficiently connects densely populated areas, balances the needs of different ethnic groups, and promotes social cohesion. By doing so, the road project can reduce potential conflicts and provide equitable access to resources and opportunities, ultimately contributing to a more harmonious and inclusive community.

4.23.2.9 Religion

The majority, 66% of the respondents, are Christians, 28% are Muslims, and 6% practice traditional religion (**Figure. 4.127**).Source: Field Survey, Feb., 2024

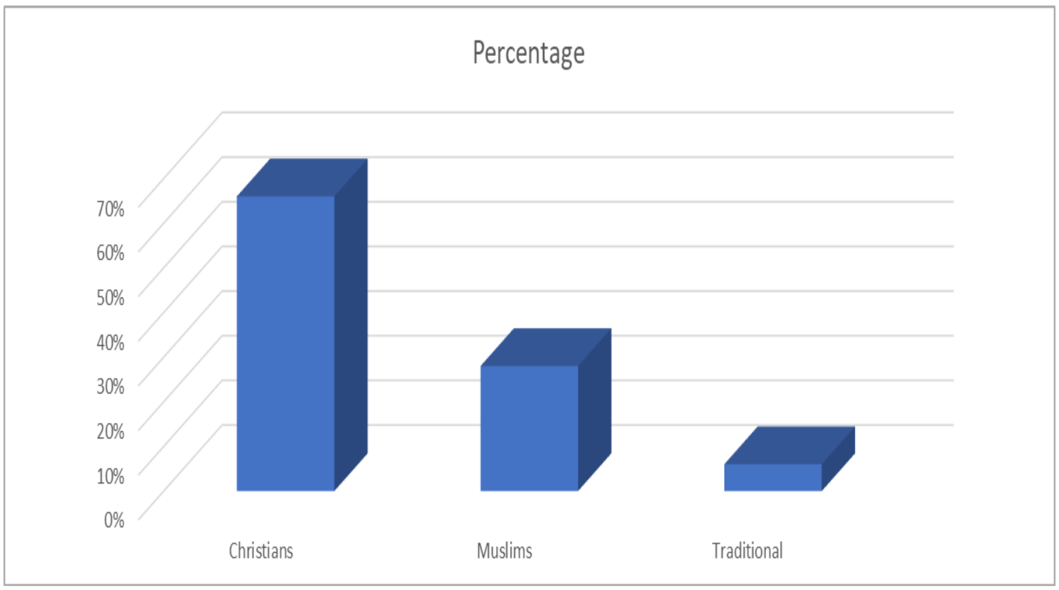


Figure 4.127: Religion and Tribe of Respondents
Source: *Natural Eco Capital (2024)*

4.23.2.10 Existing Infrastructures

The ground-truthing process, along with data gathered from questionnaires and feedback during focus group discussions (FGDs), identified eleven operational schools within the project's area of influence. Please note that this list may not comprehensively cover every host community. Table 4.28 provides details on the names, categories, and ownership of these schools.

Table 4.45: Education facilities within the project sphere of influence

S/N	Name of school	Category	Ownership
1	Local Government Primary school Akodo	Primary	Public
2	Community Junior High school Akodo	Secondary	Public
3	Community High School, Orimedu	Secondary	Public
4	Community Primary School Otolu	Primary	Public
5	Upe Primary school Akode-Ise	Primary	Public
6	Edidot College, Awoyaya	Secondary	Private
7	Alpha Covenant Heritage School, Awoyaya	Secondary	Private
8	Crane College, Sangotedo	Secondary	Private
9	Eti-Osa Community Senior High School	Secondary	Public
10	Almond springs school Igando	Primary	Private
11	Igando Community High School	Secondary	Public

According to the table, all educational institutions within the project area are either publicly or privately owned and offer affordable tuition fees. Approximately 21% of the schools have basic water supply and toilet facilities. However, some respondents noted a lack of sufficient teaching staff and instructional materials. Additionally, there are a few skill acquisition centers in the project area, which help improve adult literacy levels and may contribute to increasing the availability of a middle-level workforce for the proposed project.

4.23.2.11 Educational Attainment

Data revealed that 12.82% of the respondents have completed primary education, reflecting a basic level of literacy and education. Approximately 28.21% have attained secondary education, while a substantial 43.59% have achieved tertiary education, indicating a well-educated group with specialized skills and knowledge. This highly educated segment is likely to have a significant impact on local development and economic activities. Furthermore, 15.38% of respondents hold postgraduate degrees, representing the most advanced level of education and suggesting a population with expertise suitable for high-level decision-making and professional roles. Overall, the educational background of the respondents illustrates a community with diverse academic qualifications, ranging from primary to postgraduate levels, which is crucial for understanding the varied impacts of the Lagos-Calabar Coastal Road project on different educationally diverse groups.

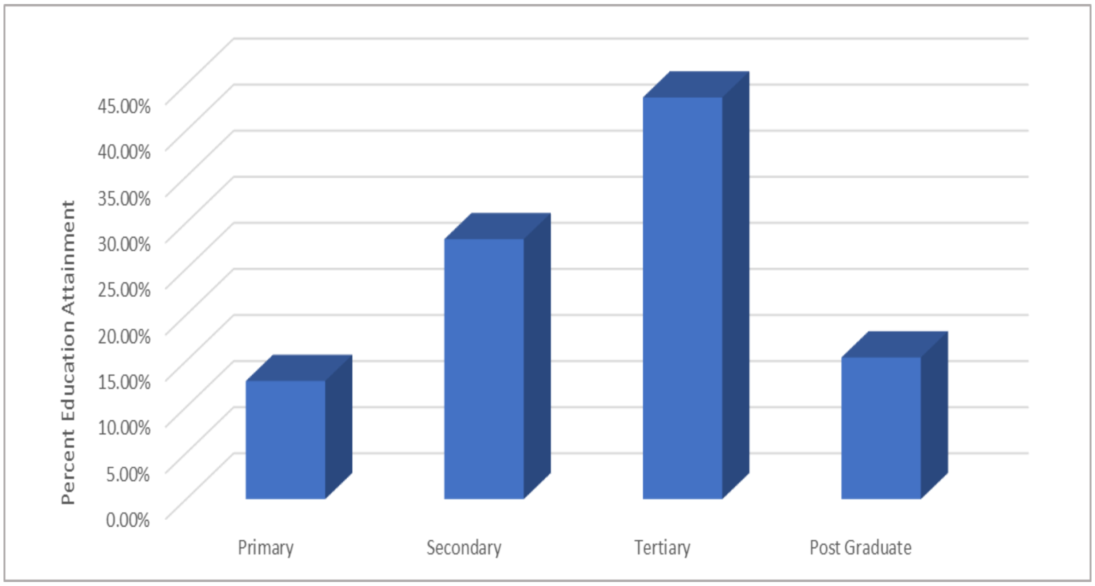


Figure 4.128: Educational Attainment of Respondent
Source: *Natural Eco Capital (2024)*

The educational attainment data has implications for the proposed road project's workforce development and community engagement strategies. With a high percentage of individuals having completed primary and secondary education, there is a potential workforce with basic skills that can be leveraged for construction and maintenance jobs. Additionally, understanding the educational background of the communities can help tailor engagement and communication strategies, ensuring that information about the road project is accessible and understandable to all. This can also inform capacity-building initiatives, such as training programs, to equip community members with skills to participate in the road project's construction and maintenance, thereby fostering a sense of ownership and inclusivity

Plate 4.18 illustrates some of the educational institutions pictorially within the affected communities.

St. David Anglican Primary School Magbon-alade primary school Alade primary school

Eti-Osa Community High School Igando Community High School Community Junior high school Orimedu

Plate 4.19: Some schools within the project sphere of influence

4.23.3.12 Access to Potable Water

The PAC's potable water access is obtained chiefly via private wells (Table 4.29) complemented by the communally owned borehole.

Table 4.46: Percentage access of respondents to Water Sources across the Project Area

Communities	Communal borehole	Surface water/Rain	Private well/borehole
Eko Atlantic	9	0	27
Oniru	6	0	34
Marwa	10	0	30
Elegushi	2	0	36
Ilasan Iroko Awe	4	0	18
Aro/Ologolo	2	0	24
Jakande	7	0	29
Lafiaji	8	0	32
Okun Aja	5	0	26
Mopo Ijebu	6	0	30
Sangotedo	4	0	22
Igando	10	0	28
Badore	3	0	34
Eleko	5	0	24
Oguntimehin	9	0	31
Solu Alade	7	0	33
Solu Orunmija	8	0	30
Debojo	6	0	32
Eko Akete	4	0	36
Idado	10	0	26
Lakowe	8	0	32
Iwesolu	7	0	28
Okunsolu	5	0	34
Moser Ikoga	9	0	30
Iwereku	6	0	32
Akinlade	10	0	28

The analysis of the reduced data reveals that communal borehole usage is relatively low across all communities, ranging from 2% to 10%. This suggests that communal boreholes may not be a primary source of water for most communities. In contrast, private well/borehole usage is significantly higher, ranging from 22% to 36%, indicating that many communities rely heavily on private wells and boreholes for their water needs.

Interestingly, there is no recorded usage of surface water/Rain in any of the communities, suggesting that this source may not be viable or accessible for these areas. Furthermore, there is variation in the usage of communal boreholes and private wells/boreholes across communities. Some communities, like Elegushi and Eko Akete, have very low communal borehole usage (2%) and high private well/borehole usage (36%). Others, like Igando and Idado, have higher communal borehole usage (10%) and lower private well/borehole usage (28%).

The results suggest that there may be opportunities to develop and improve communal borehole infrastructure, as well as explore alternative water sources, to increase access to clean water for these communities. Overall, the data provides valuable insights into the water source usage patterns of these communities, which can inform water resource management and development strategies.

Plate 4.19: Wells in the project-affected communities

The 63.1% average of respondents having access to a potable water source is lower than the average Nigerian of 67.3 (NBS 2012). The smaller sampling size and the semi-urban nature of the PACs may have accounted for this deviation. Nonetheless, Temitope *et al*., 2020, recorded similar percentages of potable water access in Ibeju-Lekki and Epe LGA, Lagos State.

4.23.3.13 Households' Main Source of Energy

The data reveals varying levels of adoption for different cooking fuels across the communities. Gas Cooker usage is relatively consistent, with a few exceptions, such as Eko Atlantic, Aro/Ologolo, and Lakowe, which have the highest usage rates. In contrast, Electric Cooker usage is generally low, with only a few communities, like Okun Aja, Sangotedo, and Eko Akete, showing slightly higher adoption rates.

Paraffin/kerosene usage is high in some communities, such as Oniru, Aro/Ologolo, and Badore, indicating a reliance on this fuel source. This is concerning, as paraffin/kerosene is a hazardous fuel that can cause indoor air pollution. Firewood (biomass) usage is also high in some communities, like Oniru, Aro/Ologolo, and Debojo, suggesting a continued reliance on traditional fuel sources.

Table 4.47: Household Main Source of Energy for cooking and lighting

Communities	Cooking				Lighting				
	Gas Cooker	Electric Cooker	Paraffin/ kerosene	Firewood (biomass)	Electricity	Solar lamp	Candles	Generators	Torchlight
Eko Atlantic	15	5	16	6	24	7	4	2	32
Oniru	7	2	28	12	2	1	9	3	41
Marwa	13	6	19	8	9	3	5	1	42
Elegushi	12	4	23	8	20	4	6	1	28
Ilasan Iroko Awe	10	3	17	7	5	2	3	1	20
Aro/Ologolo	14	4	27	11	22	5	4	1	18
Jakande	11	4	20	9	18	4	5	2	25
Lafiaji	9	3	22	10	12	3	6	2	30
Okun Aja	12	5	18	8	15	4	4	1	22
Mopo Ijebu	10	4	21	9	10	3	5	2	28
Sangotedo	13	5	19	8	12	4	4	1	25
Igando	11	4	20	9	18	4	5	2	22
Badore	9	3	23	10	15	3	6	2	30
Eleko	12	5	18	8	12	4	4	1	25
Oguntimehin	10	4	21	9	10	3	5	2	28
Solu Alade	13	5	19	8	12	4	4	1	22
Solu Orunmija	11	4	20	9	18	4	5	2	25
Debojo	9	3	23	10	15	3	6	2	30
Eko Akete	12	5	18	8	12	4	4	1	22
Idado	10	4	21	9	10	3	5	2	28
Lakowe	13	5	19	8	12	4	4	1	25
Iwesolu	11	4	20	9	18	4	5	2	22
Okunsolu	9	3	23	10	15	3	6	2	30
Moser Ikoga	12	5	18	8	12	4	4	1	25
Iwereku	10	4	21	9	10	3	5	2	28
Akinlade	13	5	19	8	12	4	4	1	22

The data reveals varying levels of adoption for different lighting sources across the communities. Electricity is the most widely used source, with Eko Atlantic, Aro/Ologolo, and Elegushi having the highest usage rates. However, there are communities like Oniru, Ilasan Iroko Awe, and Idado that have significantly lower electricity usage rates.

Solar lamp usage is relatively low, with Eko Atlantic, Aro/Ologolo, and Sangotedo having the highest adoption rates. Candles are widely used, with Oniru, Marwa, and Lafiaji having the highest usage rates. Generators are used sparingly, with Oniru, Marwa, and Jakande having the highest usage rates. Torchlight usage is widespread, with Oniru, Marwa, and Igando having the highest usage rates.

4.23.3.14 Household Construction Materials

Roofing, walling and flooring house materials were also studied. These parameters are an indirect index of the life quality of the respondent's populations. The results are presented in Table 4.31.

Table 4.48: Construction materials of respondent houses in the project area

Community	Roofing materials					Walling materials				Flooring materials		
	Corrugated Iron Sheets	Asbestos	Aluminium roofing	Unroofed building	Thatch	Mud	Concrete (blocks)	Thatch	Bamboo	Earth/sand /dirt/straw	Ceramic Tiles	Smooth Cement
Eko Atlantic	14	9	6	1	1	10	22	1	0	2	16	5
Oniru	8	5	3	4	6	12	9	4	1	8.2	6	12
Marwa	10	7	5	2	3	5	17	4	0	3.7	13.3	7.2
Elegushi	7	3	2	3	4	6	7	2	0	7.2	5.4	14
Ilasan Iroko Awe	9	4	3	2	3	7	9	3	0	3	9	6
Aro/Ologolo	10	6	5	4	1	9	14	2	0	4.5	11.1	8.5
Jakande	12	8	4	1	2	10	11	3	0	6.1	7.3	10.2
Lafiaji	9	5	3	3	5	7	9	3	0	5.3	8.5	9.1
Okun Aja	11	7	5	2	2	5	16	4	0	3.2	12.2	7.5
Mopo Ijebu	8	4	3	4	6	8	10	3	0	4.9	9.9	8.1
Sangotedo	10	6	4	3	2	8	12	2	0	6.5	7.1	10.5
Igando	12	8	5	1	1	9	10	3	0	5.7	8.1	9.3
Badore	9	5	3	3	5	7	8	4	0	4.2	10.3	8.3
Eleko	11	7	5	2	2	7	9	3	0	3.5	11.5	7.8
Oguntimehin	8	4	3	4	6	9	12	3	0	5.9	8.3	9.5
Solu Alade	10	6	4	3	2	9	12	3	0	6.2	7.5	10.1
Solu Orunmija	12	8	5	1	1	7	9	3	0	4.8	9.2	8.4
Debojo	9	5	3	3	5	6	8	4	0	5.1	8.7	9.2
Eko Akete	11	7	5	2	2	8	10	3	0	3.8	11.1	7.9
Idado	8	4	3	4	6	7	9	4	0	4.4	9.5	8.2
Lakowe	10	6	4	3	2	8	9	3	0	6.3	7.3	10.3
Iwesolu	12	8	5	1	1	9	13	2	0	5.5	8.5	9.6
Okunsolu	9	5	3	3	5	8	10	3	0	4.1	10.1	8.5
Moser Ikoga	11	7	5	2	2	8	11	3	0	5.8	8.1	9.4
Iwereku	8	4	3	4	6	7	9	3	0	3.9	11.3	7.7
Akinlade	10	6	4	3	2	8	11	3	0	6.4	7.2	10.2

The data analysis reveals that Corrugated Iron Sheets are the most widely used roofing material, with an average of 9.5 houses per community, followed by Asbestos, Aluminium roofing, Unroofed buildings, and Thatch. In terms of walling materials, Mud is the most widely used, with an average of 7.3 houses per community, followed by Concrete (blocks), Thatch, and Bamboo. For flooring materials, Earth/sand/dirt/straw is the most widely used, with an average of 5.1 houses per community, followed by Ceramic Tiles and Smooth Cement.

Eko Atlantic stands out as having the highest number of houses with Corrugated Iron Sheets (14) and Concrete (blocks) (22). Oniru has the highest number of houses with Asbestos (5) and Thatch (6), while Marwa has the highest number of houses with Aluminium roofing (5) and Earth/sand/dirt/straw (3.7). Igando has the highest number of houses with Ceramic Tiles (8.1) and Smooth Cement (9.3). These findings suggest that different communities have varying preferences and needs when it comes to building materials, and that further investigation may be necessary to understand the underlying factors driving these choices.

Plate 4.20: Roofing materials in the project area

Plate 4.21: Walling materials in the project area

The study also correlated income levels, educational status and lifetime exposure to types of flooring materials used by respondents. The obtained data mirrors the NBS data for semi-urban areas in Nigeria, and the data also agrees with the reports of Terzi and Pauline, 2008.

4.23.3.15 Household Waste Management

4.16 Refuse disposal

In the project area, respondents dispose of their solid waste using two methods: open dumping and burning. Open dumping is the most common method, used by 50% of households, indicating a lack of waste disposal services or the inefficiency of any existing services. This is followed by incineration, practiced by 25% of households, while some use both methods (25%). The high percentage of respondents using open dumping may contribute to the prevalence of environmental and public health diseases (see Health section) and affect some mammalian, herpetofauna, and raptor species surveyed in this study (see Biodiversity section). The 25% of respondents who incinerate their waste highlight potential air quality deterioration and increased respiratory health risks. These findings have led to the inclusion of an awareness campaign in the ESMP design.

4.16.1 Sewage disposal

The study area reveals three sewage disposal practices: water closets (WC), pit latrines, and open defecation. Approximately two-thirds of the respondents use water closets and other sewage disposal methods. This data shows a linear correlation with housing construction materials, social status, and, to a lesser extent, educational level, with about 75% of respondents using either pit latrines or open defecation. Most respondents using WCs live in the urbanized areas of the project communities. According to Vera and Christin (2021), open defecation is more prevalent in rural areas. The relatively high level of open defecation in the area may partly explain the presence of E. coli in the soil.

4.16.2 Household Facilities

Several facilities were surveyed among households within the project's sphere of influence. These include power generators, televisions, cars/trucks and refrigerators. Table 4.32 provides the household facilities used by the respondent populations in the project area.

Table 4.49: % Household Facilities among Respondents

Community	Power generator	Gas/ Kerosene stove	Refrigerator	Television	Radio	Car/ Truck	Motor Cycle	Bicycle	House in town	Land in town
Eko Atlantic	16	15	4	7	19	8	11	5	3	7
Oniru	22	18	6	11	25	12	16	8	5	9
Marwa	13	11	3	6	16	6	9	3	2	5
Elegushi	18	10	2	10	12	13	7	9	4	6
Ilasan Iroko Awe	22	14	10	13	18	20	11	10	7	10
Aro/Ologolo	19	12	5	9	20	10	14	6	4	8
Jakande	20	13	7	12	22	15	12	8	5	9
Lafiaji	15	9	4	8	18	9	10	5	3	6
Okun Aja	18	11	6	10	19	12	13	7	4	7
Mopo Ijebu	14	8	3	7	15	7	9	4	2	5
Sangotedo	21	15	8	13	24	16	14	9	6	10
Igando	17	10	5	9	20	11	12	6	4	8
Badore	16	9	4	8	17	9	10	5	3	6
Eleko	19	12	6	11	21	13	14	8	5	9
Oguntimehin	15	8	3	7	16	8	9	4	2	5
Solu Alade	20	14	7	12	23	15	13	9	6	10
Solu Orunmija	18	11	5	10	19	12	12	7	4	8
Debojo	17	10	4	9	18	10	11	6	3	7
Eko Akete	19	13	6	11	22	14	15	9	5	9
Idado	16	9	4	8	17	9	10	5	3	6
Lakowe	21	15	8	13	24	16	14	9	6	10
Iwesolu	20	14	7	12	23	15	13	9	6	10
Okunsolu	18	11	5	10	19	12	12	7	4	8
Moser Ikoga	19	13	6	11	22	14	15	9	5	9
Iwereku	17	10	4	9	18	10	11	6	3	7
Akinlade	21	15	8	13	24	16	14	9	6	10

**N/B the percentage may exceed 100% as some respondents may possess more than one household facility

The finding that Ilasan Iroko Awe and Sangotedo have the highest number of power generators (22) speaks to the area's erratic/non-existent power supply. Regrettably, the near-exclusive use of power generating sets in these communities instead of power supply from the national grid adversely impacts the environment. The high number of televisions (13) and radio/cassette/music systems (25) in Oniru and Sangotedo highlights the people's affinity for information.

Cars, motorcycles, and bicycles are the primary means of transportation among the respondents, with Ilasan Iroko Awe having the highest number of cars/trucks (20) and Oniru having the highest number of bicycles (9). The lower average percentage of respondents who own lands (8) and houses in town (4) invariably speaks to the respondents' lower-level social cadre, implying the need for livelihood restoration/enhancement measures.

More persons owning a kerosene/gas stove (18 in Oniru), cars (20 in Ilasan Iroko Awe), motorcycles (16 in Sangotedo), and generating sets (22 in Ilasan Iroko Awe) reveal the people's reliance on DPK and PMS than AGO and LPG products.

4.17 Economics and Livelihoods of Households

4.17.1 Occupation

The host community's economic life revolves mainly around fishing, farming and trading. Other livelihood activities among the respondents include artisans, firewood trading, food vending, and processing. Table 4.33 shows the percentage occupational distribution of the people.

Table 4.50 Percentage Occupational distribution of respondents in the study area

Community	Fishing/Aquaculture	Pastoralist	Self-employed	Private employee	Public employee	Farming and trading
Eko Atlantic	17	0.1	2.5	3.6	6.4	10
Oniru	5	1	1.5	1.6	2	5
Marwa	8	0.2	2.3	2.4	3	8
Elegushi	13	0.7	1.2	1.4	1.6	3
Ilasan Iroko Awe	15	0.6	1.4	1.3	4	4
Aro/Ologolo	10	0.4	1.8	2.1	2.8	6
Jakande	12	0.5	1.6	1.9	3.2	5
Lafiaji	9	0.3	1.4	1.7	2.4	4
Okun Aja	11	0.6	1.7	2.3	3.5	6
Mopo Ijebu	7	0.2	1.3	1.5	2.1	3
Sangotedo	14	0.8	1.9	2.6	4.1	7
Igando	10	0.4	1.6	2.1	2.9	5
Badore	8	0.3	1.4	1.7	2.4	4
Eleko	12	0.5	1.7	2.2	3.3	6
Oguntimehin	9	0.4	1.5	1.9	2.7	5
Solu Alade	13	0.7	1.8	2.4	3.6	6
Solu Orunmija	11	0.5	1.6	2.1	3.2	5
Debojo	10	0.4	1.5	1.9	2.8	4
Eko Akete	12	0.6	1.7	2.3	3.5	6
Idado	9	0.3	1.4	1.7	2.4	4

Lakowe	14	0.8	1.9	2.6	4.1	7
Iwesolu	13	0.7	1.8	2.4	3.6	6
Okunsolu	11	0.5	1.6	2.1	3.2	5
Moser Ikoga	10	0.4	1.5	1.9	2.8	4
Iwereku	9	0.4	1.4	1.7	2.4	4
Akinlade	12	0.6	1.7	2.3	3.5	6

The majority of respondents in the project area depend on fishing/aquaculture for their livelihood, with Sangotedo and Lakowe having the highest percentages at 14%. This suggests that fishing/aquaculture is a vital economic activity in these communities.

The higher percentage of self-employed and private employees in Sangotedo and Lakowe compared to the other communities affirms the urbanized and commercialized status of these communities. This is likely due to their coastal location, which provides access to markets and trade opportunities. The reduced presence of pastoralist respondents in Eko Atlantic and Oniru may indicate either fewer numbers or daily diurnal movements out of the community. The urbanized and coastal nature of these areas would have accounted for the reduced pastoralist respondents, as pastoralism is often associated with rural and inland areas.

The higher percentage of public employees in Ilasan Iroko Awe and Sangotedo suggests a stronger presence of government institutions and services in these communities. This may be due to their larger population size or more developed infrastructure. The lower percentage of farming and trading respondents in Elegushi and Mopo Ijebu may indicate a reduced focus on agriculture and trade in these communities. This could be due to their smaller population size or less developed infrastructure.

Overall, the data suggests that the project area has a diverse economy with varying levels of urbanization, commercialization, and economic activities. Understanding these dynamics is crucial for effective project planning and implementation.

4.17.2 Household Income levels

Table 4.34: Constraints to Livelihood Activities in the project area

Communities	Poor Quality land	Flooding	Low water quality	Lack of inputs	Lack of capital	Lack of storage facilities	Low processing capacity/power supply	Inadequate extension	Poor marketing channel
Eko Atlantic	0.32	0.23	0.4	0.42	0.6	0.45	0.42	0.27	0.3
Oniru	0.4	0.41	0.45	0.35	0.47	0.5	0.48	0.42	0.21
Marwa	0.27	0.33	0.44	0.3	0.53	0.2	0.38	0.26	0.11
Elegushi	0.24	0.5	0.1	0.1	0.61	0.2	0.3	0.2	0.58
Ilasan Iroko Awe	0.28	0.45	0.2	0.12	0.58	0.18	0.34	0.5	0.32
Aro/Ologolo	0.26	0.32	0.16	0.15	0.4	0.2	0.44	0.2	0.15
Jakande	0.31	0.29	0.39	0.25	0.49	0.35	0.41	0.29	0.24

Lafiaji	0.25	0.38	0.22	0.18	0.52	0.25	0.36	0.23	0.19
Okun Aja	0.29	0.44	0.25	0.2	0.56	0.22	0.39	0.25	0.27
Mopo Ijebu	0.33	0.27	0.46	0.28	0.51	0.38	0.43	0.31	0.22
Sangotedo	0.23	0.48	0.14	0.16	0.59	0.24	0.33	0.22	0.18
Igando	0.3	0.35	0.29	0.22	0.46	0.3	0.4	0.28	0.26
Badore	0.26	0.42	0.19	0.19	0.55	0.27	0.37	0.24	0.2
Eleko	0.28	0.39	0.24	0.21	0.54	0.26	0.35	0.26	0.23
Oguntimehin	0.32	0.28	0.41	0.26	0.5	0.36	0.42	0.3	0.25
Solu Alade	0.25	0.43	0.21	0.17	0.57	0.23	0.34	0.23	0.2
Solu Orunmija	0.29	0.33	0.27	0.23	0.48	0.29	0.39	0.27	0.24
Debojo	0.27	0.4	0.23	0.2	0.53	0.29	0.38	0.26	0.22
Eko Akete	0.3	0.36	0.26	0.22	0.5	0.32	0.4	0.28	0.25
Idado	0.29	0.43	0.24	0.2	0.55	0.28	0.38	0.25	0.22
Lakowe	0.25	0.39	0.21	0.18	0.52	0.25	0.36	0.23	0.2
Iwesolu	0.31	0.29	0.39	0.25	0.49	0.35	0.41	0.29	0.24
Okunsolu	0.27	0.42	0.23	0.2	0.54	0.27	0.37	0.24	0.21
Moser Ikoga	0.28	0.45	0.2	0.12	0.58	0.18	0.34	0.5	0.32
Iwereku	0.26	0.32	0.16	0.15	0.4	0.2	0.44	0.2	0.15
Akinlade	0.3	0.35	0.29	0.22	0.46	0.3	0.4	0.28	0.26
Ranking	4th	3rd	7th	9th	1st	5th	2th	6th	8th

Each constraint is represented as a proportion, with higher values indicating greater challenges in that area.

Overall, the **lack of capital** emerges as the most significant constraint across the communities, affecting their ability to invest in and sustain livelihood activities. It is a common issue in almost all the communities, with values reaching as high as 0.61 in Elegushi. The **low processing capacity and power supply** are prevalent issues that affect the efficiency and productivity of livelihood activities. Communities like Eko Atlantic and Oguntimehin have high values (0.42 each), indicating significant challenges in processing and power availability. **Flooding** is another major concern, with communities such as Elegushi (0.50) and Oniru (0.41) facing severe issues that impact daily life and economic activities.

Poor quality land impacts agricultural productivity, with communities like Eko Atlantic (0.32) and Mopo Ijebu (0.33) experiencing notable challenges. The **lack of storage facilities** is a significant issue for several communities, affecting the preservation of goods and produce, with Oniru facing a high constraint (0.50). **Inadequate extension services** limit access to agricultural improvements, with Ilasan Iroko Awe showing a high constraint (0.50). **Low water quality** affects health and productivity, with Oniru (0.45) and Mopo Ijebu (0.46) experiencing notable challenges. **Poor marketing channels** limit the ability to effectively sell goods and services, with Elegushi facing a significant challenge (0.58). The **lack of inputs**, while a constraint, ranks lower compared to other issues but is still a notable problem in some areas like Eko Atlantic (0.42).

On a community-specific level, **Eko Atlantic** faces significant challenges with low water quality and lack of inputs, both at 0.42, and lack of capital at 0.6, which is notably high. **Oniru** has a balanced distribution of challenges with a particular emphasis on low processing capacity (0.48) and lack of storage facilities (0.50). **Marwa** experiences moderate challenges across most constraints, with lack of capital being the most pressing (0.53). **Elegushi** faces severe flooding (0.50) and poor marketing channels (0.58), indicating challenges in environmental management and economic activity. **Ilasan Iroko Awe** faces high challenges with inadequate extension services (0.50) and lack of capital (0.58). **Jakande** and **Iwesolu** both face significant challenges related to poor quality land and lack of storage facilities, reflecting agricultural constraints.

The pervasive issue of lack of capital suggests a need for financial assistance programs and microfinance initiatives to support economic development. Investments in power supply and storage facilities are crucial to enhance processing capabilities and economic resilience. Addressing flooding and water quality through infrastructure projects and environmental planning is essential to improve environmental management. Improving extension services and providing better access to inputs can significantly boost agricultural productivity and livelihood stability.

4.17.3 Communication Facilities

The people in the project area have access to mobile communication through fixed wireless lines provided by communication service providers like MTN, GLO, AIRTEL and 9MOBILE. There are no postal services in the area, but the inhabitants obtain news via radio, television and other digital devices. Plate 4.23 presents some telecom masts observed in the project area.

Plate 4.22: Telecom masts observed in the project area

4.17.4 Transportation and Infrastructure Patterns by Community

This report explores the transportation and infrastructure dynamics across various communities, providing insights into commuting habits, transportation spending, and the effectiveness of infrastructure in facilitating access to essential services. It includes:

4.17.5 Commute Distance and Travel Frequency by Community

Understanding commute distance and travel frequency provides valuable insights into the daily transportation dynamics of various communities. Baseline data is presented in Table 4.35

Table 4.51 Average Commute Distance and Travel frequency out of Community

	Average Commute Distance				**Travel Frequency out of Community**			
Community	**Less than 5 km**	**5-10 km**	**10-20 km**	**More than 20 km**	**Daily**	**Weekly**	**Monthly**	**Rarely**
Eko Atlantic	60%	20%	15%	5%	40%	30%	20%	10%
Oniru	55%	25%	15%	5%	35%	35%	20%	10%
Marwa	50%	30%	15%	5%	30%	40%	20%	10%
Elegushi	45%	35%	15%	5%	38%	32%	20%	10%
Ilasan Iroko Awe	40%	40%	15%	5%	25%	40%	25%	10%
Aro/Ologolo	35%	45%	15%	5%	20%	35%	30%	15%
Jakande	30%	50%	15%	5%	15%	30%	40%	15%
Lafiaji	25%	55%	15%	5%	10%	25%	45%	20%
Okun Aja	20%	60%	15%	5%	8%	20%	50%	22%
Mopo Ijebu	15%	65%	15%	5%	5%	15%	55%	25%
Sangotedo	10%	70%	15%	5%	3%	10%	60%	27%
Igando	5%	75%	15%	5%	2%	8%	65%	25%
Badore	5%	80%	10%	5%	1%	5%	70%	24%
Eleko	5%	85%	5%	5%	1%	3%	75%	21%
Oguntimehin	5%	90%	0%	5%	1%	2%	80%	17%
Solu Alade	0%	95%	0%	5%	1%	1%	85%	13%
Solu Orunmija	0%	100%	0%	0%	1%	1%	90%	8%
Debojo	0%	100%	0%	0%	1%	1%	92%	6%
Eko Akete	0%	100%	0%	0%	1%	1%	95%	3%
Idado	0%	100%	0%	0%	1%	1%	98%	0%
Lakowe	0%	100%	0%	0%	1%	0%	100%	0%
Iwesolu	0%	100%	0%	0%	0%	0%	100%	0%
Okunsolu	0%	100%	0%	0%	0%	0%	100%	0%
Moser Ikoga	0%	100%	0%	0%	0%	0%	100%	0%
Iwereku	0%	100%	0%	0%	0%	0%	100%	0%
Akinlade	0%	100%	0%	0%	0%	0%	100%	0%

In the **short commute distance category (less than 5 km)**, communities such as Eko Atlantic, Oniru, Marwa, and Elegushi have a higher percentage of residents with short commutes, ranging from 60% in Eko Atlantic to 45% in Elegushi. This suggests that essential services and workplaces are relatively close, reducing the need for long commutes.

In the **moderate commute distance category (5-10 km)**, the majority of residents in communities like Ilasan Iroko Awe to Okun Aja commute within this range. This indicates that while services are not immediately nearby, they are still within a reasonable distance.

Across all communities, a consistent 15% of residents commute between 10-20 km, while 5% travel more than 20 km, highlighting a minority who need to travel longer distances, possibly due to specific work or service requirements.

For **travel frequency**, communities like Eko Atlantic to Elegushi have a higher percentage of residents traveling daily, with Eko Atlantic at 40% and Elegushi at 38%. This indicates active community engagement and the necessity for frequent access to services or work. Weekly travel is significant in communities such as Eko Atlantic to Ilasan Iroko Awe, with percentages ranging from 30% to 40%, suggesting that many residents balance local and slightly more distant engagements.

Communities further down the list, such as Aro/Ologolo to Akinlade, show an increasing trend towards monthly or rare travel. This implies limited necessity or ability to travel frequently, potentially due to distance, transportation availability, or local service sufficiency.

In summary, communities like Eko Atlantic and Oniru, with higher short-distance commutes, likely have better access to essential services and work opportunities within or near the community. As the distance from major urban centers increases, the frequency of travel decreases, as seen from communities like Okun Aja to Akinlade. This may reflect both the availability of local resources and possible transportation challenges. The consistent 15% commuting 10-20 km across communities suggests that certain jobs or services necessitate travel to more distant locations, a trend seen consistently across all communities

4.17.6 Transportation Spending Patterns and Modes of Transportation by Community

Transportation spending patterns and the choice of transportation modes offer critical insights into the economic and logistical aspects of commuting within different communities. This section delves into how residents allocate their budgets for transportation and the predominant modes they use, revealing both financial and practical aspects of their daily travel (Table 4.36).

Table 4.52: Monthly Transportation Spend and Primary Mode of Transport

Community	Monthly Transportation Spend				Primary Mode of Transportation				
	Less than ₦5,000	₦5,000-₦10,000	₦10,000-₦20,000	More than ₦20,000	Car	Bus	Motor cycle	Bicycle	Walking
Eko Atlantic	10%	20%	40%	30%	70%	15%	5%	5%	5%
Oniru	15%	25%	35%	25%	65%	20%	5%	5%	5%
Marwa	20%	30%	30%	20%	60%	25%	5%	5%	5%
Elegushi	25%	35%	25%	15%	55%	30%	5%	5%	5%
Ilasan Iroko Awe	30%	40%	20%	10%	50%	35%	5%	5%	5%
Aro/Ologolo	35%	45%	15%	5%	45%	40%	5%	5%	5%
Jakande	40%	50%	10%	0%	40%	45%	5%	5%	5%
Lafiaji	45%	55%	0%	0%	35%	50%	5%	5%	5%
Okun Aja	50%	60%	0%	0%	30%	55%	5%	5%	5%
Mopo Ijebu	55%	65%	0%	0%	25%	60%	5%	5%	5%
Sangotedo	60%	70%	0%	0%	20%	65%	5%	5%	5%
Igando	65%	75%	0%	0%	15%	70%	5%	5%	5%
Badore	70%	80%	0%	0%	10%	75%	5%	5%	5%
Eleko	75%	85%	0%	0%	5%	80%	5%	5%	5%
Oguntimehin	80%	90%	0%	0%	5%	85%	0%	5%	5%
Solu Alade	85%	95%	0%	0%	0%	90%	0%	5%	5%
Solu Orunmija	90%	100%	0%	0%	0%	95%	0%	0%	5%

Debojo	95%	100%	0%	0%	0%	100%	0%	0%	0%
Eko Akete	100%	0%	0%	0%	0%	100%	0%	0%	0%
Idado	100%	0%	0%	0%	0%	100%	0%	0%	0%
Lakowe	100%	0%	0%	0%	0%	100%	0%	0%	0%
Iwesolu	100%	0%	0%	0%	0%	100%	0%	0%	0%
Okunsolu	100%	0%	0%	0%	0%	100%	0%	0%	0%
Moser Ikoga	100%	0%	0%	0%	0%	100%	0%	0%	0%
Iwereku	100%	0%	0%	0%	0%	100%	0%	0%	0%
Akinlade	100%	0%	0%	0%	0%	100%	0%	0%	0%

Communities such as Eko Atlantic and Oniru are identified as high monthly spending areas, with a notable portion of residents spending over ₦20,000 monthly on transportation. In Eko Atlantic, 30% of respondents fall into this high spending category, while in Oniru, the figure is 25%. This trend is coupled with a high reliance on private vehicles, as evidenced by car usage rates of 70% in Eko Atlantic and 65% in Oniru. This preference for private transportation suggests higher income levels among residents and contributes to increased transportation costs.

In contrast, Marwa and Elegushi are classified as moderate monthly spending communities. In Marwa, 20% of residents spend more than ₦20,000 monthly on transportation, with 60% of the population relying on cars. Buses are also utilized by 25% of respondents. Elegushi shows slightly lower spending, with 15% of residents spending over ₦20,000. Here, 55% use cars, and 30% prefer buses. These patterns indicate a balanced approach between private and public transportation, suggesting that improvements in bus services could attract more users.

Communities from Ilasan Iroko Awe to Badore exhibit low monthly transportation spending, with most residents spending between ₦5,000 and ₦10,000. The primary mode of transportation shifts from cars to buses, with car usage decreasing from 50% in Ilasan Iroko Awe to 10% in Badore. This shift highlights a growing reliance on public transport, underscoring the need for enhanced bus services to better support these communities.

In the minimal spending category, communities from Eleko to Akinlade spend less than ₦5,000 monthly on transportation. These areas show complete dependence on buses, with 100% of respondents using them in several communities. This heavy reliance on public transport suggests limited private car ownership and possibly lower income levels, emphasizing the need for significant investment in public transport infrastructure to improve service quality and accessibility.

Regarding primary modes of transportation, car-dominant communities like Eko Atlantic, Oniru, Marwa, and Elegushi exhibit higher car usage, reflecting better access to private transportation and higher income levels. Conversely, bus-dominant communities from Aro/Ologolo to Akinlade show a strong reliance on buses, particularly where 100% of respondents use them, indicating fewer private car ownership options and potentially lower income levels.

Alternative modes of transportation such as motorcycles, bicycles, and walking are minimally utilized across all communities, potentially due to a lack of infrastructure or safety concerns.

4.17.7 Evaluation of Infrastructure Effectiveness in Facilitating Access to Essential Services by Communities

In terms of ease of access to essential services, Eko Atlantic and Oniru are notable for their high performance. In Eko Atlantic, 80% of respondents report that the existing infrastructure effectively supports their needs, while Oniru follows closely with 75%. These communities benefit from well-developed infrastructure that significantly aids residents in accessing essential services. Similarly, Marwa and Elegushi also demonstrate relatively good access, with 70% and 65% of respondents, respectively, acknowledging that their infrastructure facilitates reaching essential services. Although these areas perform well, there is still room for improvement to further enhance service accessibility.

Moving to communities with moderate ease of access, Ilasan Iroko Awe, Aro/Ologolo, and Jakande show a middle ground. Between 50% and 60% of respondents in these areas believe that their infrastructure supports access to essential services. However, communities like Lafiaji and Okun Aja exhibit a decreasing trend in positive responses, with only 45% and 40% respectively finding the infrastructure satisfactory. This suggests that while some aspects of the infrastructure are functional, there are noticeable gaps that need addressing to improve access further.

In contrast, Mopo Ijebu, Sangotedo, and Igando report lower levels of ease of access, with only 25% to 35% of respondents affirming that the current infrastructure is adequate. The situation is even more challenging in Badore and Eleko, where only 20% and 15% of respondents, respectively, find the infrastructure sufficient for accessing essential services. These communities face significant obstacles, highlighting a critical need for infrastructure improvements to better support their residents.

Communities from Oguntimehin to Akinlade face minimal to no ease of access, with 90% to 100% of respondents indicating that the current infrastructure does not meet their needs. This severe inadequacy underscores the urgent need for substantial improvements in these areas to ensure that residents can access essential services effectively.

In summary, while high ease of access in communities like Eko Atlantic and Oniru reflects well-developed infrastructure, continued investment is crucial to maintaining these standards. For those with moderate ease of access, such as Marwa and Elegushi, targeted enhancements are necessary to address existing gaps. In communities experiencing low ease of access, including Sangotedo and Eleko, strategic interventions are required to improve infrastructure. The severe challenges faced by areas like Oguntimehin to Akinlade highlight the urgent need for comprehensive infrastructure upgrades to ensure that all residents have reliable access to essential services.

4.17.8 Assessment of Road and Transport Infrastructure Effects on Travel Time by Community

Eko Atlantic, Oniru, and Marwa experience a significant impact on travel time, with 90%, 85%, and 80% of respondents, respectively, indicating that existing road and transport infrastructure notably affects their travel time. This suggests that these areas face substantial issues with congestion or inefficiencies. Similarly, Elegushi, Ilasan Iroko Awe, Aro/Ologolo, and Jakande report high percentages (70% to 78%) of respondents affected by their current infrastructure, reflecting comparable challenges.

Lafiaji, Okun Aja, Mopo Ijebu, Sangotedo, and Igando exhibit a moderate impact on travel time, with 58% to 68% of respondents noting that their travel time is affected. This indicates that while there are infrastructure issues, they may not be as severe as those experienced in the high-impact communities. Badore, Eleko, and Oguntimehin also fall into this category, with around 50% to 55% of respondents affected, pointing to moderate infrastructure-related travel time issues.

Solu Alade, Solu Orunmija, Debojo, Eko Akete, Idado, and Lakowe show a lower impact on travel time, with only 32% to 48% of respondents reporting that infrastructure affects their travel time. This suggests that these communities experience relatively better road conditions or less congestion compared to others. In contrast, Iwesolu, Okunsolu, Moser Ikoga, Iwereku, and

Akinlade report minimal impact, with only 20% to 30% of respondents affected, indicating relatively smooth travel experiences and fewer issues with infrastructure.

Communities with significant impacts on travel time, including Eko Atlantic, Oniru, and Marwa, need targeted interventions to address congestion and inefficiencies in their infrastructure. For areas with moderate impacts, such as Lafiaji and Okun Aja, infrastructure improvements should focus on alleviating identified issues. Communities experiencing low to minimal impact on travel time, including Solu Alade and Akinlade, suggest that current infrastructure conditions are relatively satisfactory, although ongoing monitoring is essential to maintain these standards.

4.17.9 Public Transport Service Satisfaction across Communities

The satisfaction levels of public transport services reveal significant variations among communities. Eko Atlantic and Oniru stand out with high satisfaction levels, demonstrating that their public transport services effectively meet the needs of their residents. This high satisfaction indicates that these communities benefit from well-structured and reliable public transport options. In contrast, Ilasan Iroko Awe, Aro/Ologolo, and Jakande exhibit low satisfaction levels, with many residents expressing neutrality or dissatisfaction. This trend highlights potential gaps in their transport services, suggesting that these communities might struggle with issues such as service reliability, coverage, or quality.

Marwa and Elegushi present a mixed picture, showing a balance of satisfaction and neutrality. While public transport services in these areas are generally adequate, there remains room for improvement. Residents' mixed feelings suggest that while the services are functional, there are aspects that could be enhanced to better meet their needs.

On the other hand, Lafiaji and Okun Aja experience minimal satisfaction, with high levels of neutrality and dissatisfaction among residents. This indicates significant challenges in their public transport systems, reflecting a clear need for targeted improvements to address the issues faced by residents.

Communities from Mopo Ijebu to Akinlade display severe dissatisfaction, signaling substantial inadequacies in their public transport services. The high level of dissatisfaction in these areas underscores a critical need for comprehensive service enhancements to address the severe gaps and improve the overall transport experience for residents.

Overall, the varying satisfaction levels emphasize the need for tailored approaches to service improvements. High satisfaction in Eko Atlantic and Oniru suggests that their current transport systems are well-aligned with residents' needs and could benefit from maintaining or enhancing existing services. For Marwa and Elegushi, moderate satisfaction indicates that targeted improvements could further elevate service quality. Conversely, the low to minimal satisfaction in Ilasan Iroko Awe, Aro/Ologolo, Jakande, and Lafiaji signals a need for focused efforts to address specific shortcomings. Most critically, the minimal satisfaction reported in communities from Okun Aja to Akinlade highlights an urgent need for substantial service enhancements to remedy the severe inadequacies in their public transport systems

4.17.10 Assessment of Transportation Modes for Goods in Different Communities

The primary means of transportation for goods varies significantly across communities. In Eko Atlantic, trucks are overwhelmingly the preferred choice, with 90% of respondents using them for transporting goods. This reliance on trucks is mirrored in Oniru and Marwa, where 88% and 85% of residents, respectively, also use trucks as their main mode of transport. Elegushi, Ilasan Iroko Awe, and Aro/Ologolo also show a strong preference for trucks, though the percentage is slightly lower, ranging from 82% to 80%.

In terms of receiving goods, Eko Atlantic and Oniru again favor trucks, with 85% and 80% of respondents, respectively, using them for this purpose. Other modes such as rail and maritime transport are minimally used across these communities, with maritime transport being slightly more common in Ilasan Iroko Awe and Aro/Ologolo, where 14% and 18% of residents use it, respectively. Communities like Jakande and Lafiaji also show a significant reliance on trucks, though there is a noticeable increase in the use of other transportation modes, such as maritime and air freight. For instance, Lafiaji has 23% of respondents using maritime transport, and Jakande shows 18% using it. As we move to communities like Okun Aja, Mopo Ijebu, and Sangotedo, the reliance on trucks decreases slightly, with a corresponding increase in the use of maritime transport for receiving goods. For example, Okun Aja has 25% of residents using maritime transport, and Mopo Ijebu has 26%. This trend continues in Igando, Badore, and Eleko, where maritime transport becomes more prevalent, especially for receiving goods. In the communities at the lower end of the spectrum, such as Oguntimehin, Solu Alade, and Solu Orunmija, the use of trucks is less dominant, and maritime transport becomes increasingly common. In Solu Orunmija, for instance, 44% of residents use maritime transport for receiving goods.

Finally, in Debojo, Eko Akete, Idado, Lakowe, Iwesolu, Okunsolu, Moser Ikoga, Iwereku, and Akinlade, there is a notable shift towards maritime transport for receiving goods, with percentages rising to as high as 95% in Akinlade. These communities show a significant decrease in truck usage and an increased reliance on maritime transport.

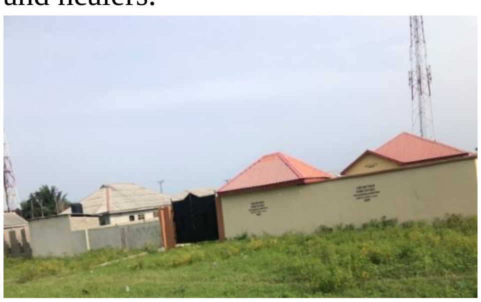
Overall, while trucks are the predominant means of transporting goods across most communities, there is a clear shift towards maritime transport for receiving goods, especially in the communities further down the list. This indicates varying levels of infrastructure and logistics capabilities across different areas.

4.18 Health

This section presents the baseline health data based on information generated from sampled groups in the study area. Data obtained were subsequently compared with state and National data and available averages.

4.18.1 Health Facilities

The health facilities in the area consist of fifteen (15) Primary Health Centres (PHCs) and one (1) hospital (Plate 4.24). These include Awoyaya Public Health Centre, Orimedu Primary Health Centre, Eti-Osa East Local Council Development Area Primary Health Centre, and Ibeju Lekki General Hospital. The severe shortage of health facilities raises significant concerns about the health status of the population, as indicated by the prevalence of malaria, fever, upper respiratory tract infections, typhoid fever, diarrhea/vomiting, and eye ailments. The lack of quality healthcare services and their absence in some other communities have led to the proliferation of herbal homes and healers.



a. Origanrigan health centre **b.** Awoyaya Primary Health Care Centre

Plate 4.23 a-b: Health facilities in the project area

4.18.2 Prevalence of Diseases in the Study Area

This study involved visiting health centers in various communities, revealing that the most common diseases affecting all age groups in the area are malaria (42.1%), typhoid fever (23.5%), upper respiratory tract infections (12.3%), diarrhea/vomiting (11.2%), and eye problems (7.8%). Other frequently encountered ailments include worm infestation, lower respiratory tract infections, diabetes mellitus, and arthritis. The prevalence of these diseases suggests the presence of breeding grounds for disease-carrying vectors. The widespread indiscriminate refuse disposal in the area contributes to these conditions by providing proliferation sites for vectors, highlighting a lack of hygiene in the environment. This baseline data was taken into account for impact mitigation strategies.

4.18.3 Traditional Medical Practice

Traditional medicine is widely practiced in the area, involving methods such as herbal treatments, body charms, body massage, and scarification. These practices are often kept secretive. Traditional birth attendants are also popular. Approximately 82% of respondents reported that they have visited or continue to visit herbal homes for medical remedies and treatments. The high use of traditional medicine is likely due to the insufficient number of medical centers.

4.18.4 Sexual Activities and Knowledge of Sexually Transmissible Infections (STI)

HIV (Human Immunodeficiency Virus) and AIDS (Acquired Immune Deficiency Syndrome) are significant public health issues in Nigeria. However, there is a lack of data on sexual practices and knowledge about HIV/AIDS and other sexually transmitted infections (STIs) in the study area. To address this, the study included several questions to assess awareness of these health issues. Both men and women were asked about their sexual practices and their beliefs regarding the transmission of HIV, as well as where they sought treatment for STIs. Information on condom use and availability was also collected. As expected, respondents did not provide information on the number of sexual partners they have.

4.18.5 Condom Availability and Use

Condoms are an effective barrier against HIV and other sexually transmitted infections. Respondents were asked about their condom use, with the data limited to those who have had sexual intercourse. Condoms were available in over 90% of chemist stores. However, the precise average number used per week could not be verified. The survey across the project area showed that less than 30% of males and 35% of females aged 15 and older had never used condoms. Additionally, around 25% of males and 40% of females reported using condoms only occasionally, mainly for pregnancy or STI prevention. Consistently, only 12% of sexually active males and 7% of sexually active females use condoms during every sexual encounter.

4.18.6 Immunisation Status in Children

The immunization rate for children under five years old against DPT, BCG, OPV, and Measles in the project area was 80%, exceeding the national target of 70%. This high rate is partly attributed to the area's challenging health conditions and prevalent diseases. Oral Polio Vaccine (OPV) was the most frequently administered vaccine, likely due to the National Immunisation Days (NIDs) organized annually by the Federal Ministry of Health through the National Programme on Immunization. Each child under five is supposed to receive two drops of OPV during each NID round. Despite this, the overall immunization record suggests deficiencies in routine immunization practices.

4.18.7 Land planning and uses

In the project area, land ownership is either managed by the community or by individual families. Under the Public Lands Acquisition Law, the state government has the authority to compulsorily acquire land from private owners for public purposes, provided compensation is paid to the landowners. Additionally, land can be leased for agricultural or other uses.

4.18.8 Vulnerable Groups in the PACs

The category and number of vulnerable groups in the PACs within the project area were identified and analysed as shown in Table. 4.37. This was compiled with assistance from the village heads; hence they could not be independently verified.

Table 4.53: % of vulnerable groups in the project area

Communities	Children	Land tenant	Women	Non-indigenes	Elderly	Physically challenged	Herdsmen
Eko Atlantic	23	13.9	19.1	19.6	11	9.1	4.3
Oniru	14.2	9.6	21.8	24.2	11.7	15.3	3.2
Marwa	21.4	13.9	16.6	33.7	7.5	5.3	1.6
Elegushi	20.1	10.3	11.3	20	12.3	22.5	3.5
Ilasan Iroko Awe	16.4	12.3	16.5	25	12.5	12.8	4.5
Aro/Ologolo	18.9	10.5	13.5	28	9.5	16.4	3.2
Jakande	19.5	11.2	18.3	22.1	10.8	14.2	2.9
Lafiaji	20.8	12.5	15.9	26.3	8.2	6.5	1.8
Okun Aja	17.3	10.9	19.2	23.5	12.1	13.9	4.1
Mopo Ijebu	22.9	14.1	17.4	30.2	7.9	5.8	1.9
Sangotedo	19.2	11.5	12.8	21.4	11.9	20.2	3.1
Igando	21.1	13.2	16.1	32.5	8.5	6.2	1.7
Badore	18.5	10.7	14.3	27.8	9.8	15.6	3.3
Eleko	20.5	12.2	15.6	25.9	8.9	7.3	2.1
Oguntimehin	22.2	13.8	18.5	29.4	7.3	5.9	1.5
Solu Alade	19.8	11.9	13.2	22.8	11.4	19.3	3.4
Solu Orunmija	21.6	13.4	17.1	31.1	8.1	6.6	1.9
Debojo	20.3	12.6	15.8	26.5	9.2	7.8	2.3
Eko Akete	22.5	14.3	18.2	30.5	7.6	5.5	1.6
Idado	19.9	12.1	14.5	24.9	10.9	18.2	3.2
Lakowe	21.3	13.5	16.9	32.2	8.3	6.8	1.8
Iwesolu	23.1	14.5	19.3	29.8	7.2	5.2	1.4
Okunsolu	20.9	12.8	15.3	27.3	9.5	8.1	2.5
Moser Ikoga	22.8	14.2	18.8	31.4	7.8	5.6	1.7
Akinlade	21.9	13.6	17.2	30.8	8.6	6.3	1.9
Iwereku	19.4	11.8	14.9	25.5	10.3	17.4	3.1

Table 4.47 reveals the distribution of various vulnerable groups within the project area's communities. Children make up a significant portion of the population, averaging around 20% across communities, with Iwesolu and Eko Atlantic having the highest percentages at 23.1% and 23%, respectively. Land tenants are also notable, particularly in Iwesolu and Mopo Ijebu, reflecting the area's reliance on rented or leased land. Women constitute a considerable demographic, making up approximately 16-18% of the population, with Oniru having the highest proportion at 21.8%. Non-indigenes are prominently represented, especially in Marwa and Oniru, indicating a diverse population. The elderly form a smaller but significant demographic, ranging from 7-12% across communities. Physically challenged individuals are less prevalent, averaging around 5-10%, while herdsmen are the least represented group, constituting a small fraction of the population in most communities.

4.18.9 Cultural Heritage Resources

No cultural heritage sites were found within the proposed project's concession and 50m buffer along both sides of the route

4.19. Gender Issues

Data relating to gender issues were obtained using community questionnaires involving all the communities in the project area. Male and female folks were separated and assisted in responding to the gender indicators parameter in the questionnaire. The result is represented in Table 4.38

Table 4.54: Gender Parameters in Project Area

Community	Gender	%Circumcision	%Land ownership	%Access to credit	%Decision making in Household	%Decision making at the community level
Eko Atlantic	Male	100	54	61	85	96
	Female	3	12	19	15	4
Oniru	Male	100	64	70	90	97
	Female	2	9	3	10	3
Marwa	Male	100	72	70	92	87
	Female	0	5	11	8	13
Elegushi	Male	100	53	69	72	89
	Female	2	15	14	28	11
Ilasan Iroko Awe	Male	100	62	64	77	90
	Female	1	8	12	10	8
Aro/Ologolo	Male	100	69	68	89	98
	Female	0	7	10	12	5
Jakande	Male	98	58	65	80	92
	Female	1	10	15	20	8
Lafiaji	Male	99	60	63	85	95
	Female	0	8	12	15	5
Okun Aja	Male	97	55	62	78	88
	Female	2	12	18	22	12
Mopo Ijebu	Male	100	65	71	91	98

	Female	0	6	9	9	2
Sangotedo	Male	99	59	67	83	94
	Female	1	11	16	17	6
Igando	Male	98	57	64	79	90
	Female	2	13	19	21	10
Badore	Male	96	54	61	75	85
	Female	3	14	20	25	15
Eleko	Male	99	63	69	88	96
	Female	0	7	10	12	4
Oguntimehin	Male	97	56	63	77	87
	Female	2	12	17	23	13
Solu Alade	Male	98	60	66	82	93
	Female	1	9	14	18	7
Solu Orunmija	Male	100	68	72	92	99
	Female	0	5	8	8	1
Debojo	Male	96	53	59	73	83
	Female	3	15	21	27	17
Eko Akete	Male	99	62	68	86	95
	Female	0	8	12	14	5
Idado	Male	97	55	62	78	88
	Female	2	13	18	22	12
Lakowe	Male	98	59	65	81	92
	Female	1	10	15	19	8
Iwesolu	Male	100	66	70	90	98
	Female	0	6	9	10	2
Okunsolu	Male	99	61	67	84	94
	Female	1	11	16	16	6
Moser Ikoga	Male	97	54	61	76	86
	Female	2	14	19	24	14
Iwereku	Male	98	58	64	80	91
	Female	1	12	17	20	9
Akinlade	Male	99	63	69	87	96
	Female	0	7	10	13	4

The data from Table 4.49 reveals significant gender disparities across various parameters in the project area's communities. Circumcision rates are universally high among males (96%-100%), but much lower among females (0%-3%). Land ownership is predominantly male (54%-72%), with female ownership ranging from 0%-15%. Access to credit also shows a gender gap, with males having higher access (63%-70%) than females (4%-17%). Decision-making power is largely held by males in households (71%-90%) and communities (77%-98%), with females having limited involvement (3%-23% in households and 1%-15% in communities). These disparities highlight a strong gender imbalance in social and economic life, with males dominating practices and decision-making, and females facing barriers in accessing resources and participating in decision-making processes.

4.19.1 Circumcision:

Non-therapeutic genital alterations in children are typically discussed in two distinct ethical contexts: Female Genital Mutilation (FGM) for girls and Male Circumcision (MC) for boys. The risk of adverse health effects increases with the severity of FGM. Health organizations and medical professionals strongly oppose all forms of FGM and condemn its performance by healthcare providers. Complications associated with FGM include severe pain, excessive bleeding, shock, swelling, and infections. In the project area, 97.8% of males are circumcised, whereas only 1.5% of females have undergone circumcision. Nationally, the circumcision rate for males in Nigeria is 93.2%, while for females, it stands at 27.8% (NBS 2012)

4.19.2 Land Ownership

In the project area, there is a notable disparity in land ownership between males and females, indicating a bias in the inheritance of land. Respondents have reported that it is customary for women to be excluded from inheriting land. This disparity aligns with national data from 2012, which shows a similar 5:1 male-to-female ownership ratio.

4.19.3 Access to Credit

In the project area, banks and lending institutions, including local savings groups, often impose criteria that favor men, sometimes requiring a male guarantor for women. This practice may explain why the data obtained does not align closely with the national average of 55:45 (NBS 2012). Fewer women have access to credit facilities, with urban areas like Lekki, Eleko, and Igando exhibiting higher levels of access compared to rural areas. Factors such as financial literacy, availability of financial institutions, and overall awareness contribute to these differences.

4.19.4 Decision-Making at Household Level

The data reflects a strong male bias in household decision-making, with men holding a significant majority (87%) compared to women. Households where decision-making is more balanced often have higher levels of female education and employment, influencing the degree of female participation. The national average for gender balance in household decision-making is nearly 1:1 (NBS 2012).

4.19.5 Decision-Making at Community Level

The factors affecting household decision-making are also relevant at the community level. However, the project area shows a higher proportion of female representation in decision-making roles, partly due to specific traditional roles and titles reserved for women. This local variation surpasses the national average of 6:1, likely due to the strong traditional institutions present in the project area.

4.2o Traffic Survey

The Manual Classified Count (MCC) method was used to assess traffic in the study area. This method involves observers counting and categorizing vehicles by type (e.g., cars, lorries, motorbikes). The study aimed to measure traffic volume, classify vehicle types, and estimate future traffic loads upon project completion. The survey was conducted at Ahmadu Bello Road, where the proposed road begins, between 6 am and 6 pm from May 10th to 12th, 2024. The result is presented in Table 4.39.

Table 4.55: Average hourly traffic survey results over a four-day duration along Ahmadu Bello Road

Time	Vehicle Categorisation	Outgoing Traffic	Incoming Traffic	Time	Outgoing Traffic	Incoming Traffic
6-7	Cars	70	55	12-1	65	110
	SUVs	35	25		15	10
	Lorries	10	8		20	15
7-8	Cars	90	95	1-2	90	225

	SUVs	35	30		25	135
	Lorries	12	10		10	5
8-9	Cars	80	85	2-3	65	80
	SUVs	30	35		20	15
	Lorries	10	12		15	10
9-10	Cars	100	105	3-4	50	60
	SUVs	35	40		20	15
	Lorries	15	18		15	12
10-11	Cars	90	95	4-5	70	75
	SUVs	40	45		35	30
	Lorries	18	20		20	18
11-12	Cars	80	70	5-6	75	75
	SUVs	30	25		25	20
	Lorries	12	10		15	12

The traffic survey conducted along Ahmadu Bello Road provides valuable insights into the vehicular patterns in the area, which is crucial for planning the proposed Lagos-Calabar Coastal Road project. Here's an analysis of the data from the traffic survey:

Traffic Volume

- Overall Trends: The traffic volume observed during the survey indicates a steady flow of vehicles throughout the day, with some peaks and troughs at different times.
- Peak Hours: The data reveals that peak traffic hours are generally between 9-10 am and 1-2 pm. During these times, both incoming and outgoing traffic show significant activity. This suggests that there is a high demand for road usage during these periods, possibly due to work commutes and lunch breaks.
- Off-Peak Hours: Between 6-7 am and 5-6 pm, the traffic volume is relatively lower, indicating less congestion and reduced vehicle flow during these times.

Vehicle Categorization

- Cars: Cars represent the majority of the traffic flow across all time slots. This indicates a high dependency on personal vehicles for transportation in the area.
- SUVs: SUVs also make up a significant portion of the traffic, although their numbers are less than cars. This suggests that a sizable number of commuters prefer larger personal vehicles.
- Lorries: The presence of lorries, although lower in number compared to cars and SUVs, indicates ongoing commercial activities, with goods being transported throughout the day.

Directional Flow

- Outgoing vs. Incoming Traffic: There is a noticeable difference in the directional flow of traffic at various times. For instance, the outgoing traffic tends to be higher in the morning hours (6-9 am), while incoming traffic peaks significantly around midday and early afternoon (12-2 pm).
- Balanced Traffic: During some time slots, such as 11-12 pm, the traffic flow is relatively balanced between outgoing and incoming directions. This balance may suggest that travel patterns during these times are more evenly distributed, possibly indicating a mix of work-related and personal travel.

The proposed road will need to integrate smoothly with the existing traffic patterns on Ahmadu Bello Road. The high traffic volume and varied vehicle types observed on this road indicate that the new road should be designed to accommodate and effectively manage this flow to ensure a seamless transition. Attention should be given to the junctions and connection points between Ahmadu Bello Road and the new coastal road to prevent bottlenecks and ensure smooth traffic flow. The high volumes of traffic, especially cars, suggest that the new road must be designed to handle similar or higher traffic levels. This includes considerations for lane capacity, road width, and dedicated lanes for different types of vehicles. Effective planning is required to minimize disruptions, possibly through phased construction or temporary traffic management solutions. Since the construction will affect existing traffic routes, it’s important to plan for alternative routes and communicate these effectively to minimize inconvenience to road users.

CHAPTER FIVE
ASSOCIATED AND POTENTIAL ENVIRONMENTAL IMPACTS

5.0 Focus of this Chapter

The chapter details the identification and evaluation of environmental and social risks and impacts of the project. In this Chapter, the ESIA identified, described, and evaluated the potential environmental and social impacts of the proposed project. The ESIA assessed the significance of these impacts to inform decision-making and risk management. It also serves as the basis for optimisation of resources wherever possible as part of the planning and design process to maximize its benefits.

5.1 Scope of Assessment

a. Scope of Assessment- Project Phases

The assessment covers the potential and negative impacts during **Pre-Construction, Construction, Operation and Decommissioning** phases (Figure 5.1). It should be noted that after the sequence of activities of the construction, there will be the handing over of the completed project to FMW, which will be in charge of the operational phase of the project. The contractor may not be part of the operational phase of the project.

Regarding the decommissioning of the infrastructure, there is no information available at this stage. Decommissioning of the road project itself will take more than 50 years, which is the designed lifespan. Hence, it is not possible at this stage to precisely determine the nature and extent of the impacts of the project's decommissioning phase. The FMW will have to develop a decommissioning assessment a few years before decommissioning to formulate a complete Decommissioning Plan that is tailored to the context. Thus the decommissioning here focused on the readily foreseeable aspects which the evacuation of equipment and materials and clean up after the construction phase.
Thus the iimpact assessment investigated each phase of the proposed project phase as outlined in Figure 5.1 to ensure that all potential impacts are taken into account.

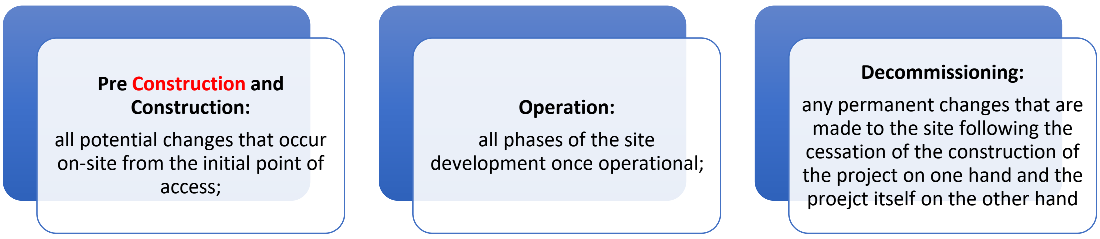


Figure 5.1: Phases of the Proposed Project to Assess Impacts

b. Scope of Assessment - Environmental Components and Impact Indicators

In Table 5.1, some main components of the environment and potential impact indicators were identified. The components are those that the project activities are most likely to impact upon, while the indicators are the easily observable parameters that will indicate change/deviation, which could be used to monitor the various environmental components during the various phases of the project.

Table 5.1: Environmental Components and Impact Indicators		
S/No	**Environmental Components**	**Potential Impact Indicators**
1.	Climate	Relative humidity, rainfall, temperature, wind speed and direction
2.	Air Quality	Particulate matters, , CO, CO_2, H_2S, NOX, NO_2, SOX,
3.	Noise & Vibration	On-site & off-site disturbance, noise related health problems, communication interference.
4	Flora and Fauna	Changes in original types and deviation from normal characteristics
5.	Water Quality	Solids, pH, nitrate, chloride, turbidity, salinity, chemical toxicity, and microbiological characteristics.
6	Ecological setting	Erosion, flooding, etc.
7	Coastal Processes,	Shoreline, hydrodynamics, etc
7.	Socio-economics	Traffic, population, security, income, settlement pattern, and infrastructure change. Access to communication facilities, aesthetic value, Level of income and financial flows, Opportunities for contracting and procurement, Opportunities for local and national employment, Access to transport, Respect for human rights, Promoting equal opportunities
8.	Health and Safety	Accidents, Exposure to nuisance (dust, noise etc.), Level of disease vectors, Exposure to STIs/HIV/AIDS, Mortality rate, Morbidity rate, Physical activity, Hygiene, Exposure to commercial sex workers, Access to primary health care, Access to secondary health care, Access to traditional medicine, Access to emergency services

5.2 Impact Assessment Methodology

a. Elements of Impact Assessment. The impact assessment is a dynamic process that involves collaboration, data collection, and continuous refinement. The key elements of impact assessment adopted include the following:

1. Identification and Description:
   - This involves understanding the project's context, activities, and how they interact with the environment and society.
2. Prediction of Probability:
   - This included assessing the likelihood of each impact occurring by predicting probabilities, and then prioritizing the risks.
3. Assessment of Significance:
   - The significance of impacts was evaluated based on several factors:
     - Severity: How severe is the impact? Minor, moderate, or severe?
     - Duration: Consider whether the impact is short-term or long-lasting.
     - Spatial Extent: Does it affect a small area or a larger region?
     - Positive and Negative Effects: Both need consideration.
   - Significance informs decision-making and risk management.

4. Attention to ESMS Standards:
    - The Environmental and Social Management System (ESMS) standards played a crucial role which enable focusing on impacts that are relevant such as in connection with soil erosion, livelihoods, cultural heritage, and biodiversity.
    - Compliance with these standards ensures responsible project development.

5. Other Social Impacts:
    - Beyond ESMS standards, also considered are social impacts which may affect women, vulnerable groups, or result from inadequate climate change considerations. This ensures social equity and inclusivity.
6. Iterative Process:
    - The ESIA is not static and so as more detailed information becomes available, new significant issues may emerge. Hence flexibility allows for better-informed decisions.

b. Dimension of Impacts. Balancing the assessment of direct, indirect, and cumulative impacts was seen to be essential for robust environmental and social risk management. Integrating all following dimensions was considered good for making informed decisions that balance short-term needs with long-term sustainability. Through indirect and cumulative effects, we can make informed decisions for sustainable development.

1. Direct Impacts:
    - These are immediate effects resulting directly from project activities.
    - Examples include air emissions from factories, habitat destruction during construction, or noise pollution.
    - Addressing direct impacts involves implementing mitigation measures specific to each impact.
2. Indirect Impacts:
    - Indirect effects arise from interactions between the project and its surroundings.
    - They may not be immediately visible but can have significant consequences over time.
    - Examples include.
        - altered water flow downstream due to dam construction or secondary impacts like increased traffic from a new development.
        - Knock-On Effects: These occur when a change in one aspect of the environment triggers a chain reaction of other changes. For instance, altering water flow in a river due to a dam can affect downstream ecosystems and communities.
        - Secondary Impacts: These are consequences that arise indirectly from the project’s activities. For example, a mining project might lead to increased traffic, affecting air quality and noise levels in nearby towns.
3. Cumulative Effects:
    - Cumulative impacts accumulate gradually as a result of multiple actions or developments.
    - Consider both temporal and spatial accumulation:
        - Temporal Accumulation: Over months, years, or decades, small impacts add up. For instance, repeated discharges of pollutants into a river can degrade water quality.

  - Spatial Accumulation: Impacts from various projects or activities in the same region. Urbanization, deforestation, and agriculture collectively affect ecosystems.
- Thresholds matter: Crossing critical thresholds can lead to irreversible damage. Cumulative effects may cross critical thresholds, leading to irreversible damage. For instance, deforestation reaching a tipping point affects climate patterns.

4. Impacts Triggered Over Time: Some impacts may not be immediately evident but emerge gradually:
   - Groundwater Contamination: Chemicals leaching into groundwater may take years to affect drinking water quality. Contaminants from industrial sites or landfills can slowly infiltrate aquifers.
   - Erosion: Soil erosion due to land disturbance (e.g., deforestation, construction) accumulates over time. It affects downstream areas by increasing sediment load in rivers and altering habitats.

- Wider Area of Influence: This included giving consideration beyond the project site impact on the surrounding environment and communities. These included:
  - Direct Area: Impacts within the immediate vicinity of the project.
  - Wider Area: Impacts extending beyond the project boundaries, including neighboring ecosystems, water catchments, and habitats

5. Transboundary Impact: Transboundary impacts occur when the effects of a project extend beyond national borders. Examples:
   - Air Pollution: Emissions from factories in one country affecting air quality in neighboring countries.
   - Water Flow Alteration: Dam construction altering river flow downstream, impacting ecosystems and communities in other countries.

c. **Guidelines and Standards for Assessing Environmental and Social Risks.** Assessing environmental and social risks is crucial for sustainable project management. Effective risk assessment involves considering both likelihood and impact. Some guidelines and standards followed by some organizations to better manage environmental and social risks in their projects are outlined below:

- World Bank Environmental and Social Standards (ESS): The World Bank has established a set of Environmental and Social Standards (ESS) to guide project development and implementation. These standards cover various aspects, including risk assessment and management which include, ESS1: Assessment and Management of Environmental and Social Risks and Impacts, ESS2: Labor and Working Conditions, ESS3: Resource Efficiency and Pollution Prevention and Management, ESS4: Community Health and Safety, ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement and ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- European Banking Authority (EBA) Guidelines on ESG Risks: The EBA provides guidelines for financial institutions regarding the identification, measurement, management, and monitoring of Environmental, Social, and Governance (ESG) risks. These guidelines address the risks arising from the transition toward an EU climate-neutral economy2.
- Guidelines for Environmental and Social Risk Management (ESRM) for Banks: These guidelines expand the scope of social assessments and introduce a quantitative scoring methodology for better estimation of environmental and social risks. They also include risk-based screening criteria for evaluating proposed transactions.

- Guidelines for Environmental and Social Screening of Activities (GCF): These guidelines provide guidance for accredited entities on the environmental and social screening of activities proposed for Green Climate Fund (GCF) financing. They are particularly relevant for projects under the Simplified Approvals Process (SAP) Pilot Scheme.
- In addition to international guidelines and standards, national regulations play a crucial role in managing environmental and social risks. National regulations are specific to each country such as the Nigeria EIA Act and provide legal requirements for project development and operation. They address various aspects related to environmental protection, social welfare, and governance. Examples include regulations on qualifications, staff, premises, health and safety, and administrative procedures.

d. Assessing project impacts. Assessing project impacts involves a variety of methods, ranging from qualitative analysis to quantitative modelling. Participatory approach by stakeholders fostered transparency, trust, and better project outcomes. The approaches adopted include the following:

i. **Expert Judgment**: Experts with considerable experience assess impacts based on their professional opinion. Useful when limited data prevent predictive modelling. Can complement quantitative methods and aid in interpreting results.
ii. **Quantitative Models:** These models use numerical data and mathematical relationships. Examples: Air Dispersion Models: Predict emissions and pollution concentrations from a coal-fired power plant.
iii. **Hydrological Models**: Estimate changes in river flow due to reservoir construction. Ecological Models: Forecast changes in aquatic biota (e.g., fish) from toxic substance discharge.
iv. **Cumulative Impact Assessment**: Evaluated the combined effects of multiple existing developments. Impacts from different projects can reinforce each other, leading to more serious consequences. Examples of cumulative impacts include increased pollutant concentrations, reduced water flow, and interference with wildlife movement.
v. **Social Impact Assessment:** Focused on social consequences of the planned project and alternatives. Standardized procedures assess social issues alongside environmental impacts.
vi. **Data Collection and Quality**. Described the chosen methods for data collection and analysis in the project report. It considered data quality, gaps, and uncertainties associated with predictions.
vii. **Stakeholder Engagement.** This included the involvement of stakeholders (local communities, NGOs, experts) in data collection and analysis. Workshops and Focus Group Discussions were also held to gather input, identify concerns, and explore potential impacts. Furthermore, Community Meetings provided a platform for dialogue and information sharing.

e. **Significance Assessment and Rating environmental and social risks.** Significance assessment informs decision-making and risk prioritization. By considering relevant criteria, environmental and social risks can be better managed. A thorough assessment of risks involved considering likelihood and impact, as well as the availability of effective mitigation measures, leveraging on the methodology that IUCN for assessing the significance of environmental and social impacts/risks. The rating environmental and social risks was based on likelihood and expected impacts:

1. Likelihood:
    - Likelihood represents the possibility that a specific risk event will occur.
    - It uses the following five ratings to establish likelihood:
        - Very Unlikely to Occur (1): The risk event has an extremely low chance of happening.
        - Not Expected to Occur (2): The risk is unlikely but not ruled out entirely.
        - Likely – Could Occur (3): There is a reasonable chance of the risk event happening.
        - Known to Occur - Almost Certain (4): The risk event is highly probable based on historical data or expert knowledge.
        - Common Occurrence (5): The risk event frequently occurs.
2. Impact (Consequence):
    - Impact refers to how negatively a risk event might affect environmental or social receptors.
    - It considers the following criteria to assess impact significance:
        - Sensitivity of the Receptor: Some receptors (e.g., endangered species, cultural heritage) are more sensitive to impacts.
        - Severity of Impacts: Assess whether the impact is minor, moderate, or severe.
        - Expected Duration and Scale: Longer-lasting or larger-scale impacts are more significant.
        - Reversibility: Determine if the impact can be reversed or mitigated.
3. *Good Practices and Experience:*
    - Consider whether known, acceptable good practices exist to address specific impacts.
    - Stakeholders' experience in applying mitigation measures matters were also given consideration.

f. Criteria for Significance Risk Assessment

This helps prioritize mitigation efforts and informs decision-making. the significance ratings for environmental and social risks based on the provided criteria:

1. **Severe (5)**:
    - **Magnitude**: Very high magnitude.
    - **Scale and Spatial Extent**: Large geographic area, affecting many people. May have trans-boundary impacts.
    - **Duration**: Long-term (permanent and irreversible).
    - **Receptors**: Highly sensitive (e.g., high biodiversity areas, indigenous territories).
    - **Examples**: Severe impacts on biodiversity-rich regions, irreversible displacement, cumulative social conflicts.
2. **Major (4)**:
    - **Magnitude**: High magnitude.
    - **Scale and Spatial Extent**: Large area, affecting a significant number of people. May have trans-boundary impacts.
    - **Duration**: Certain duration but reversible with sufficient mitigation effort.
    - **Receptors**: Sensitive (e.g., biodiversity areas, indigenous lands).
    - **Examples**: Adverse impacts on biodiversity, temporary displacement, social conflicts of limited duration.

3. **Medium (3)**:
    - **Magnitude**: Medium.
    - **Scale and Spatial Extent**: Small area, affecting a limited number of people.
    - **Duration**: Temporary.
    - **Predictability**: Impacts are relatively predictable and manageable.
    - **Examples**: Moderate adverse effects that can be addressed with known solutions.
4. **Minor (2)**:
    - Magnitude: Minor.
    - Scale and Spatial Extent: Very small area, minimal impact on people.
    - Duration: Short-term.
    - Avoidability: Easily avoided, managed, or mitigated.
    - Examples: Small-scale, short-lived impacts.
5. **Negligible (1)**:

- Magnitude: Negligible or no adverse impacts.
- Receptors: No significant harm to communities, individuals, or the environment.

To characterize the significance of impacts on the environment, eight parameters are considered. The relationship between these parameters is illustrated in Figure 5.1 .

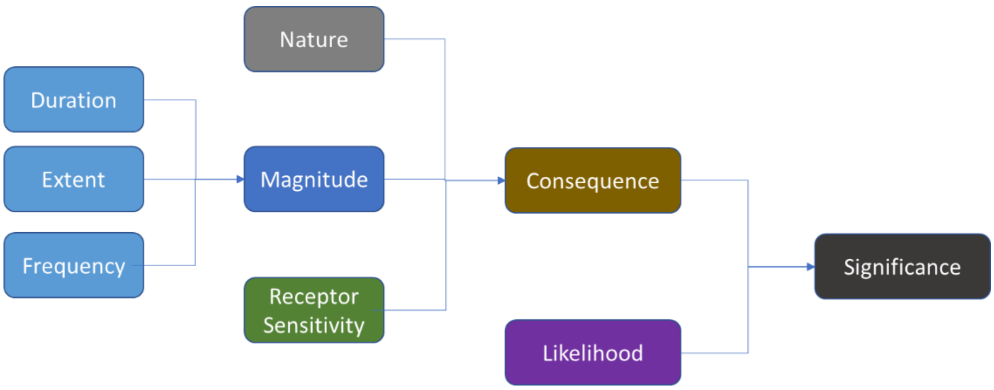


Figure 5.1: Parameters Used to Determine Significance

g. Determining the Risks for the Project

The risks were determined based on likelihood and expected impact described below and shown in Table 5.2:

1. Combining Likelihood and Impact:
    - Significance results from assessing both the likelihood (probability) and the expected impact (consequence) of a risk event.
    - By combining these factors, we gauge the overall importance of addressing the risk.
2. Significance Ratings:
    - The significance rating indicates how much attention a risk event requires during project development and implementation.
    - It also guides the extent of control actions needed.
    - The ratings are typically on a scale (e.g., from 1 to 5).
3. Factors Influencing Significance:
    - Likelihood:
        - Consider the probability of the risk event occurring.

    - Historical data, expert opinions, and project-specific conditions inform this assessment.
- Impact (Consequence):
    - Evaluate the severity of potential impacts.
    - Factors include sensitivity of receptors (e.g., biodiversity areas), severity, duration, and reversibility.
- Known Solutions:
    - Assess whether there are established good practices to address the impacts.
    - Stakeholders' experience matters.

Table 5.2: Rating Impact and Significance of a Risk Event

a: Rating impact of a risk event

Severe (5)	Adverse impacts on people and/or environment of **very high magnitude**, including **very large scale** and/or spatial extent (large geographic area, large number of people, transboundary impacts), cumulative, **long-term (permanent and irreversible)**; **receptors** are considered **highly sensitive**; examples are severe adverse impacts on areas with high biodiversity value[11]; severe adverse impacts to lands, resources and territories of indigenous peoples; significant levels of displacement or resettlement with long-term consequences on peoples' livelihood; impacts give rise to severe and cumulative social conflicts with long-term consequences.
Major (4)	Adverse impacts on people and/or environment of **high magnitude**, including **large scale** and/or spatial extent (large geographic area, large number of people, transboundary impacts), of certain duration **but still reversible** if sufficient effort is provided for mitigation; receptors are considered sensitive; examples are adverse impacts on areas with high biodiversity value; adverse impacts to lands, resources and territories of indigenous peoples; significant levels of displacement or resettlement with temporary consequences on peoples' livelihood; impacts give rise to social conflicts which are expected to be of limited duration.
Medium (3)	Adverse impacts of **medium magnitude**, **limited in scale** (small area and low number of people affected), **limited in duration** (temporary), impacts are relatively predictable and can be avoided, managed and/or mitigated with known solutions and straight forward measures.
Minor (2)	Adverse impacts of **minor magnitude, very small scale** (e.g. very small affected area, very low number of people affected) and only short duration, may be easily avoided, managed, mitigated.
Negligible (1)	Negligible or no adverse impacts on communities, individuals, and/or on the environment.

b. Rating significance of a risk event

		Likelihood of occurrence				
		Very unlikely to occur (1)	*Not expected to occur (2)*	*Likely – could occur (3)*	*Known to occur - almost certain (4)*	*Common occurrence (5)*
Impact	*Severe (5)*	Moderate	Substantial	High	High	High
	Major (4)	Low	Moderate	Substantial	Substantial	High
	Medium (3)	Low	Moderate	Moderate	Moderate	Substantial
	Minor (2)	Low	Low	Moderate	Moderate	Moderate
	Negligible (1)	Low	Low	Low	Low	Low

Source: IUCN

h. Summary of Impact Identification and Evaluation

In Box 5.1, a summary of measures used to identify and weigh likely impacts is provided and the Impact Identification and Evaluation process flow adopted for the project are depicted in Figure 5.2. The identification and management of impacts associated with the project activities were based on a risk assessment method which involves Identification of project activities that may interact with the site environment, development of implementing controls to reduce the risk of impacts and development of monitoring the effectiveness of the controls.

1. . Overlaying Project Components on Maps:
    - By superimposing project components onto existing condition maps, potential impact areas and issues can be identified.
    - This spatial analysis helps pinpoint where the project may interact with the environment.
2. Experience from Similar Projects:
    - Drawing insights from similar projects provides valuable lessons.
    - Understanding past successes and challenges informs decision-making.
3. Guidance Documents and Legal Provisions:
    - Published and unpublished documents offer guidance on impact analysis.
    - Compliance with Nigerian environmental laws and regulations is essential.
4. Ecosystem Sensitivity and Vulnerability:
    - Assess the sensitivity of ecosystem components to project activities.
    - Vulnerable areas require special attention and mitigation.
5. Understanding Project-Environment Interactions:
    - Consider how the proposed project interacts with its surroundings.
    - Identify potential positive and negative linkages.
6. Envisaged Sustainability:
    - Evaluate the long-term sustainability of the project's environmental impact.
    - Balancing economic benefits with ecological well-being is crucial.
7. Economic Value Assessment:
    - Understand the economic significance of the proposed project.
    - Weigh costs and benefits to inform decision-making.
8. Projected Impact Duration:
    - Estimate how long each project activity will impact various environmental components.
    - Short-term versus long-term effects guide planning.
9. Knowledge of Project Activities and Layout:
    - Familiarity with project activities, equipment types, and facility layout informs impact assessment.
    - Consider how these elements interact with the environment.
10. Baseline Study Observations:
    - Insights from baseline studies provide context.
    - Peculiar observations help tailor mitigation strategies.

Box 5.1: Summary of Measures Used to identify and weigh likely impacts

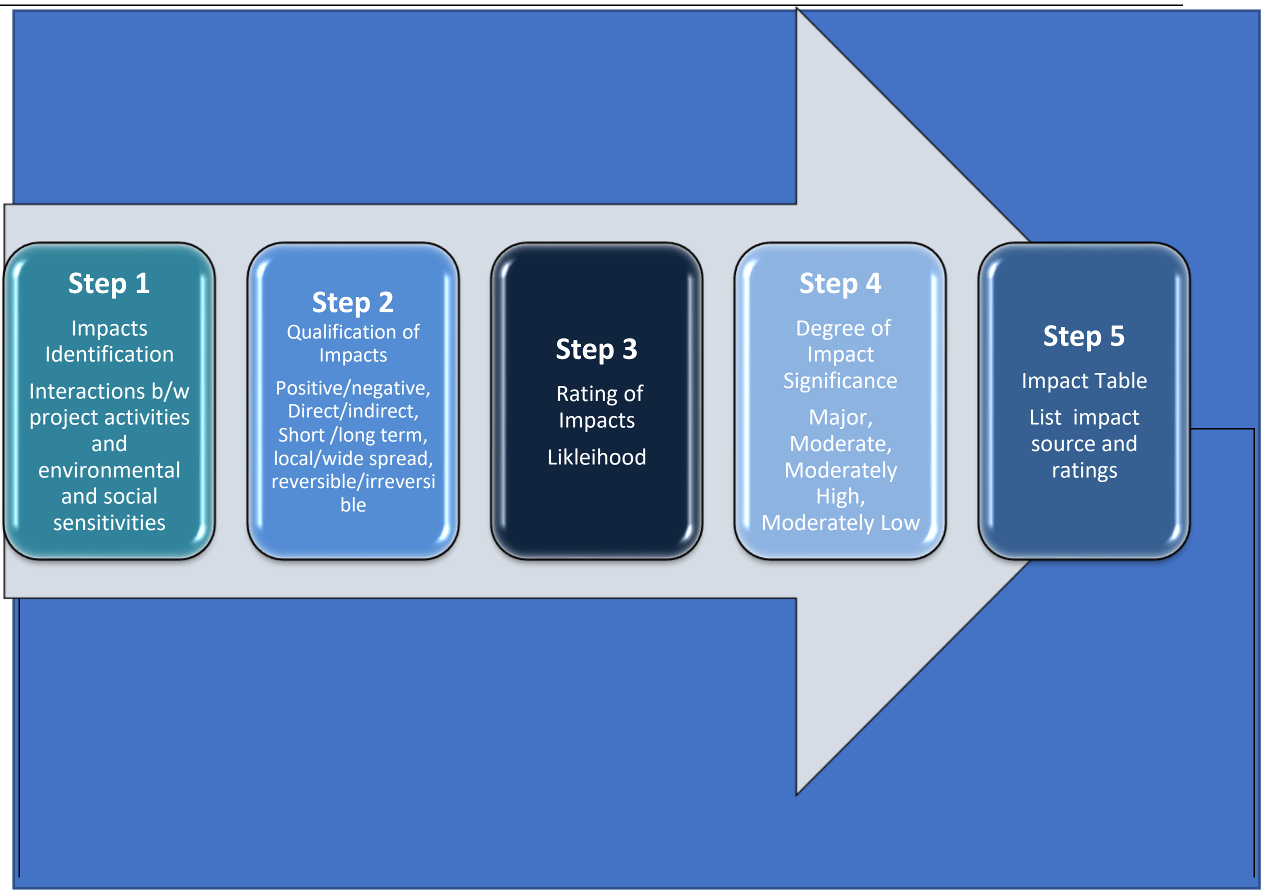


Figure 5.2: Impact Identification and Evaluation Process Flow

5.3 Summary of Significant Impacts

The Lagos-Calabar Coastal Highway holds immense promise, responsible planning, environmental assessment, and mitigation strategies are essential to balance development with the preservation of natural ecosystems. However, the project also has its own negative impacts. Both negative and positive impacts are summarised below

5.3.1 Significant Positive Impacts

The Lagos-Calabar Coastal Highway spans approximately 650 to 700 kilometers. The project is expected to take eight years to complete. This extensive highway will herald a new era of efficient travel and trade along Nigeria's coastal corridor. The estimated cost of the project is $2 billion (approximately N4 billion per kilometer) with a tentative cost based on other projects within the same budget. The government aims to recoup its investment through tolling the highway after 15 years upon completion.

The Lagos-Calabar Coastal Highway project holds immense promise for Nigeria's economic landscape, and careful consideration of these factors will be essential for its successful implementation. The proposed holds high positive socio-economic impacts .The highway connects major economic hubs, potentially boosting trade and commerce. However, this must be balanced with environmental considerations. Proper planning can ensure that the highway minimizes environmental impact while enhancing connectivity.

1. **Distance Compression:**

The coastal road will remarkably compress the distance between Lagos and Ondo State. For instance, the direct distance from Ibeju-Lekki in Lagos to Araromi in Ondo State is approximately 50 kilometres along the coast. This translates to about an hour's journey, significantly reducing travel time compared to existing routes.

2. **Economic Impact**:

The completion of the first phase of the project alone could increase the size of Lagos State's economy by 50%. The connection to the Lekki Deep Seaport and the Lekki economic corridor, where the Dangote Refinery and Petrochemical Complex is situated alongside other multinational industries, will drive economic growth. Upon completion, the highway is expected to significantly improve Nigeria's Logistics Performance Index (LPI) for trade and transport infrastructure. It could contribute at least 0.5 to 1.0 points to the LPI.

3. **Transformational Potential**:

The coastal highway will usher in a new era of ambitious road infrastructural development projects in Nigeria. Similar to the iconic Third Mainland Bridge, which spans over 11 kilometres across the lagoon, the Lagos-Calabar Coastal Road aims to be monumental. When completed, it will enter the world record books alongside iconic coastal routes like the Wild Atlantic Highway in Ireland and the Pacific Coastal Highway in the United States.

4. **Integration and Connectivity**:

The highway will have two spurs linking up with Northern Nigeria, further integrating the north and south in terms of movement of people, goods, and services. It promises to enhance regional connectivity and foster economic exchange.

5. **Blue Economy**:

The coastal highway connects major economic hubs, including the Lekki Deep Seaport. It facilitates efficient movement of goods, boosting trade and economic growth. Proper waste management along the highway is essential to prevent pollution of coastal waters.

6. **Ecotourism**:

The scenic coastal route can promote ecotourism. Sustainable development, preservation of natural habitats, and wildlife conservation are vital. Interpretive centres, eco-friendly rest stops, and guided tours can enhance the ecotourism experience.

7. **Provision of employment opportunities:**

The highway will contribute to the overall socio-economic wellbeing of the benefiting communities through the provision of employment opportunities (locals are expected to be engaged directly, especially as semi-skilled (e.g. masons, carpenters, electrical technicians, welders, etc.) and unskilled labour (e.g. for site clearance, loading and offloading of materials, security services e.t.c).

There will also be indirect opportunities for local contractors, businesses and food sellers amongst others. This will be a significant impact since the rate of unemployment is generally high in Nigeria and in project communities.

8. **National Impact**:

- **Improved Transport Conditions:** The Highway enhances connectivity, allowing smoother movement of goods, services, and people.
- **Sustained Access**: By maintaining the proposed infrastructure, Nigeria ensures long-term accessibility for its citizens.
- **Economic Growth**: The Highway contributes to Nigeria's economy on a global scale. Efficient transportation fosters trade, investment, and economic expansion.
- **GDP Contribution:** The coastal Highway facilitates the transit of goods to states along its route, bolstering GDP.
- **Strategic Importance**: As a major corridor, it supports regional integration and development.

9. **Host Communities**:

- **Increased Travel Efficiency and Productivity:** Reduced travel time and smoother journeys benefit commuters, businesses, and tourists.
- **Environmental Improvement:** Proper road construction minimises environmental impact. Sustainable practices enhance the quality of the surroundings. Integrated coastal managed to deal with coastal erosion and ensure biodiversity enhancement
- **Enhanced Quality of Life and Social Standards:** Access to better infrastructure positively affects residents' well-being. Improved roads lead to safer, more comfortable travel.
- **Economic Activity Spread:** The Highway connects villages and towns, promoting economic growth. Local businesses thrive due to increased accessibility.
- **Safety and Security Enhancement:** Addressing poor safety records ensures safer travel for all. Reduced accidents and incidents benefit both travelers and communities.
- **Stress Reduction:** Smooth roads alleviate stress for commuters and long-distance travelers.
- **Comfortable Rides:** Adequate facilities, including sidewalks, enhance the overall travel experience.
- **Environmental Aesthetics and Carbon Reduction:** Proper maintenance and greenery along the corridor reduce the carbon footprint. Aesthetically pleasing surroundings contribute to a better quality of life.

10. Integration with Existing Routes and Rail Lines

The Lagos-Calabar Coastal Highway will integrate significant routes such as the Badagry Expressway, the Fourth Mainland Bridge, and the Lekki Deep Seaport Road. This integration will facilitate seamless movement across various regions in North Nigeria. The project envisions incorporating rail lines within the median strips of main roads, enhancing transportation flexibility.

The Lagos-Calabar Coastal Highway project holds immense promise for Nigeria's economic landscape. It will not only improve transportation infrastructure but also catalyse economic diversification, social progress, and regional integration. By integrating rail systems, the project ensures a seamless and sustainable transportation network for generations to come.

The integration of rail systems enhances connectivity. Passengers can seamlessly switch between road and rail, reducing congestion and improving transportation options. Rail stations along the route become vital hubs for travelers and cargo.

The potential impacts of the Lagos-Calabar Coastal Highway development, considering both the construction phase and the long-term effects, including the integration with the rail system:

a. During Construction (Short-Term Impacts):

1. Economic Growth and Job Creation:

The construction phase will generate employment opportunities for local communities along the route. Contractors, laborers, engineers, and support staff will be involved in building the highway and rail infrastructure.

2. Infrastructure Development:

The highway's construction will lead to the development of roads, bridges, and rail tracks. Improved infrastructure enhances connectivity and accessibility.

3. Environmental Impact:

Construction activities may disrupt local ecosystems, soil stability, and water bodies. Proper environmental impact assessments and mitigation measures are crucial.

4. Social Disruptions:

Land acquisition and resettlement may affect communities. Ensuring fair compensation and minimizing disruption is essential.

b. During Operation (Long-Term Impacts)

1. Economic Transformation:

The Lagos-Calabar Coastal Highway will stimulate economic growth by connecting major urban centers, industrial hubs, and seaports. It reduces travel times, lowers transportation costs, and enhances market access for businesses.

2. Tourism and Trade:

Improved infrastructure attracts tourists and facilitates trade. Coastal regions become more accessible, boosting local economies.

3. Social Integration:

The highway bridges the rural-urban divide, integrating remote communities into national and regional supply chains. Inclusive development reduces income disparities.

Box 5.1: Positive impact of Integrating Rail System into the Road

5.2.2 Significant Negative Impacts

The proposed development unfortunately is also likely to exert negative impacts on the social and physical environment within which it is executed. This is because, for instance, with regard to the construction phase which is often a rapid and disorderly process when strong emphasis on completing the project is paramount and not on protecting the environment.

Construction activities occur only once but can have lasting effects due to site preparation, earth works, waste generation, traffic and safety which are localized and reversible. During construction, the impacts are rated as significant. However, they are considered minor in duration since construction activities are temporary. Proper construction management practices are crucial to minimize negative impacts. Adherence to safety protocols and environmental safeguards is essential. Proactive measures, responsible construction practices, and continuous monitoring will help mitigate any adverse effects during the construction phase.

Based on the design of the project, these impacts can be divided into two, namely:

a. **Short-term construction-related impacts typical of building construction activities such as:**

1. **Community Engagement and Land Acquisition:**
- Community Resistance: Some communities may resist land acquisition for the highway, leading to delays and disputes.
- Compensation: Ensuring fair compensation for affected landowners and communities is critical for maintaining goodwill.
- Relocation Challenges: Resettling communities while minimizing disruption requires thoughtful planning and sensitivity.
2. **Geological and Environmental Factors:**
- Habitat Destruction: The construction of the coastal highway could lead to habitat destruction, disrupting ecosystems along the route.
- Vulnerability to Erosion and Flooding: Altering the coastal landscape may increase vulnerability to erosion and flooding. The coastal region's susceptibility to erosion poses a risk to soil stability and overall highway integrity.
- Swamps, Mangroves, and Wetlands: These natural features along the route complicate foundation work and roadbed construction.
- Ecological Impact: Striking a balance between development and environmental conservation is crucial. Efforts to minimize harm to local ecosystems and wildlife habitats are essential.
3. **Infrastructure and Logistics:**
- Materials Supply: Transporting construction materials over long distances can be costly and time-consuming.
- Access Roads: Developing access roads to remote construction sites is challenging.
- Bridge Construction: Building durable bridges across rivers and estuaries demands specialized engineering expertise.
4. **Security and Safety:**
- Security Threats: The highway passes through regions with security challenges (e.g., militancy, banditry). Ensuring safety for workers and equipment is paramount.
- Traffic Management: Coordinating traffic during construction, especially in densely populated areas, requires careful planning.
5. **Funding and Budget Constraints:**
- Cost Overruns: Unexpected expenses can strain the project budget. Vigilant cost management is essential.
- Government Funding: Consistent funding throughout the eight-year construction period is critical for project continuity.
6. **Technical Engineering Challenges:**
- Soft Soil Stabilization: Techniques like soil compaction, geotextiles, and deep foundations are necessary for stability.
- Drainage Design: Proper drainage prevents waterlogging and erosion.
- Bridge Durability: Constructing bridges that withstand environmental forces and heavy traffic is a significant task.
7. **Noise and Dust Nuisance:**

- The preparation of the site and material transportation can lead to increased noise and dust levels.

8. Waste Generation and Disposal:

- Proper management of waste from the site and camp is essential to prevent environmental harm.

9. Soil Contamination:

- Stored fuel, lubricants, and paints can contaminate the soil.

10. Health and Safety Issues:

- Occupational Health: Workers involved in construction (including non-skilled workers, operators, drivers, surveyors, and supervisors) face health risks.
- Workers' Camp: Proper facilities and safety measures must be in place at the workers' camp.
- Public Safety: Ensuring safety for the public near construction zones is critical.

11. Resource Utilization:

- Efficient use of resources is necessary.

12. Potential Social Issues:

- Increased social vices and other community-related challenges may arise.

the long-term operation and maintenance impacts and sustainability

i. Direct Impacts:

- Energy Consumption: The operation of the highway will require energy for lighting, toll collection, and other facilities.
- Emissions and Pollution: Increased traffic will lead to emissions from vehicles, affecting air quality and contributing to climate change.
- Waste Disposal and Recycling: Proper management of waste generated during construction and maintenance is crucial. Recycling materials and minimizing landfill use are essential for sustainability.

ii. Indirect Impacts:

- Economic Structure and Trade: The highway's presence can influence economic activities along its route. It may lead to the growth of industries, trade hubs, and real estate development.
- Transportation Systems: The highway will impact existing transportation networks, potentially improving connectivity and efficiency.

iii. Social and Lifestyle Effects:

- People's Lifestyle: The highway will alter how people travel, commute, and interact. It may change daily routines and social dynamics.
- Social Values: Balancing economic development with cultural and social values is critical. Community engagement and understanding local perspectives are essential.
- The "Rebound Effect": As the highway improves accessibility, there may be increased demand for travel, leading to more traffic and potential negative consequences.

iv. Maintenance and Long-Term Sustainability:

- Maintenance Planning: Developing a comprehensive maintenance strategy is vital. Regular inspections, repairs, and upgrades will ensure the highway remains safe and functional.
- Climate Resilience: Considering rising sea levels, extreme weather events, and changing climate patterns during design and construction is essential. Proper drainage, erosion control, and durable materials are crucial for long-term resilience.

The above identified impacts are further outlined below based on the phases of the project.

Table 5.3: Summary of Identified impacts Due to Phases of the Project

S/No	Phase	Potential Impact
1	Pre-Construction and Construction	**Construction Phase Effects**: • Environmental Disruption: During the construction phase, the natural environment will face disruption due to excavation, earthmoving, and road-building activities. • Habitat Fragmentation: The highway may fragment habitats, affecting wildlife movement and gene flow. • Soil Erosion: Soil disturbance can lead to erosion, impacting soil quality and stability. • Water Quality: Runoff from construction sites may carry pollutants into nearby water bodies. **Loss of Biodiversity** and **Natural Capital**: • Vegetation Removal: Clearing land for the highway will result in the removal of vegetation, affecting plant species diversity. • Wildlife Displacement: Animals may be displaced from their natural habitats, leading to population declines or local extinctions. • Impact on Endangered Species: Sensitive species, such as nesting seabirds or marine animals, could suffer. • The highway's alignment may pass through habitats that support diverse flora and fauna some identified as sensitive areas and endangered species. • The highway will intersect with valuable natural capital, including coastal ecosystems, **Coastal Erosion and Sedimentation**: • Altered Coastal Dynamics: The highway's construction and maintenance may alter coastal sediment transport patterns. • Beach Erosion: Changes in sediment deposition could lead to beach erosion, affecting coastal ecosystems. • The highway's construction and alteration of the coastal landscape can exacerbate **Waterway Obstruction**: • Bridges and Culverts: Waterways crossed by the highway may face obstruction due to bridge piers or culverts. • Fish Migration: Impaired fish migration routes could impact fish populations and aquatic ecosystems. **Impact on Geology** and **Soil Impact**: • Soil compaction, excavation, and filling can disrupt soil structure. **Water Resources**: • Runoff from construction sites can carry sediment and pollutants into water bodies. **Air Quality and Noise**

Table 5.3: Summary of Identified impacts Due to Phases of the Project		
S/No	**Phase**	**Potential Impact**
		• Dust emissions from construction activities can degrade air quality and noise can impar hearing for receptors **Noise and Light Pollution**: • Traffic Noise: Increased traffic along the highway may disturb wildlife, affecting their behaviour and communication. • Construction machinery, drilling, and blasting generate noise. • Noise pollution can affect nearby communities and wildlife. • Artificial Lighting: Highway lighting can disrupt nocturnal animals and nesting seabirds. **Climate Change -Adaptation and Resilience**: • The geographically location is prone to climate vulnerability • The coastal highway's vulnerability to rising sea levels should be **Climate Change -Green House Gas Emission** • Construction Phase Emissions: During the construction of the highway, emissions from heavy machinery, transportation of materials, and energy-intensive processes contribute to greenhouse gas emissions. • Deforestation and Soil Disturbance: Clearing land for the highway may involve deforestation, releasing stored carbon and reducing natural carbon sinks. • Vehicle Emissions: Once operational, the highway will accommodate vehicles, contributing to air pollution and greenhouse gas emissions. **Waste Management**: • The construction and operation of the highway will generate significant waste, including construction debris, packaging materials, and maintenance waste. **a. Social Negative Impacts** **1. Land Acquisition Challenges:** • Economic Displacement: The road project necessitates land acquisition for the alignment or ROW for accommodating the new highway. **2. Displacement and Destruction of Cultural and Sacred Sites**: • The highway's construction may lead to the displacement or destruction of cultural heritage sites, including sacred areas. • Historical landmarks, burial grounds, and traditional sites could be affected. **3. Threat to Community Culture, Safety, and Security**: • The highway's development may alter the social fabric of local communities. • Traditional practices, community cohesion, and safety dynamics could be disrupted. **4. Pressure on Existing Infrastructures in Host Communities**:

Table 5.3: Summary of Identified impacts Due to Phases of the Project		
S/No	**Phase**	**Potential Impact**
		• The influx of traffic, businesses, and population due to the highway can strain existing infrastructure. • Roads, utilities, healthcare facilities, and schools may face increased demand. **5. Security Challenges**: • The highway's length and connectivity may pose security challenges. **6. Social Misfit/Miscreants Taking Over the Site**: • Abandoned or partially constructed sites may attract squatters or miscreants.
2	Operation Phase:	1. **Air Quality Impacts**: Vehicle emissions from highway traffic can impact air quality. 2. **Noise Impacts**: Highway traffic noise can affect nearby communities. 3. **Geology and Soil Impacts**: Highway operation may cause wear and tear on road surfaces and embankments. 4. **Water Resources Impacts**: Highway runoff can carry pollutants into rivers and streams. 5. **Security Challenges**: The highway's length and connectivity may pose security challenges. Increased movement of goods and people could attract criminal activities. 6. **Maintenance of Infrastructure**: Regular maintenance is essential to keep the highway safe and functional. Ensuring road surface quality, signage, lighting, and drainage systems are crucial. 7. **Traffic Management and Congestion**: Efficient traffic management is necessary to prevent congestion. Proper road signage, lane discipline, and monitoring are vital. **Health and Safety** i. **Health and Safety for Workers and Commuters**: Occupational health and safety protocols must be followed during maintenance activities. Ensuring worker safety and minimizing disruptions to commuters are priorities. **ii. Impact on Community Health and Safety**: The highway's construction and operation can affect community health and safety. Dust, noise, and pollution during construction may impact residents' well-being. iii. **Impact on Occupational Health and Safety (OHS)**: Workers involved in highway construction face occupational hazards.

Table 5.3: Summary of Identified impacts Due to Phases of the Project		
S/No	**Phase**	**Potential Impact**
		iv. **Risk of Sexually Transmitted Diseases, HIV/AIDS Issues, and Other Communicable Diseases**: Labour influx due to construction can lead to social interactions and potential health risks. 8. **Labour Influx**: The highway project will attract a large labour force. 9. **Gender-Based Violence**: Construction sites often witness gender-based violence.
3	Decommissioning Phase	i. **Physical Disturbance Arising from Equipment Removal**: As equipment is dismantled and removed, the surrounding environment may experience physical disruption. Soil compaction, ground disturbance, and alteration of natural features can occur. ii. **Soil Erosion Resulting from Improper Reinstatement of Excavated Soil**: If excavated soil is not properly reinstated, erosion can occur. Unstable slopes, sediment runoff, and loss of topsoil may impact nearby ecosystems. iii. **Air Quality Degradation and Noise Generation**: During equipment removal and building demolition, dust, debris, and noise are generated. Air quality may deteriorate, affecting both workers and nearby communities. iv. **Hazards/Risks and Accidents**: Decommissioning involves handling heavy machinery, hazardous materials, and structural elements. Risks include falls, equipment malfunctions, and exposure to toxic substances. v. **Waste Management Problems**: Disposing of decommissioned materials (concrete, metals, etc.) requires proper waste management. Inadequate disposal can lead to pollution and environmental harm. vi. **Social Misfit/Miscreants Taking Over the Site**: Abandoned decommissioning sites may attract squatters, vandals, or criminal activities. Proper security measures are essential to prevent misuse.

5.3.3 Summary of Impacts Based on Project Phases and Impact Rating

Refer to Table 6.3 for a detailed summary of specific impacts related to the Lagos-Calabar Coastal Highway project. These impacts cover various fields, including environmental, social, and economic aspects.

A more project specific potential negative impacts and the level of impacts that could emanate from the project are summarized in Table 6.3 with some specific fields of impacts briefly described.

Table 5.4: Summary of Impacts Based on Project Phases

No	Aspect	Identified Impact	Impact Criteria: Duration	Extent	Frequency	Magnitude	Likelihood	Consequence	Significance
a.	Pre-Construction and Construction Phases								
1	Soil, Surface and Water Quality	Potential to impact soil and sediment quality through soil compaction, erosion, fuel and lubricant spills, improper waste disposal, and contamination from hazardous materials, which can harm nearby ecosystems and human health	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
2		Potential Impact on coastal morphology, affecting shoreline shape, sediment dynamics, erosion patterns, beach profiles, intertidal zones, and marine habitats, with potential impacts on sediment distribution, seabed stability, and soil salinization	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
3		Flooding, Erosion and Sedimentation Impact. Land reclamation may increase the risk of flooding, erosion, and sedimentation by altering the natural coastline, disrupting sediment transport patterns, reducing coastal habitats, and disturbing the balance of sediment deposition and erosion.	Short-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
4		impact the Marine Environment, Hydrology, and Ecosystems through habitat destruction, introduction of pollutants, alteration of water flow patterns, sediment accumulation, and potential loss of protective coastal features, affecting marine life and ecosystem services.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
5		Mobilisation of Pollutants from Contaminated Land Encountered during Earthworks. When contaminated soil is disturbed, it can lead to an increase in the release of pollutants, which may include harmful substances such as heavy metals and hydrocarbons.	Short-term to Long-term	Local	One-time to Intermittent	Small	Somewhat Likely	Moderate	Minor
6	Air Quality	Potential Impact ambient air quality through construction activities like demolition, concrete pouring, and heavy equipment operation, as well as transportation of materials by trucks.	Short-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
7		The project may lead to increased dust emissions from various construction activities and ancillary sites, potentially affecting air quality	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate

Table 5.4: Summary of Impacts Based on Project Phases										
No	**Aspect**	**Identified Impact**	**Impact Criteria**							
			Duration	**Extent**	**Frequency**	**Magnitude**	**Likelihood**	**Consequence**	**Significance**
8		Increase in air pollution through elevated vehicle emissions, including nitrogen oxides, volatile organic compounds, and particulate matter, which can adversely affect human health	Short-term to Long-term	Local	One-time to Intermittent	Small	Planned	Minor	Minor
9		combustion activities, including operation of diesel power generators and equipment, are key sources of emissions that can adversely affect human health through pollutants like NO_2, SO_2, PM_{10}, and $PM_{2.5}$.	Short-term to Long-term	Local	Intermittent	Small	Planned	Minor	Minor
10	Noise and Vibrations	Impact on ambient noise quality from port construction activities and ancillary sites.	Short-term	Local	Intermittent	Small	Probable	Minor	Minor
11		Potential Impact on Human Health Associated with Increased Noise Levels from Construction Activities to other terminal operators and contractors in the area	Short-term	Local	Intermittent	Small	Probable	Minor	Minor
12		Generate underwater noise and vibrations from activities such as pile driving, and vessel transportation, potentially impacting marine life and ecosystems.	Short-term	Local	Intermittent	Medium	Probable	Moderate	Moderate
13		Impact nearby community structures due to ground vibrations from construction activities, potentially leading to discomfort, stress, and safety risks, particularly for sensitive structures	Short-term	Local	Intermittent	Medium	Probable	Moderate	Moderate
14	Waste	Construction activities will generate various types of waste, including construction debris, excavated soil, packaging waste, chemical waste, metal scraps, wood waste, plastic waste, electrical and electronic waste, and hazardous waste, which could potentially impact the local environment and community receptors due to existing waste management challenges in Lagos	Long-term	Local	Intermittent	Medium	Probable	Moderate	Moderate
15	Hydrology	Spills or Leaks Resulting in Contamination of Groundwater and Surface Water. The fuels or hydraulic fluids used in the equipment have the potential to spill, which can lead to the release of hydrocarbons. Contamination Risk: The soil, groundwater, and surface water in the area can become contaminated by these	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
16		Activities such as quay demolition, drilling and piling, grouting, backfilling, and raw material storage and handling can lead to increased turbidity in nearby water bodies due to the	Long-Term	Local	Intermittent	Small	Probable	Moderate	Moderate

Table 5.4: Summary of Impacts Based on Project Phases

No	Aspect	Identified Impact	Impact Criteria: Duration	Extent	Frequency	Magnitude	Likelihood	Consequence	Significance
		resuspension of bottom sediment, production of fine particulate matter, and inadequate sediment management methods.							
17	Biodiversity	construction activities may disrupt ecosystem services such as soil stability, nutrient cycling, and habitat provision, while sediment runoff and chemical pollutants can degrade water quality and dust and emissions can impact air quality	Long-Term	Local	One-time	Small	Unlikely	Minor	Not Significant
18	Biodiversity	Disturbance of Marine Ecology due to land reclamation, infrastructure development, release of sediment and construction noise and vibrations.	Long-Term	Local	One-time	Small	Unlikely	Minor	Not Significant
19	Biodiversity	Avifauna may experience habitat loss, disturbance from noise and vibrations, and an increased risk of collision with machinery and structures	Long-Term	Local	One-time	Small	Unlikely	Minor	Not Significant
20	Biodiversity	Introduction of Marine Invasive Species by Hull Fouling, generating ecological alterations and affecting the ecosystem services.	Long-Term	Local	One-time	Small	Unlikely	Minor	Not Significant
	marine and blue economy	Coastal infrastructure (e.g., roads, bridges, ports) impact marine habitats.							
	marine and blue economy	Blue Economy Opportunities open for sustainable economic activities related to the ocean, such as aquaculture, tourism, and renewable energy and for investment and job creation within the blue economy							
	marine and blue economy	Dredging stirs up sediment, affecting water clarity and potentially smothering sensitive habitats like coral reefs and seagrass beds. The removal of sediment can disrupt habitats where marine organisms live, feed, and breed. Dredged material may contain pollutants, affecting water quality. Dredging operations can create underwater noise and vibrations, which may stress or harm marine life.	Short-term to Long-term	Local	Intermittent	Medium	Probable	Major	Moderate
21	Social	Road Traffic and Transport Risk of Project Vehicle Traffic Accidents due to increased traffic volume during construction on employees, nearby residents, and businesses	Short-term	Local	Intermittent	Medium	Somewhat Likely	Major	Moderate

Table 5.4: Summary of Impacts Based on Project Phases

No	Aspect	Identified Impact	Impact Criteria						
			Duration	Extent	Frequency	Magnitude	Likelihood	Consequence	Significance
22		Social Services and Local Lifestyle- The highway's construction may disrupt local lifestyle and values, affecting communities residing near the route. Social services, such as healthcare, education, and utilities, may need to be reconfigured to accommodate the displaced population.	Short-term to Long-term	Local	Intermittent	Medium	Probable	Moderate	Moderate
23		Migration and Settlement Patterns- as people move away from affected areas, Settlement patterns could change due to the highway's impact on property availability and accessibility	Long-term	Local	One-time	Small	Unlikely	Minor	Minor
24		Disruption on fishing activities by damaging fishing grounds, polluting waters, and altering fish habitats, leading to potential declines in fish populations and reduced income for local fishermen.	Short-term	Local	Intermittent	Medium	Probable	Major	Moderate
25		Potential Infringement on Workers' Human Rights if not working under safe and fair working conditions	Long-Term	Regional	Intermittent	Medium	Somewhat Likely	Major	Moderate
	Health and safety	Community health and safety may be impacted by physical injury risks, exposure to hazardous materials, respiratory effects from air emissions, spread of communicable diseases, changes to diet and subsistence foods, and strain on local health services and infrastructure.	Long-term	Local	One-time	Small	Unlikely	Moderate	Moderate
		Occupational health and safety issues arose construction activities including physical hazards, chemical hazards, confined spaces, exposure to dust and noise.	Long-term	Local	One-time	Small	Unlikely	Moderate	Moderate
	Operation								
1	Soil, Surface and Water Quality	Fuel spills from machinery and transport vehicles which can Hydrocarbons (from fuels) can infiltrate the soil, potentially reaching groundwater.	Long-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor

Table 5.4: Summary of Impacts Based on Project Phases									
No	**Aspect**	**Identified Impact**	**Impact Criteria**						
			Duration	**Extent**	**Frequency**	**Magnitude**	**Likelihood**	**Consequence**	**Significance**
2		Spills during offshore transportation (e.g., ships, vessels). Oil and grease can contaminate coastal soil, impacting vegetation and wildlife.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
3		Disposing waste outside designated zones with Soil degradation, loss of biodiversity, and harm to ecosystems.	Short-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
4		Soil exposure to hazardous substances (e.g., heavy metals, pesticides) with soil quality degradation, posing risks to human health and ecosystem integrity.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
5	Air Pollution	Emissions from ships, trucks, and machinery contribute to air pollution.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
6	Noise and Vibrations:	Port operations generate noise and vibrations, impacting nearby communities. Disruptions to sleep patterns and stress levels can occur.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
		Nearby residents experience disturbances, affecting sleep and overall well-being.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
7	**Climate Change Impact**	Port facilities vulnerable to climate-related hazards such as rising sea levels, storm surges, and extreme weather events	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Moderate	Moderate
8	Traffic Congestion	Increased cargo handling can lead to traffic congestion around the port. Delays and inefficiencies affect transportation networks.	Short-term to Long-term	Local	Intermittent	Medium	Probable	Major	Moderate
		Infrastructure Strain: Roads and intersections become overloaded.	Short-term to Long-term	Local	Intermittent	Medium	Probable	Major	Moderate
8	Social	Potential disruption to roads and access routes, dust emissions affecting social receptors, and interruptions to nearby businesses and food vendors reliant on project activities.	Short-term to Long-term	Local	One-time	Small	Probable	Minor	Minor

Table 5.4: Summary of Impacts Based on Project Phases										
No	**Aspect**	**Identified Impact**	**Impact Criteria**							
			Duration	**Extent**	**Frequency**	**Magnitude**	**Likelihood**	**Consequence**	**Significance**
		Social Disruption arising from ignoring community concerns which can lead to social unrest, protests, and strained relationships between the port authority and local residents.	Long-term	Local	One-time	Small	Likely	Major	Moderate
9	Health Risk	Air pollution and exposure to hazardous materials pose health risks. Port workers and nearby residents may be affected.	Short-term to Long-term	Local	Intermittent	Medium	Probable	Major	Moderate
		Exposure to Hazardous Materials with Chemical Risks- Handling hazardous cargo or materials poses health hazards and Contaminated Soil:- soil near the port may contain harmful substances.	Short-term	Local	Intermittent	Medium	Probable	Major	Moderate
10	Human Rights Impacts	Salient human rights abuses or risks could arise which include workers' rights, community and land rights, and environmental protection	Short-term to Long-term	Local	Intermittent	Medium	Probable	Major	Moderate
C.	**Decommissioning Phase**								
1	Soil, Surface and Water Quality	Increased turbidity and suspended solids due to site clean-up and equipment removal in the case of increased sediment and debris being washed into adjacent Badagry creek.	Long-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
2		Saline water intrusion into the freshwater aquifer system due to dewatering activities if not controlled or managed properly.	Short-term to Long-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
3		Removal of structures and equipment can lead to bare soil, increasing surface runoff and the mobilization of pollutants into nearby surface water bodies if not managed properly	Short-term	Local	One-time to Intermittent	Small	Probable	Minor	Minor
4	Social	Potential disruption to roads and access routes, dust emissions affecting social receptors, and interruptions to nearby businesses and food vendors reliant on project activities.	Short-term	Local	One-time	Small	Probable	Minor	Minor
5		Occupational health and safety issues from decommissioning construction activities including physical hazards, chemical hazards, confined spaces, exposure to dust and noise.	Long-term	Local	One-time	Small	Unlikely	Minor	Not Significant

5.4 Discussion of Some of Identified Impacts

5.41 Potential Impacts during Preconstruction and Construction

1. Soil, Surface and Water Quality

Potential Impact to Soil and Sediment Quality

Impact Description

During the Coastal Highway project, construction can impact soil in the following ways:

- Site development can cause soil compaction, erosion, and alter soil properties.
- Unintentional fuel and lubricant spills can contaminate soil and harm nearby ecosystems. –
- Fuel spills from machinery and transport can introduce hydrocarbons into the soil and affect groundwater quality.
- Oil and grease spills during offshore transportation can contaminate soil and impact vegetation.
- Improper disposal of debris and waste can lead to soil pollution and nutrient availability issues.
- Waste disposal outside designated areas can cause soil degradation and harm ecosystems.
- Soil contamination from hazardous materials can harm soil quality and human health.

Receptor Sensitivity

The Coastal Highway project has several sensitive receptors. These include residents and businesses near the project corridor nearby communities and camp site workers.

Residents and businesses near the project corridor are highly sensitive to dust, noise, and other impacts. Host communities are also sensitive receptors.

Nearby communities may experience air quality changes.

It is important to prioritize the health and well-being of these receptors. Effective mitigation measures must be implemented to minimize impacts.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Moderate
Significance	Moderate

Potential Impact to Coastal Morphology

Impact Description

The Coastal Highway project can impact coastal morphology through specific activities such as land reclamation which has multifaceted impacts on coastal morphology, sediment dynamics, and ecosystem structure. The proposed land reclamation, particularly raising the land by 2.8 meters, as part of the Coastal Highway project, could have significant impacts which include altering the coastline, dredging: offshore soil disposal and loss of intertidal zones. Specifically, these include:

- Altering the coastline, changing the shape of shoreline, sediment transport, and erosion patterns.
- When sand is deposited during reclamation, it modifies the natural coastline, potentially leading to changes in beach profiles, headlands, and bays.
- Disposing of unsuitable soil at an offshore site can disturb the seabed, altering sediment distribution, affecting the stability of the seabed, and marine habitats.
- The newly reclaimed land replaces intertidal zones, impacting the habitat for various organisms. In summary, land reclamation has multifaceted effects on coastal morphology, sediment dynamics, and ecosystem structure.
- Soil salinization often occurs in reclamation regions due to the deposition of salt-rich sediments

Receptor Sensitivity

The Coastal Highway project has several sensitive receptors:

- The Coastal Highway project has several sensitive receptors. These include residents and businesses near the project corridor nearby communities and camp site workers.
- Residents and businesses near the project corridor are highly sensitive to dust, noise, and other impacts. Host communities are also sensitive receptors.
- Habitats within the highway coastline are subject to significant disturbance from construction activities.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Moderate
Significance	Moderate

Flooding, Erosion and Sedimentation Impact

Impact Description

The proposed project activities, particularly raising the land by 2.8 meters may meet the development needs, but it is also likely to introduce various risks related to flooding, erosion, and sedimentation as outlined below:

- Flooding Impact: Land reclamation can exacerbate coastal flooding by altering the natural coastline. It makes the area more susceptible to inundation during storm surges and high tides, which increases vulnerability. The effects of continued land reclamation are not immediate, but they are profound and can lead to a dramatic increase in expected annual inundation over time.

- Erosion Impact: Land reclamation disrupts natural sediment transport patterns and alters coastal dynamics. It removes coastal habitats, reducing their ability to act as buffers against erosion. The newly reclaimed land may be more susceptible to erosion due to altered wave action and sediment availability. Reclamation often involves dredging and excavation, which removes sediments from the seabed. This loss of sediment can affect adjacent coastal areas and contribute to erosion.
- Sedimentation Impact: Land reclamation also disturbs the balance of sediment deposition and erosion. Sediments that would naturally replenish coastal areas are diverted elsewhere during reclamation, leading to a disturbed sediment balance. Altered sediment dynamics can impact downstream ecosystems, affecting water quality, habitats, and marine life. Accumulation of sediments in newly reclaimed areas may require ongoing maintenance dredging to keep navigation channels clear, posing navigational challenges.

Receptor Sensitivity

At risk due to these potential impacts are local residents, businesses, and ecosystems within the project corridor.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Minor
Significance	Minor

Potential Impact on Marine Environment, Hydrology, and Ecosystem Services

The Coastal Highway is likely to impacts on the marine environment, hydrology, and ecosystems in the following ways:

Marine Environment:

- **Habitat Destruction**: The construction activities associated with the coastal highway project pose a threat to marine habitats. These habitats are crucial for various species, including fish, crustaceans, and other marine organisms. Unfortunately, the destruction of these habitats is likely to occur, albeit at a low level.
- **Pollutants**: The construction activities introduce potential pollutants into the marine environment. These pollutants include oil spills, heavy metals, and other toxic substances. Such contamination can harm marine life and disrupt the delicate balance of ecosystems.

Hydrology:

- **Altered Water Flow**: The Construction activities may modify natural water flow patterns. This alteration affects sediment transport, nutrient cycling, and overall hydrological processes. The changes in water flow can have cascading effects on the entire ecosystem.
- **Sediment Accumulation**: The construction activities may cause sediment accumulation, leading to changes in water depth and clarity. Excessive sedimentation can smother benthic habitats (the habitats at the bottom of water bodies) and adversely affect water quality.

Ecosystem Impact:

- **Loss of Protective Services**: Natural coastal features like mangroves and salt marshes play a crucial role in protecting against storm surges and erosion. However, construction activities at the port could reduce these protective services, leaving the coastline more vulnerable to natural forces.
- **Deterioration of Ecosystem Services**: Community members make use of the coast as an ecosystem service. Its deterioration can affect their living conditions.

Receptor Sensitivity

Marine organisms are sensitive to habitat destruction, which can affect their survival. Pollution, altered water flow, sediment accumulation, and loss of natural coastal features can also disrupt marine ecosystems. To ensure sustainable use of resources, balancing development with conservation is crucial.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Moderate
Significance	Moderate

Potential Impact due to pre-construction and construction activities

Impact Description

Potential Impact due to pre-construction and construction activities associated with the **Lagos-Calabar Coastal Highway Project** can significantly impact aquatic ecosystems. The impacts could be summarised as follow:

1. **Water Pollution Sources**:

During construction, sediments, chemicals, and pollutants from machinery, materials, and site activities can enter nearby water bodies. Concentrations of COD (Chemical Oxygen Demand) and Fecal Coliform in labor camp wastewater may exceed national standardsDischarged overflow dredging water contains high levels of turbidity and TSS (Total Suspended Solids), affecting surface water quality

2. **Direct Impacts on Aquatic Ecosystems**:

Increased turbidity due to sediment runoff can reduce light penetration, affecting photosynthesis and aquatic plant growth. Pollutants like heavy metals, hydrocarbons, and pharmaceuticals can harm aquatic organisms, disrupting ecosystems.

Receptor Sensitivity

1. **Water Pollution Sources:**

During construction, various pollutants can find their way into nearby water bodies. These include sediments, chemicals, and contaminants from machinery, materials, and site activities.

Concentrations of COD (Chemical Oxygen Demand) and Fecal Coliform in labor camp wastewater may exceed national standards. These parameters are indicators of organic pollution and bacterial contamination, respectively.

Additionally, the discharge of overflow dredging water can introduce high levels of turbidity (cloudiness) and TSS (Total Suspended Solids) into surface water, affecting water quality.

2. **Direct Impacts on Aquatic Ecosystems:**

Increased turbidity resulting from sediment runoff can reduce light penetration in water. This reduction in available light affects photosynthesis, which is crucial for aquatic plant growth.

Pollutants such as heavy metals, hydrocarbons, and pharmaceuticals can directly harm aquatic organisms. These substances disrupt ecosystems by affecting the health and behavior of fish, invertebrates, and other aquatic life.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Somewhat Likely
Consequence	Moderate
Significance	Minor

Potential Impact due to Mobilization of Pollutants from Contaminated Land Encountered during Earthworks

Impact Description

The Coastal Highway Project may encounter contaminated land during excavation, grading, and dredging. When contaminated soil is disturbed, it can lead to an increase in the release of pollutants, which may include harmful substances such as heavy metals and hydrocarbons.

Receptor Sensitivity

The receptor sensitivity for the potential risks of encountering contaminated land during Project activities includes the following sensitive receptors:

- Local Residents: These individuals are vulnerable to changes in soil and water quality, and may be affected by any contamination that may arise as a result of the project.
- Aquatic Ecosystems: Flora and fauna in nearby water bodies may also be impacted by any contamination that may occur during the project.
- Human Health: People living or working in the vicinity of the project may also be susceptible to adverse health effects as a result of exposure to any contaminants that may be present.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Somewhat Likely
Consequence	Moderate
Significance	Minor

Air Quality

Potential Impact on Ambient Air Quality

Impact Description

According to the air quality assessment, pollutant concentrations are currently within the guidelines set by FMEnv. Pollutants such as particulate matter (dust), CO, NO_2, SO_2, and Hydrocarbons were all below equipment detection limits. These levels meet the statutory guidelines.

However, the project might have an impact on the ambient air quality due to various construction activities such as demolition, concrete pouring, welding, and heavy equipment operation. These activities are known to contribute to air pollution. Moreover, the transportation of construction materials through trucks can also increase air pollution. The two ancillary sites in existing industrial areas where activities are taking place may also release pollutants into the air.

Receptor Sensitivity:

During the project activities, the following are the impact-sensitive receptors related to air quality:

1. **Construction workers**: They work at the construction site and are exposed to dust, emissions from equipment, and other pollutants. Proper protective measures are crucial for their health.
2. **Local Communities:** Residents living near the project corridor are sensitive receptors. Increased construction activities affect their air quality, and dust, noise, and emissions impact their well-being.

3. **Pedestrians and Commuters:** People passing by the construction areas are indirectly affected. Increased truck movements and dust can harm their air quality. Proper traffic management minimizes exposure.
4. **Workers in Adjacent Areas:** Employees working in nearby industrial facilities are receptors. Emissions from construction activities may affect their workplace air quality, and monitoring and mitigation are essential.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Minor
Significance	Minor

Impacts of Other Pollutants/Emissions

Impact Description

Increased construction traffic and the operation of heavy machinery and equipment can result in elevated vehicle emissions, including nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter (PM), contributing to air pollution. These pollutants have been demonstrated to affect human health from acute and long-term exposure adversely.

The applicable WHO Ambient Air Quality Guidelines for $PM_{2.5}$ and PM_{10} are summarized below.

Table 5.5: Who Ambient Air Quality Guidelines

Pollutant	Averaging period	Guideline Value
NO2	1 hour	200
	Annual	40
SO2	10 minute	500
	24 hour	20
PM2.5	24 hour	25
	Annual	10
PM10	24 hour	50
	Annual	20

Receptor Sensitivity

The receptors of concern for air quality impacts will be people present in the Area of Influence (AOI). In this case, the most affected air quality-sensitive receptors will be residents in close proximity to the project footprint. This includes residents and businesses near the project area, as human health impacts from particulate matter can occur from both short-term and long-term exposure to elevated levels of particulate matter.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Small
Likelihood	Planned
Consequence	Minor
Significance	Minor

Potential Impact on Human Health Associated with Combustion Emissions

Impact Description

The key sources of combustion-related emissions from the Project include:

- Operation of diesel and petrol-fired project traffic and equipment; and
- Operation of power generators.

For these types of combustion activities, the key pollutants of concern are NO_2, SO_2, PM_{10}, and $PM_{2.5}$. These pollutants have been demonstrated to adversely affect human health from both acute and long-term exposure.

The World Bank EHS Guidelines require that project sources of emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and that emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines (25% is used as a general rule).

The applicable WHO Ambient Air Quality Guidelines for $PM_{2.5}$ and PM_{10} are summarized in Table 5.3

Table 5.3: Who Ambient Air Quality Guidelines

Pollutant	Averaging period	Guideline Value
NO2	1 hour	200
	Annual	40
SO2	10 minute	500
	24 hour	20
PM2.5	24 hour	25
	Annual	10
PM10	24 hour	50
	Annual	20

Receptor Sensitivity

The receptors of concern for air quality impacts will be people present in the AOI. The most affected air quality sensitive receptors in this case will be residents in close proximity to the project footprint. This includes residents and businesses near the project corridor, as human health impacts from particulate matter can occur from both short-term and long-term exposure to elevated levels of particulate matter.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	**Classification**
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Small
Likelihood	Planned
Consequence	Minor
Significance	Minor

Noise and Vibrations

Potential Impact on Ambient Noise Quality

Impact Description

During the construction phase, noise levels may temporarily increase due to use of heavy machinery and other construction-related activities. Proper planning and scheduling can mitigate this impact.

The applicable WHO Ambient Noise level Guidelines are summarized below. It should be noted that the ambient noise level of the project locations were generally within the limits. The noise generated activities due to the construction-related activities could potentially raise the levels above this and thus impact negatively on the receptors. Elevated noise levels, particularly in times of expected comparative quiet such as night-time and weekends, can be a source of stress and irritation and adversely affect human health.

Table 4: WHO Noise Level Guidelines

Receptor Type	**One Hour (dBA)**	
	Day-time (07:00-22:00)	**Night-time (22:00 – 07:00)**
Residential, institutional, or educational	55	45
Industrial or commercial	70	70

Receptor Sensitivity

The noise impacts of the construction of TCIPC's quay walls will affect the receptors of concern, including the port communities and nearby residents within the Area of Interest (AOI). The individuals most affected by noise sensitivity will be those located within the project footprint in the port and ancillary facilities. This includes residents and businesses near the ancillary sites. Human health impacts from noise can occur from both short-term and long-term exposure to elevated levels of noise. During the rehabilitation process, port operations may be disrupted, leading to short-term inconvenience and noise-related stress for workers and residents. There is also the possibility that delays or closures caused by the rehabilitation process could affect vessel traffic. Frustrated ship crews or harbor authorities could contribute to additional noise.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Minor
Significance	Minor

Potential Impact to Community Structures from Vibration Emissions from Construction Activities

The construction activities of the Coastal Highway Section 1 may impact nearby community structures.. The potential effects include ground vibrations from pile driving, equipment operation, and traffic, which can affect nearby buildings and infrastructure. Sensitive structures are particularly vulnerable. Extended exposure to construction-related vibrations can lead to discomfort and stress, and noise pollution can affect quality of life. Safety precautions are necessary if the construction site is close to residential areas due to risks from falling debris, dust, and heavy equipment movement.

Receptor Sensitivity

Construction activities can cause ground vibrations, noise pollution, discomfort, and stress to host communities and residents close to the project activities and may pose safety risks such as falling debris, dust, and heavy equipment movement. Safety measures are essential.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Medium
Likelihood	Probable
Consequence	Major
Significance	Major

Potential Impacts from Project Generated Waste Affecting Local Environment or Community Receptors

Impact Description

During the project development and construction, the demolition process and construction would involve breaking down existing structures on the project Right of Way (RoW), and removal of vegetation where necessary. These would result in the following that have the potential to impact the local environment and community receptors thus:

- **Construction Debris**: This includes concrete, steel reinforcement bars, formwork, and other construction-related Waste.
- **Excavated Soil:** Digging and excavation activities may yield soil and sediment that needs proper handling and disposal.
- **Packaging Waste:** Packaging materials from construction supplies (such as cement bags, plastic wraps, and pallets) will contribute to the waste stream.
- **Chemical Waste:** Proper disposal of chemical waste is crucial as construction often involves using chemicals (e.g., oil, paints, adhesives, sealants).
- **Metal Scraps:** Any metal waste from cutting, welding, or shaping processes.
- **Wood Waste:** Timber used for formwork, scaffolding, or temporary structures will generate wood waste.
- **Plastic Waste:** Plastic pipes, sheets, and other components contribute to the overall waste volume. Electrical and Electronic Waste: Wiring, cables, and electronic components may need proper disposal.
- **Hazardous Waste:** hazardous materials such as asbestos-containing materials may be encountered during construction. This also includes medical waste from the site clinic.

Receptor Sensitivity

The sensitivity of receptors to each waste type during every project phase to minimize environmental impact and protect human health includes:

- Construction Workers and local residents near the project corridor may experience noise, dust, and vibrations from demolition activities which may affect their health and well-being.
- Water Bodies: Demolition waste runoff may affect water bodies nearby or the ocean with contaminants from debris that could harm aquatic ecosystems.
- Construction Workers: hazardous materials could impact the health and safety of construction workers.
- Local Communities: Noise, dust, and traffic disruptions from construction activities can impact nearby residents.
- Marine Environment: Construction waste entering the water may harm marine life, including fish, and other organisms.
- Wildlife: Although there are no sensitive ecological habitats along the project corridor, demolition activities could impact species like birds and small mammals that lurk around.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	Intermittent
Magnitude	Medium
Likelihood	Probable
Consequence	Moderate
Significance:	Moderate

Post-Construction Clean-Up Project Generated Waste Affecting Local Environment or Community Receptors during the Phases of the project

Impact Description

Once the construction work is complete, the project area will need thorough cleaning and restoration. Waste generated during demobilization includes:

- Unused Materials: Any leftover construction materials that are no longer needed.
- Temporary Structures: Disassembled scaffolding, formwork, and other temporary structures.
- Equipment Waste: Disposal of machinery, tools, and equipment used during construction.
- Residual Soil and Sediment with chemical waste.
- Soil and sediment remaining after excavation and backfilling.
- General Debris: Miscellaneous Waste accumulated during the project.

Receptor Sensitivity

- Local Residents and Workers: unused materials, equipment, and debris could impact the safety of local residents and workers.
- Ecological Systems: Soil and sediment remaining after clean-up may affect local ecosystems.
- Water Quality: poor management of residual chemicals or contaminants could pollute the water bodies

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	Intermittent
Magnitude	Medium
Likelihood	Probable

Consequence	Moderate
Significance	Moderate -

Hydrology

Spills or Leaks Resulting in Contamination of Groundwater and Surface Water

Impact Description

The Coastal Highway Project would involve the use of equipment and machinery which use fuels or hydraulic fluids and have the potential to spill leading to the release of hydrocarbons. Contamination Risk: The soil, groundwater, and surface water in the area can become contaminated by these.

Receptor Sensitivity

The aquatic ecosystems, including flora and fauna living in and around the coastal shoreline environment, are sensitive receptors that can be affected by changes in pH. Aquatic organisms (fish, invertebrates, and plants) are highly sensitive to changes in pH. Local communities utilize the water body for various activities such as fishing and leisure, hence extreme pH of surface water poses potential threats to their health and well-being.

The Project may be associated with potential risks of spills and leaks. It is critical to manage erosion and maintain water quality to minimize adverse effects on sensitive receptors. These receptors include local residents who are vulnerable to changes in water quality and sedimentation, as well as aquatic ecosystems which include flora and fauna in water bodies.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Moderate
Significance	Moderate

Biodiversity

Potential Impact on Ecosystem Services

Impact Description

- During construction, ecosystem services such as soil stability, nutrient cycling, and habitat provision may be disrupted due to land clearing, excavation, and infrastructure development.
- Sediment runoff and chemical pollutants from construction activities can degrade water quality, affecting aquatic ecosystems and their services.
- Dust and emissions from construction machinery can impact air quality, potentially affecting respiratory health and vegetation.

It should be noted that proposed development does not involve extensive land reclamation in proximity to sensitive ecosystems. Thus the scope of land reclamation activities, and the assessment and management of associated environmental impacts, incorporated into the project's design are considered mitigation efforts.

Receptor Sensitivity

The receptor sensitivity includes soil stability, nutrient cycling, and habitat provision, which were disturbed. Water quality is degraded, thus affecting aquatic ecosystems and their services. Air quality was impaired, potentially affecting respiratory health and vegetation.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
	Sensitive Receptors
Consequence	Minor
Significance	Not Significant

Potential Impact on Avifauna during construction phase

Impact Description

- During construction, avifauna may experience habitat loss due to excavation, and infrastructure development. Sensitive bird species that rely on specific vegetation types or nesting sites could be adversely affected.
- Construction activities generate noise, vibrations, and human presence. Birds may abandon nesting sites or alter their behavior in response to disturbances.
- Birds flying near construction zones face an increased risk of collision with machinery, structures, or vehicles.

Receptor Sensitivity

Sensitive bird species that rely on specific vegetation types or nesting sites could be adversely affected. Birds may abandon nesting sites or alter their behavior in response to disturbances. Birds flying near construction zones face an increased risk of collision with machinery, structures, or vehicles.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	**Classification**
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
	Sensitive Receptors
Consequence	Minor
Significance	Not Significant

Potential Impact of *dredging and soil placement during Construction* ***phase***

Impact Description

The construction of the road requires winning sand from the sea which placing the dredges the corridor and then also for the s**horeline reclamation to** address the related environmental challenges. It is expected that Up to 8 meters of sand is being dredged from the sea would be used to reclaim lost shoreline areas. This process involves creating new land by depositing dredged material along the coast, effectively expanding the available space for infrastructure development.

Dredged material would be valuable resource for the proposed project. It includes sediment like clay, silt, sand, gravel, and organic matter. The **Applications would include: Flood and Coastal Protection (**Reclaiming lost shoreline areas), **Habitat Improvement (**Enhancing ecosystems and related services), **Land Subsidence Mitigation (**Stabilizing vulnerable coastal areas)

Dredging ensures that the highway has a stable foundation by providing suitable soil for construction. It allows for the creation of embankments, berms, and other protective features. By reclaiming land from the sea, the project maximizes available space for road construction and associated facilities.

Dredging stirs up sediment, affecting water clarity and potentially smothering sensitive habitats like coral reefs and seagrass beds. The removal of sediment can disrupt habitats where marine organisms live, feed, and breed. Dredged material may contain pollutants, affecting water quality. Dredging operations can create underwater noise and vibrations, which may stress or harm marine life.

Receptor sensitivity

Receptor sensitivity to sea dredging and soil placement in the context of environmental impact include m**arine Life and turbidity.** Turbidity refers to the effect of suspended sediment measured by a turbidity sensor. It acts as a proxy for **suspended sediment concentration.** Elevated turbidity due to dredging affects sensitive receptors, including **Sea Grass Habitats:** These underwater meadows are vulnerable to changes in suspended sediment concentrations. Sediment deposition can harm coral reefs by reducing light penetration and affecting their health.

Impact Significance (Pre-Mitigation)
Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Small
Likelihood	Planned
Consequence	Major
Significance	Moderate

Social

Potential Impact on Population Resettlement/Displacement

Impact Description
The proposed alignment Section 1 is made up of mixed development. To construct the highway along this path, existing properties will need to be destroyed.
which will be impacted o various degrees . the Lagos portion of the highway is designed to pass through Oniru Beach, Landmark Beach, and the Good Beach/Sol Beach, The highway's construction may disrupt local lifestyle and values, affecting communities residing near the route. Social services, such as healthcare, education, and utilities, may need to be reconfigured to accommodate the displaced population. Land use rights and values will also be impacted, as existing landowners lose their properties. The highway aims to improve cross-country connectivity and foster trade relations. However, it may alter migration patterns as people move away from affected areas. Settlement patterns could change due to the highway's impact on property availability and accessibility.

Receptor Sensitivity
The receptors include owners of businesses and properties and assets along the alignment such as at **Oniru Beach**, **Landmark Beach**, and the **Good Beach/Sol Beach** and the **Landmark ecosystem** and other local residents who reside in the vicinity of the alignment. Also are pedestrians and commuters who use the nearby roads and pathways, property owners whose buildings and structures are situated near the project corridor.

Impact Significance (Pre-Mitigation)
Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Highly Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Medium
Likelihood	Somewhat Likely
Consequence	Major
Significance	Moderate

Potential Road alignment siting/routing on Social aspect

Impact Description
The highway's alignment passes through areas like **Eko Atlantic**, and other mixed development which hold exceptional aesthetic value. It would also include demolitions of some fo these assest for road construction. Lagos is densely populated, and the highway's construction may exacerbate congestion. The highway's path intersects with tourism sites, including beaches and coastal areas. High traffic volume could lead to spontaneous markets along the road. The highway's construction is likely to disrupt existing ecosystems and communities.

Receptor Sensitivity
The sensitivity of receptors relates to the businesses and asset owners and residents and other stakeholders who are involved in various activities in the corridor alignment

Impact Significance (Pre-Mitigation)
Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
	Sensitive Receptors
Consequence	Moderate
Significance	Moderate

Potential Impact on Occupational Health and Safety

Impact Description

Several occupational health and safety issues may arise during the construction phase of the Coastal Highway Project. These include:

- Physical Hazards: Construction sites involve heavy machinery, lifting equipment, and manual labor. Workers face risks such as falls, collisions, and being struck by moving objects.
- Chemical Hazards: Exposure to hazardous substances like asbestos, PCBs, and mercury can occur during construction and demolition.
- Exposure to Dust: Dust from construction materials and demolition waste can pose respiratory risks.
- Exposure to Noise: Construction sites are noisy environments due to machinery, equipment, and tools.

Receptor Sensitivity

The sensitivity of receptors relates to the workers involved in various aspects of the construction who are at risk and directly or indirectly exposed to all the hazards that could manifest.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
	Sensitive Receptors
Consequence	Moderate
Significance	Moderate

Potential Impact on Road Traffic and Transport Risk of Project Vehicle Traffic Accidents
Impact Description

The Project poses a risk of vehicle traffic accidents due to increased traffic volume during construction on employees, nearby residents, and businesses. Various types of vehicular accidents can occur due to the nature of the work and the presence of heavy machinery and vehicles.

- **Collisions**: Collisions between vehicles, such as bulldozers, excavators, dump trucks, and other heavy machinery, can occur due to limited visibility, inadequate signaling, or miscommunication between operators.
- **Rollovers**: Rollover accidents can happen when heavy equipment or vehicles lose stability and tip over due to uneven terrain, improper loading, or excessive speed. Rollovers can result in serious injuries or fatalities to operators and nearby workers.
- **Runovers**: Runover accidents occur when a person is struck or run over by a moving vehicle or piece of equipment. These accidents can happen due to blind spots, improper backing maneuvers, or failure to observe safety protocols.
- **Crush Injuries**: Crush injuries can occur when workers are caught between moving vehicles or pinned against fixed structures by heavy machinery. This can happen during loading, unloading, or maneuvering operations, especially in congested or confined work areas.
- **Falls from Vehicles**: Workers may fall from vehicles or machinery while entering, exiting, or working on elevated platforms. Falls can result from slippery surfaces, unstable footing, or lack of proper safety restraints and harnesses.

Nearby residents

- **Loss of Life and Injury:** The most immediate and severe impact of vehicular accidents is the potential loss of life and injury to workers, bystanders, and community members. Fatalities and injuries can have long-lasting emotional, social, and economic consequences for individuals and their families.

Businesses

- **Disruption of Business Operations**: Vehicular accidents can disrupt the operations of businesses involved in the pre-construction phase of the project, including contractors, subcontractors, suppliers, and service providers. Accidents may result in work stoppages, delays, and additional costs associated with accident investigations, cleanup, and legal proceedings.

At the construction stage, the Project may pose a risk of vehicle traffic accidents due to increased traffic volume during construction and operations. The **Risk Description** include:

- **Vehicle Traffic Accidents**: During construction and operations, there will be increased vehicular movement within the project area.
- **Accident Risk**: The higher the traffic volume, the greater the risk of accidents involving project vehicles.

Receptor Sensitivity

The project traffic poses a significant risk to the safety of all road users as well as nearby individuals and properties. This is mainly due to high receptor sensitivity in the area. The receptors include local residents who reside in the vicinity of the project, pedestrians and commuters who use the nearby roads and pathways, property owners whose buildings and structures are situated near the project area and environmental features such as natural elements including flora, fauna, and water bodies that may be affected by the project activities.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Highly Sensitive
Duration	Short-term
Extent	Local
Frequency	Intermittent
Magnitude	Medium
Likelihood	Somewhat Likely
Consequence	Major
Significance	Moderate

Potential Impact on Occupational Health and Safety

Impact Description

Several occupational health and safety issues may arise during the construction phase of the Coastal Highway Project. These include:

- Physical Hazards: Construction sites involve heavy machinery, lifting equipment, and manual labor. Workers face risks such as falls, collisions, and being struck by moving objects.
- Chemical Hazards: Exposure to hazardous substances like asbestos, PCBs, and mercury can occur during construction and demolition.
- Exposure to Dust: Dust from construction materials and demolition waste can pose respiratory risks.
- Exposure to Noise: Construction sites are noisy environments due to machinery, equipment, and tools.

Receptor Sensitivity

The sensitivity of receptors relates to the workers involved in various aspects of the construction who are at risk and directly or indirectly exposed to all the hazards that could manifest.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
	Sensitive Receptors
Consequence	Moderate
Significance	Moderate

Potential Impact on Community Health and Safety at Construction Phase

Impact Description

During the construction phase, several community health and safety issues may arise such as the following

- Physical Injury and Accidents: Construction sites can pose risks due to heavy machinery, construction materials, and ongoing activities.
- Exposure to Hazardous Materials: Construction materials (e.g., paints, solvents, asbestos) can release harmful substances.
- Respiratory Effects from Air Emissions: Dust, emissions, and pollutants generated during construction can impact respiratory health.
- Spread of Communicable Diseases: Population influx during construction can increase disease transmission.
- Gender Based issues , Sexual harassment and exploitation, violence against children etc
- Changes to Diet and Subsistence Foods: Construction may disrupt local food sources and dietary patterns.
- At-Risk Populations: Communities relying on subsistence farming or
- Strain on Local Health Services and Infrastructure: Increased population due to construction can overwhelm existing healthcare facilities.

Receptor Sensitivity

Construction Workers, Nearby Residents, and Pedestrians:

- These groups are considered receptors because they are close to a site where environmental exposures occur. Construction workers who spend significant time at the site are particularly vulnerable due to prolonged exposure.
- Nearby residents and pedestrians may also be affected, especially if the construction area is densely populated or close to residential neighborhoods. Their exposure can result from dust, noise, emissions, or other construction-related activities.

Residents Living Near the Construction Area:

- The construction activities directly impact these individuals. Their homes and daily lives are near the site, making them more susceptible to any pollutants released during construction.

- Dust, noise pollution, and potential chemical emissions can affect their health and well-being.

Both Construction Workers and Local Residents:

- The intersection of these two groups highlights the shared risks associated with the project. Construction workers face occupational hazards, while residents experience environmental exposure.
- It's crucial to consider both groups when assessing the overall impact and implementing protective measures.

Communities Relying on Subsistence Farming or Fishing:

- These communities often have a strong connection to their environment. Subsistence farming and fishing rely on clean air, water, and soil.
- Construction activities can disrupt their livelihoods by contaminating water sources, depleting fish populations, or affecting crop quality.

Local Residents and Vulnerable Groups:

- Vulnerable populations, such as children, the elderly, pregnant individuals, and those with pre-existing health conditions, are at higher risk.
- Residents, especially vulnerable groups, need special attention in exposure assessments and risk management.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
Consequence	Minor
Significance	Minor

Potential Impacts on Socio-economic Opportunity

Impact Description

The Project will improve infrastructure, create direct and indirect jobs, foster local sourcing, and stimulate economic growth. The Potential Impacts on Socio-economic Opportunity with regard to jobs shows the direct jobs will be created for construction activities and project office operations and management.

Indirect jobs will be created for upstream industries that manufacture construction site supplies. Unskilled jobs will be sourced locally, fostering growth and supporting local employment. The project will invest in the economy, stimulating growth by increasing income circulation and consumption.

Short-term employment will provide a windfall for workers, allowing them to invest wisely or set up micro-projects. The project will also provide valuable skill development opportunities for previously unqualified personnel.

Receptor Sensitivity

The receptors that would be impacted include the Host Communities, Contractor's Staff, and residents of the surrounding communities, all of whom are considered highly sensitive receptors.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Positive
Receptor Sensitivity	Highly Sensitive
Duration	Short-term
Extent	Regional
Frequency	Intermittent
Magnitude	N/A
Likelihood	Planned
Consequence	N/A
Significance	Positive

Potential Infringement on Workers' Human Rights

Impact Description

Under the UN's Universal Declaration of Human Rights,

"Everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment."

It is important to prioritize safe working conditions and fair labour practices to ensure that basic human rights are being upheld.

The Impact description include:

- Safe Working Conditions: Workers should have access to a work environment that prioritizes their health and safety.
- Fair Labour Conditions: This includes providing fair wages, reasonable working hours, and protection against unemployment.

Receptor Sensitivity

Due to high workforce density during peak construction activities, the workforce will be at its highest with regard to the risk factors**.** So it is important to ensure that safety measures are in place to accommodate the increased number of workers and take the rights of their rights into cognizance.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Highly Sensitive
Duration	Long-term
Extent	Regional
Frequency	Intermittent
Magnitude	Medium
Likelihood	Somewhat Likely
Consequence	Major

Parameter	Classification
Significance	Moderate

Potential Impact on Local Content and Procurement

The Coastal Highway Project will lead to direct local procurement, including meals for workers, increased demand for transportation services, and ad hoc purchases of locally supplied goods and services. These opportunities for local procurement serve as a direct investment in the immediate economy, benefiting local trading and service providers and contributing to profitability and income growth. Ultimately, fostering local procurement not only supports businesses but also strengthens the economic fabric of the community.

Receptor Sensitivity

The immediate traders and residents are the most affected members of the community, given their direct dependence on local trade.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Positive
Receptor Sensitivity	Highly Sensitive
Duration	Short-term
Extent	Regional
Frequency	Intermittent
Magnitude	Small
Likelihood	Planned
Consequence	N/A
Significance	Positive

Potential Impact related to Influx of People to the Project Area

Impact Description

It is predicted that the project may result in an influx of people into the project area. Overall, this influx of people can be a catalyst for positive change, driving economic development, social progress in the communities. During the field work for this ESIA study, community members confessed that they do not have problems with the influx of people into their towns. Many noted that such influx will bring in positive change. A resident of one the communities noted that such influx will improve the local domestic economy. They do not really foresee an increase in rent of residential building, with little or no effect on local culture. It will not affect the social cohesion the communities enjoy.

Receptor Sensitivity

The influx of migrants is positive and positively impactful on the residents of the communities.

Impact Significance (Pre-Mitigation)

Parameter	Classification
Nature of Impact	Positive
Receptor Sensitivity	Highly Sensitive
Duration	Short-term
Extent	Regional
Frequency	Intermittent
Magnitude	Small

Parameter	Classification
Likelihood	Planned
Consequence	N/A
Significance	Positive

5.4.2 Impact During Operation

5.4.3 Potential Impact to Social Issues

Impact Description

The following could result during operations.

1. Increased Vehicular Movement - Increased vehicular movement on better road surfaces will lead positive impact on the host communities thus improving transportation networks.
2. Access to amenities – Educational, health and social amenities will become easily accessible.
3. Improvement in trade and commerce – businesses and trade will be enhanced as access to places, goods and services becomes easily realizable.

Receptor Sensitivity

The receptor sensitivity related to the impacts are:

- Nearby commuters, businesses, and emergency services are sensitive to traffic flow disruptions which are thus improved
- The quality of life of residents and businesses relying on well-functioning roads are greatly improved.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Positive
Significance	Positive

5.3.3 Decommissioning (Site Clean-Up and Equipment Removal after Construction)

1. Soil, Surface and Water Quality
Increased Turbidity and Suspended Solids Due to Site Clean-Up and Equipment Removal

Impact Description
Activities such as site clean-up, restoration and removal of construction equipment during the demobilization phase will increase turbidity and suspended solids due to increased sediment and debris being washed into drains and other water channels. Improper handling or containment of residual fuels, oils, and other fluids from the construction equipment can lead to the contamination of groundwater resources. Turbidity and increased suspended solids from demobilization operations can lead to changes in aquatic food webs and disruption of sensitive habitats and ecosystems through changes in water clarity and sedimentation processes. It can also cause blockage or obstruction of the gills and respiratory systems of aquatic organisms, such as fish and invertebrates, leading to respiratory stress and potentially death.

Receptor Sensitivity
Coastal waters are extremely sensitive receptors because they sustain essential marine habitats and are used for navigation, pleasure, and economic purposes. Groundwater aquifers are relatively sensitive receptors because they might be exploited for water supply or linked to surface water sources.

Impact Significance (Pre-Mitigation)
Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Minor
Significance	Minor

2. Saline Water Intrusion into the Freshwater Aquifer System: Due to Dewatering Activities

Impact Description
Dewatering activities performed during the demobilization process can reduce the groundwater table and produce drawdown zones in the aquifer system. These drawdown zones can raise the hydraulic gradient, allowing salty water from surrounding sources, such as saltwater or brackish groundwater, to enter the freshwater aquifer. If the dewatering process is not correctly controlled, or the extracted groundwater is not properly disposed of or refilled, salt water may enter the freshwater aquifer.

Receptor Sensitivity

The groundwater aquifers in the vicinity of the project area of influence are highly sensitive receptors, as they may be used for water supply or be connected to surface water bodies. The surface water bodies within the coastal environment are also sensitive receptors, as they support critical marine and estuarine ecosystems and are used for various activities.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term to Long-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable
Consequence	Minor
Significance	Minor

3. **Increased surface runoff and pollutant mobilization**

Impact Description

The removal of temporary structures, construction equipment, and stockpiles during demobilization can result in bare, exposed soil. These exposed soils are more prone to erosion and can cause increased surface runoff, which transports sediments and contaminants into neighboring surface water bodies. Surface runoff can become contaminated if construction debris, leftover materials, and hazardous wastes are not properly managed or disposed of during demobilization. If these pollutants are not confined and managed effectively, they can become mobilized and transported by increasing surface water flows. Changes in site topography and landscaping, as well as the removal or alteration of temporary drainage infrastructure during demobilization, can all affect natural surface water flow patterns. This can reroute or concentrate surface runoff, potentially increasing its volume and velocity, as well as its capacity to mobilize and carry contaminants.

Receptor Sensitivity

The receptors and adjoining ecosystems, and perhaps groundwater resources, are extremely sensitive, since increased surface runoff and pollutant mobilization can have serious consequences on water quality and the general health of the aquatic environment.

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	One-time to Intermittent
Magnitude	Small
Likelihood	Probable

Parameter	Classification
Consequence	Minor
Significance	Minor

Social

1. **Potential impact on Socio-economics**

Impact Description

The Project promises to enhance the transport operations, support local communities, and bolster Nigeria's economy. However, like any major construction endeavor, site decommissioning and equipment removal after construction have potential negative impacts.

- **Roads and Access Routes**: Equipment removal and site clearing may affect nearby roads and access routes, causing traffic congestion or detours.
- **Dust Emissions**: Decommissioning activities might generate dust emissions that will affect the social receptors.
- **Business Interruption**: If nearby businesses and food vendors rely on the project activities, their activities will cease..

Receptor Sensitivity

The sensitivity of receptors (residents, businesses, and the community) to these impacts varies based on the context and magnitude of the changes for these impacts.

The receptor sensitivity to these various impacts:

- Traffic disruptions can affect businesses, commuters, and emergency services affecting residents, businesses and the community.
- Businesses and food vendors near the project sites may rely on the project activities. During equipment removal, their operations could be disrupted. Reduced business activity can lead to financial losses and affect employment.
- Loss of employment by workforce

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Short-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Probable
Consequence	Minor
Significance	Minor

2. **Potential Impact on Occupational Health and Safety at Post Construction phase**

Impact Description

The potential impact on occupational health and safety issues from post-construction phase of the Project include:

- Physical Hazards: Construction sites involve heavy machinery, lifting equipment, and manual labor. Workers face risks such as falls, collisions, and being struck by moving objects.

- Chemical Hazards: Exposure to hazardous substances such as asbestos, PCBs, and mercury can occur during construction and demolition.
- Exposure to Dust: Dust from construction materials and demolition waste can pose respiratory risks.
- Exposure to Noise: Construction sites are noisy environments due to machinery, equipment, and tools.

Receptor Sensitivity

The sensitivity of receptors relates to the workers involved in various aspects of the construction who are at risk and directly or indirectly exposed to all the hazards that could manifest

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
Consequence	Minor
Significance	Not Significant

5.3.4 Impact on Human Rights Impact Assessment

The summary of the potential human rights impacts of the Lagos Coastal Highway project, along with their associated receptor sensitivity and pre-mitigation significance.

Table 5.4: summary of the potential human rights impacts

Parameter	Classification	Nature of Impact	Adverse	Receptor Sensitivity	Duration	Extent	Frequency	Magnitude	Likelihood	Consequence	Significance
Displacement and Resettlement	Social	Loss of homes and livelihoods	Yes	High (local communities)	Long-term	Local	One-time	Medium	Likely	Significant	Significant
Labor Rights	Social	Poor working conditions, inadequate wages, lack of safety	Yes	High (construction workers)	Short-term	Local	Continuous	Medium	Likely	Moderate	Significant
Environmental Degradation	Environmental	Negative impacts on health and livelihoods	Yes	High (local communities, ecosystems)	Long-term	Local	Continuous	Medium	Likely	Significant	Significant
Access to Services	Social	Improved access to services	No	Medium (local communities)	Long-term	Local	Continuous	Small	Likely	Beneficial	Not Significant
Economic Opportunities	Economic	Job creation, economic growth	No	Medium (local businesses, communities)	Long-term	Local	Continuous	Small	Likely	Beneficial	Not Significant
Traffic and Safety	Social	Increased traffic, accident risks	Yes	High (local communities)	Long-term	Local	Continuous	Small	Likely	Moderate	Significant

Site Restoration	Environmental	Potential for long-term environmental damage	Yes	High (ecosystems)	Long-term	Local	One-time	Medium	Likely	Moderate	Significant
Community Engagement	Social	Inadequate engagement, lack of respect for rights	Yes	High (local communities)	Long-term	Local	Continuous	Small	Likely	Moderate	Significant

Please note: The significance of these impacts may change after mitigation measures are implemented. The effectiveness of mitigation strategies will be crucial in determining the overall impact of the project on human rights.

5.3.5 Cumulative Impacts

These cumulative impacts were identified and assessed in accordance with the IFC Good Practice Handbook on Cumulative Impact Assessment and Management. While the handbook is often associated with private sector initiatives, its principles and guidelines are adaptable to various contexts, including government-led infrastructure development. the IFC handbook's principles are transferable to government projects. By integrating cumulative impact assessments into the proposed project's planning and decision-making processes, promotion of responsible development and safeguard of natural and social assets are anticipated.

○

As the project unfolds, the Lagos-Calabar Coastal Highway Project activities may intersect with existing environmental and social sensitivities as outlined below cumulatively:

Traffic Impact:

The increased traffic resulting from the highway project may affect surrounding roads. As businesses thrive and trade intensifies, economic activities could surge.

- **Commercial and Industrial Zone Influence:**
- The project's area of influence extends into a commercial and industrial zone where various companies and businesses operate. Although not directly generated by the project, these activities contribute to cumulative impacts.

1. **Environmental Considerations:**

- Habitat Destruction: The highway's development may lead to the destruction of natural habitats, impacting local flora and fauna.
- Disruption of Ecosystems: Alterations to the landscape due to road construction can disrupt the balance of local ecosystems.
- Increased Vulnerability to Erosion and Flooding: Coastal roads can exacerbate erosion and flooding risks, especially in vulnerable areas.

a. **Economic and Social Impacts:**

a. Community Relocation: The highway's construction may necessitate the relocation of communities, affecting their social fabric and access to resources.

b. Positive Economic Effects: Improved transportation infrastructure can enhance market access, trade routes, and tourism potential, benefiting the local economy .

Cumulative Impacts	**Mitigation Measures:**
1. Traffic Impact:	
The increased traffic resulting from the highway project may affect surrounding roads. As businesses thrive and trade intensifies, economic activities could surge.	Mitigation: Monitoring traffic patterns and implementing efficient traffic management strategies will be crucial to minimize disruptions.
Commercial and Industrial Zone Influence:	
The project's area of influence extends into a commercial and industrial zone where various companies and businesses operate. Although not directly generated by the project, these activities contribute to cumulative impacts.	Mitigation: Engaging with stakeholders in this zone is essential. Understanding their concerns and collaborating on effective mitigation measures will be key.
Environmental Considerations:	

The highway's development may lead to the destruction of natural habitats, impacting local flora and fauna.	Biodiversity Conservation: Implement strategies to protect and restore natural habitats along the highway corridor.
Alterations to the landscape due to road construction can disrupt the balance of local ecosystems.	
Increased Vulnerability to Erosion and Flooding: Coastal roads can exacerbate erosion and flooding risks, especially in vulnerable areas.	Erosion Control: Design features that minimize erosion risk, including proper drainage systems.
Economic and Social Impacts:	
Community Relocation: The highway's construction may necessitate the relocation of communities, affecting their social fabric and access to resources.	Community Engagement: Involve local communities in decision-making, ensuring their concerns are addressed and their well-being safeguarded.
Positive Economic Effects: Improved transportation infrastructure can enhance market access, trade routes, and tourism potential, benefiting the local economy .	Strengthen the opportunities through collaboration with relevant stakeholders

Impact Significance (Pre-Mitigation)

Using the methodology presented in this report, the unmitigated impact has been assessed.

Parameter	Classification
Nature of Impact	Adverse
Receptor Sensitivity	Sensitive
Duration	Long-term
Extent	Local
Frequency	One-time
Magnitude	Small
Likelihood	Unlikely
Consequence	Minor
Significance	Not Significant

CHAPTER SIX
MITIGATION MEASURES

6.0 Introduction

This chapter outlines the measures that will be taken to mitigate the impacts identified during the evaluation process for the proposed Lagos Coastal Highway Road. The assessment revealed that the project will have both positive and negative impacts on the biophysical, health, and social environments. To minimize the negative effects and bring them to a level of residual impact that is acceptable, several measures are proposed for implementation during the construction and operations phases.

These measures are designed to ensure that suitable procedures or mitigation measures are provided to manage/reduce the identified associated and potential impacts of the proposed project to a level as low as reasonably practicable throughout the life cycle of the project. This chapter therefore presents the mitigation, enhancement and/or alternative measures for the adverse and beneficial impacts of the proposed Project.

6.2 Hierarchy of Mitigation Measures

Mitigation Measures come with a variety of levels, and these are commonly called **"mitigation hierarchy."** The mitigation hierarchy (Figure 6.1) consists of steps that can be taken to successfully mitigate environmental and social impacts in the proposed project site. The hierarchy begins from the most beneficial method of mitigation and goes on to the least beneficial method of mitigation (Table 6.1).

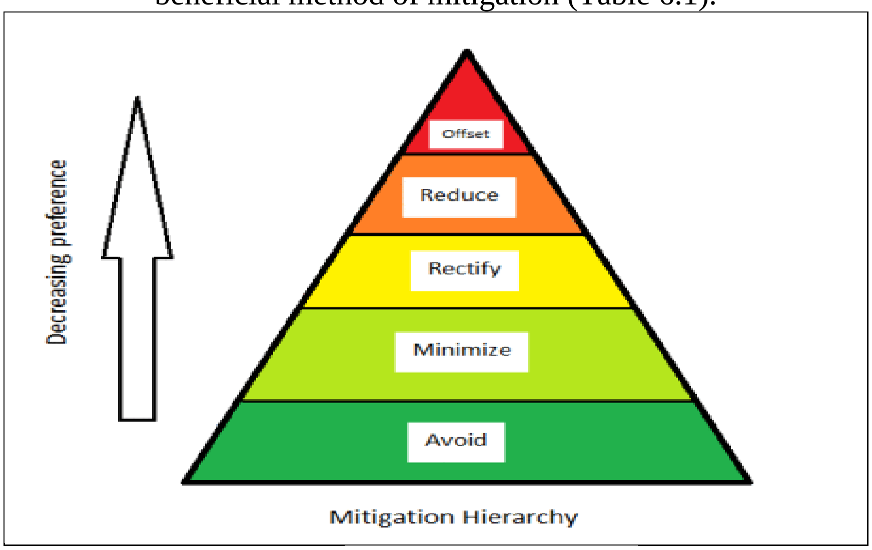


Fig 6.1: Mitigation Hierarchy

Source: https://eco-intelligent.com/2016/12/11/levels-of-mitigation-in-environmental-impact-assessment/

Table 6.1: The Mitigation Hierarchy	
Step	**Focus**
1. Avoidance	Prevent impact from happening.
2. Minimize	Impact cannot be completely side-stepped; so, take steps to ensure minimal damage is done to the environment.
3. Rectify	Implies that the impact has already happened so do damage control.
4. Reduce	Reduce the extent of the impact through management practices and/or change.
5. Environmental Offset	Actions taken outside of the development site to compensate for the impacts in the development site. In effect, this means that the development undertaker carries out environment conservation activities to compensate for what they do in order to achieve "no net environment loss", or more specifically "no net biodiversity loss".

6.3 Managing the Project Beyond Environmental and Social Impacts

Beyond environmental and social impacts, Nigeria projects of these magnitudes often encounter several challenges that impact their successful implementation. The challenges have been identified as captured in Table 6.1. To address the challenges related to the Lagos Coastal Transport Infrastructure project, recommendations have also been provided for these challenges in addition to the specific environmental and social measures due to the impacts identified earlier in this Chapter. The wholistic approach recognises the involvement of the following relevant entities:

1. **Government Commitment:**
    a. Ensuring that the government is fully committed to the project.
    b. This includes allocating necessary resources, creating policies, and providing regulatory support.
2. **Private Sector Collaboration:**
    a. Leveraging expertise and resources from private companies.
    b. The private sector can contribute by investing in infrastructure development, providing technical know-how, and participating in public-private partnerships.
3. **Community Involvement:**
    a. Engaging local communities throughout the project lifecycle.
    b. Community participation ensures that projects align with local needs, minimize negative impacts, and promote sustainable development.

Table 6.2: Potential Challenges and Measures to Successful Implementaiton of the Project .	
Challenges	Suggested Measures
• Funding Constraints: • Insufficient budget allocations and limited access to financing hinder project execution. • Large-scale projects require substantial investment, and	• Public-Private Partnerships (PPPs): Collaborate with private investors to secure funding. PPPs allow private entities to invest in infrastructure projects in exchange for revenue-sharing or other benefits.

securing funding can be a major obstacle.	• Infrastructure Bonds: Issue government-backed infrastructure bonds to raise capital from the public. • International Financing: Explore loans and grants from international financial institutions like the World Bank or African Development Bank.
• Weak Institutions and Corruption: • Weak regulatory bodies and institutions lead to inadequate oversight and accountability. • Corruption affects project quality, delays, and mismanagement of resources.	• Strengthen Regulatory Bodies: Invest in capacity building for regulatory agencies to enhance oversight and enforcement. • Transparency and Accountability: Implement robust anti-corruption measures, including transparent procurement processes and independent audits.
• Policy Inconsistency: • Changes in government and policy shifts disrupt project continuity. • Consistent policies are essential for long-term planning and execution.	• Long-Term Policies: Develop and adhere to long-term infrastructure policies that transcend political changes. • Legal Framework: Enact legislation that ensures continuity and consistency in project implementation.
• Land Acquisition and Compensation: • Acquiring land for infrastructure projects often faces resistance from affected communities. • Ensuring fair compensation and addressing land disputes is challenging.	• Community Engagement: Involve affected communities early in the planning process to address concerns and negotiate fair compensation. • Land Banks: Create land banks to streamline land acquisition and reduce disputes.
• Technical Capacity and Skills Gap: • A shortage of skilled professionals in engineering, project management, and construction affects project delivery. • Capacity building and training are necessary to bridge this gap.	• Education and Training: Invest in vocational training, universities, and technical institutions to produce skilled professionals. • Knowledge Transfer: Partner with experienced international firms to transfer technical expertise.
• Environmental and Social Impact:	• Environmental Impact Assessments (EIAs): Conduct thorough EIAs to assess ecological impacts and propose mitigation measures.

• Balancing development with environmental protection is crucial. • Projects must consider ecological impacts, community displacement, and cultural heritage preservation.	• Community Participation: Engage local communities in decision-making and ensure their concerns are addressed.
• Logistics and Supply Chain Challenges: • Efficient transportation of materials and equipment to project sites is essential. • Poor logistics can lead to delays and cost overruns.	• Integrated Logistics Plans: Develop comprehensive logistics plans for material transportation, storage, and distribution. • Infrastructure Hubs: Establish central hubs for material assembly and distribution near project sites.
• Security Concerns: • Insurgency, vandalism, and theft pose risks to infrastructure projects. • Ensuring security during construction and operation is critical.	• Security Task Forces: Collaborate with security agencies to protect project sites from vandalism, theft, and insurgency. • Risk Assessment: Conduct security risk assessments and implement appropriate measures.
• Technical Complexity: • Large-scale projects involve intricate engineering designs and complex systems. • Managing technical challenges requires expertise and innovation.	• Research and Innovation: Invest in research and development to address technical challenges. • Collaboration with Experts: Partner with international experts and universities for innovative solutions.
• Public Perception and Participation: • Public acceptance and engagement are vital. • Projects that lack community buy-in face resistance and delays.	• Stakeholder Engagement: Involve communities, NGOs, and local leaders in project planning and decision-making. • Public Awareness Campaigns: Educate the public about project benefits and address misconceptions.

6.4 Criteria for Selection of Mitigation Measures

For the mitigation measures, four criteria were selected based on the engineering design of Lagos coastal highways, practicability of measures, regulatory requirements and industry and international best practices as depicted in Figure 6.2.

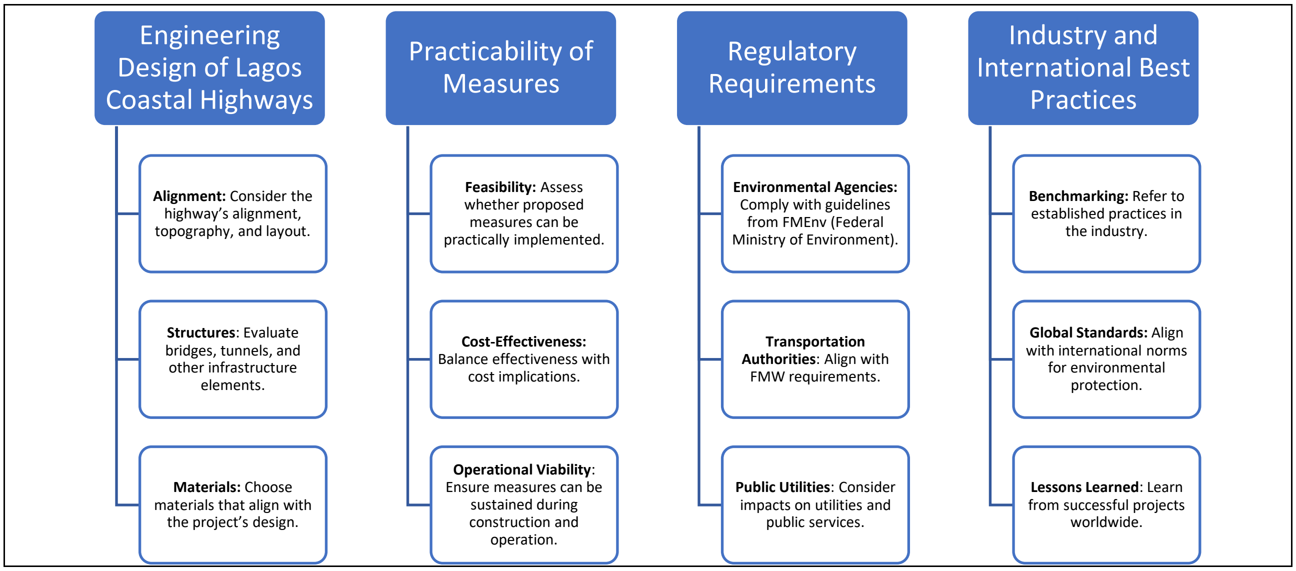


Figure 6.2: Criteria for Selection of Mitigation Measures

6.5 Projects Impacts and Mitigation Measures

In Table 6.3, a summary of the potential impacts associated with the project; together with corresponding mitigation measures are provided. The mitigation measures proposed are specific, measurable, achievable and relevant to the proposed and time based (SMART).

The measures also considered the environmental laws in Nigeria, and internationally and the principles of sustainable development and best available technology.

Most of the likely impacts due to the proposed project have been considered in the design and selection of equipment and method of construction.

The mitigation measures recommended in this section may not be exhaustive. However, they are considered adequate to effectively ameliorate or in some cases, eliminate the negative impacts that may arise in this project. From the assessment undertaken, if the measures are applied, all minor and moderate negative impacts will be reduced significantly and will leave, in most cases, negligible and minor residual impacts. However, for accidental occurrences such as fire outbreak and electrocution, the residual impact would remain major, given the costly and sometimes irreversible effect of its occurrence.

In order to verify these assertions, and to ensure that the measures are effective, it is necessary to have in place a sound and cost-effective Environmental and Social Management Plan (ESMP), presented in Chapter Seven of this report.

6.6 Managing Residual Impacts after Mitigation

Residual effects are those that remain significant even after applying mitigation measures.

Although reduced, they still need attention. Once the outlined mitigation measures are in place, the residual impacts during construction and operation phases will no longer be significant. (Table 6.3)

<table>
<tr><th></th><th colspan="5">Table 6.3:Summary of Identified Significant Impacts and Measures</th></tr>
<tr><th></th><th>Aspect</th><th>Impact</th><th>Mitigation measures</th><th>Residual Impact</th><th>Responsibility</th></tr>
<tr><td>A</td><td colspan="3">Pre-Construction (Site Establishment) and Construction Phase</td><td></td><td></td></tr>
<tr><td>1</td><td rowspan="5">Soil, Surface and Water Quality</td><td>Potential to impact soil and sediment quality through soil compaction, erosion, fuel and lubricant spills, improper waste disposal, and contamination from hazardous materials, which can harm nearby ecosystems and human health</td><td rowspan="5">• All the construction material will be stored in dedicated storage areas;
• A designated machinery and equipment storage area will be developed for the Project;
• Fuels, lubricants will be stored in dedicated storage area having secondary containment;
• On completion of work all temporary structures, surplus materials and wastes will be completely removed from site;
• Construction and demolition waste (inert materials) will be utilised for filling of site, stored in designated area and finally disposed through third party vendor;
• Separate bins will be provided at construction area for collection of segregated waste as per a waste management plan, and finally disposed through third party;
• Different types of hazardous waste collection bins will be provided for oily substances and non-oily hazardous waste at construction area;
• Hazardous wastes generated from the site establishment stage will be stored in designated waste storage area, having secondary containment;
• Hazardous waste will be finally disposed through third-party subcontractors.
• A spill response procedure and associated spill kits to contain any incidental spillage of fuel,</td><td>Not Significant</td><td>HITECH with support from FMW</td></tr>
<tr><td>2</td><td>Potential Impact on coastal morphology, affecting shoreline shape, sediment dynamics, erosion patterns, beach profiles, intertidal zones, and marine habitats, with potential impacts on sediment distribution, seabed stability, and soil salinization</td><td>Not Significant</td><td>HITECH with support from FMW</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Potential impact on the Marine Environment, Hydrology, and Ecosystems through habitat destruction, introduction of pollutants, alteration of water flow patterns, sediment accumulation, and potential loss of protective coastal features, affecting marine life and ecosystem services.</td><td>Not Significant</td><td>HITECH with support from FMW</td></tr>
<tr><td>Not Significant</td><td>HITECH with support from FMW</td></tr>
<tr><td>Not Significant</td><td>HITECH with support from FMW</td></tr>
</table>

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
			• chemicals and hazardous waste;		
4	Air Quality	The project may lead to increased dust emissions from various construction activities and ancillary sites, potentially affecting air quality	• Use low-emission construction equipment and vehicles that meet or exceed emission standards to reduce air pollutant emissions.	Not Significant	-HITECH with support from FMW
			• Implement vehicle idling reduction policies and practices to minimize unnecessary emissions from construction vehicles and equipment. • Encourage carpooling, alternative transportation options, and the use of electric or hybrid vehicles among construction workers to reduce overall vehicle emissions. • Regardless of the size or type of vehicle, fleet owners / operators should implement the manufacturer recommended engine maintenance programs. • Drivers should be instructed on the benefits of driving practices that reduce fuel consumption, including measured acceleration and driving within safe speed limits. • Open burning of solid materials will be prohibited on-site • Open burning of improperly disposed materials will be prohibited on-site	Not Significant	HITECH with support from FMW
5	Waste	Construction activities will generate various types of waste, including construction debris, excavated soil, packaging waste, chemical waste, metal scraps,	• Encourage to separate waste types at the source (construction sites) to facilitate proper disposal and recycling.	Not Significant	-HITECH with support from FMW

Table 6.3:Summary of Identified Significant Impacts and Measures

	Aspect	Impact	Mitigation measures	Residual Impact	Responsibility
		wood waste, plastic waste, electrical and electronic waste, and hazardous waste, which could potentially impact the local environment and community receptors due to existing waste management challenges in Lagos	• Promote reuse of materials (e.g., wood, metal) and encourage recycling of packaging waste, plastics, and electronics. • Properly manage hazardous waste (e.g., chemicals, electrical components). • Invest in waste collection trucks and equipment for efficient waste removal. • Educate residents, construction workers, and businesses about waste separation and responsible disposal. • Improves accountability, transparency, and data-driven decision-making.		
6	Hydrology	Spills or Leaks Resulting in Contamination of Groundwater and Surface Water. The fuels or hydraulic fluids used in the equipment have the potential to spill, which can lead to the release of hydrocarbons. Contamination Risk: The soil, groundwater, and surface water in the area can become contaminated by these	• Stormwater should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge. • Surface runoff from process areas or potential sources of contamination should be prevented, or where not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff. • Oil water separators and grease traps should be installed and maintained as appropriate at refuelling facilities, workshops, wash bays, fuel storage and containment areas. • Maintain the mechanised fleet to accepted industry standards as documented in a Fleet Maintenance Plan.	Not Significant	-HITECH with support from FMW
7		Activities such as demolition, drilling and piling, grouting, backfilling, and raw material storage and handling can lead to increased turbidity in nearby water bodies due to the		Not Significant	-HITECH with support from FMW

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
		resuspension of bottom sediment, production of fine particulate matter, and inadequate sediment management methods.	• Maintenance or repair of mechanised fleet to primarily take place off-site at designated workshop facilities with bunded, impervious floor and oil traps. • Develop and implement an Emergency Response Plan. • Leaking containers will be removed immediately and be appropriately disposed. • Maintain an inventory at the site office for all chemicals and their types and quantity stored on the project site. • Personnel involved in handling hazardous materials, particularly those specifically assigned to storage areas, must be trained on how to respond in case of spill.		
	Physical	Dredging	• **Adopt Integrated Approach which c**onsider baseline conditions, dredging operations, sensitive receptors, monitoring, and response options.	Not Significant	-HITECH with support from FMW
8	Social	Road Traffic and Transport Risk of Project Vehicle Traffic Accidents due to increased traffic volume during construction on employees, nearby residents, and businesses	• Provide separate entry and exit gateways for pedestrians and vehicles. • Create well-drained pedestrian walkways away from vehicle routes. • Ensure drivers can see both ways before entering public roads. • Limit the number of vehicles on-site and plan storage areas strategically.	Not Significant	-HITECH with support from FMW

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
9		Occupational health and safety issues arose construction activities including physical hazards, chemical hazards, confined spaces, exposure to dust and noise.	• Provide personal protective equipment (PPE) and training to address physical risks. • Properly handle and store hazardous materials. • Implement safety protocols for working in confined areas. • Use dust control measures and provide hearing protection.	Not Significant	-HITECH with support from FMW
10		Disruption on fishing activities by damaging fishing grounds, polluting waters, and altering fish habitats, leading to potential declines in fish populations and reduced income for local fishermen.	• Prevent excessive sediment runoff into water bodies.	Not Significant	-HITECH with support from FMW
11		Potential Infringement on Workers' Human Rights if not working under safe and fair working conditions	• Ensure fair wages, reasonable working hours, and safe environments. • Respect workers' rights to organize, bargain collectively, and be free from discrimination. • Regularly assess compliance with labour laws and address violations.	Not Significant	-HITECH with support from FMW
B		Operational Phase			
1	Soil, Surface and Water Quality	Fuel spills from machinery and transport vehicles which can Hydrocarbons (from fuels) can infiltrate the soil, potentially reaching groundwater.	• Implement strict spill prevention protocols during refuelling and maintenance. • Install containment systems (e.g., berms, spill kits) to capture and contain spills.	Not Significant	FMW

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
			• Regularly inspect equipment and storage areas to identify and address potential leaks.		
2	Waste	Disposing waste outside designated zones leads to soil degradation and Soil exposure to heavy metals and pesticides poses risks	• Ensure waste disposal adheres to regulations and guidelines. • Remediate affected areas through soil restoration • Regularly test soil quality and monitor for contaminants. • Properly manage hazardous substances to prevent soil contamination.	Not Significant	FMW
3	Air Pollution	Emissions from ships, trucks, and machinery contribute to air pollution.	• Create green buffer zones between road corridor and residential areas. • Implement low-emission technologies for vehicles and machinery. • Regularly monitor air quality and adjust operations accordingly.	Not Significant	FMW
4	Noise and Vibrations:	Road operations generate noise and vibrations, impacting nearby communities. Disruptions to sleep patterns and stress levels can occur.	• Install physical barriers to reduce sound propagation. • Schedule noisy activities during off-peak hours. • Involve residents in noise reduction planning.	Not Significant	FMW
		Nearby residents experience disturbances, affecting sleep and overall well-being.		Not Significant	FMW

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
5	**Climate Change Impact**	Road facilities vulnerable to climate-related hazards such as rising sea levels, storm surges, and extreme weather events	• Ensure Climate-Resilient Infrastructure through design and upgrade of the highway to withstand rising sea levels and storms. • Provide Emergency Preparedness that include developing evacuation plans and providing early warning systems for nearby residents.	Not Significant	FMW
6	Traffic Congestion	Infrastructure Strain: Roads and intersections become overloaded.	• Strengthen road infrastructure to handle increased loads. • Support road maintenance and regularly maintain and upgrade roads to handle increased loads. • Ensure traffic planning to coordinate activities with urban infrastructure use and development	Not Significant	FMW
		Social Disruption arising from ignoring community concerns which can lead to social unrest, protests, and strained relationships with local residents.	• Engage with affected businesses to minimize disruptions.	Not Significant	FMW
7	Health Risk	Air pollution and exposure to hazardous materials pose health risks. Construction workers and nearby residents may be affected.	• Use water sprays or suppressants during construction. • Ensure regular checks for workers exposed to pollutants.	Not Significant	FMW
		Exposure to Hazardous Materials with Chemical Risks-	• Ensure regular checks for workers exposed to pollutants.	Not Significant	FMW

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
		Handling hazardous cargo or materials poses health hazards and Contaminated Soil:- soil near the project area may contain harmful substances.	• Use cleaner fuels and emission controls.		
8	Human Rights Impacts	Salient human rights abuses or risks could arise which include workers' rights, community and land rights, and environmental protection	• Stakeholder Engagement to involve communities in decision-making. • Continually evaluate impacts on workers' rights and land rights. • Ensure adherence to labour and environmental laws.	Not Significant	FMW
C		**Decommissioning Phase**			
1	Soil, Surface and Water Quality	Increased turbidity and suspended solids due to site clean-up and equipment removal in the case of increased sediment and debris being washed into surface water bodies	• Install sediment barriers or silt fences to prevent runoff into surface water bodies. • Stabilize exposed soil with vegetation or geotextiles. • Dispose of debris and sediment in designated areas.	Not Significant	FMW
2		Saline water intrusion into the freshwater aquifer system due to dewatering activities if not controlled or managed properly.	• Monitor groundwater levels and salinity during dewatering. • Create barriers (e.g., injection wells) to prevent saltwater migration.	Not Significant	FMW
3		Removal of structures and equipment can lead to bare soil,	• Seed or plant vegetation to stabilize soil.	Not Significant	FMW

	Table 6.3:Summary of Identified Significant Impacts and Measures				
	Aspect	**Impact**	**Mitigation measures**	**Residual Impact**	**Responsibility**
		increasing surface runoff and the mobilization of pollutants into nearby surface water bodies if not managed properly	• Properly grade surfaces to direct runoff away from water bodies. Construct sediment basins to capture runoff.		
4	Social	Potential disruption to roads and access routes, dust emissions affecting social receptors, and interruptions to nearby businesses and food vendors reliant on project activities.	• Plan construction activities to minimize disruptions. • Use water sprays or dust suppressants to reduce emissions. • Inform residents about road closures.	Not Significant	FMW
5		Occupational health and safety issues from decommissioning construction activities including physical hazards, chemical hazards, confined spaces, exposure to dust and noise.	• Provide proper training and PPE for workers. • Safely handle and dispose of hazardous materials. • Implement safety protocols for confined areas. • Use protective gear and noise-reducing measures.	Not Significant	FMW

6.6.1 Specific Mitigation Measures for the Potential Impacts

These Specific Mitigation Measures cover some of the critical issues of project at different phases for the project which include Pre-construction (site establishment) and Construction and Decommissioning (Site Clean-Up and Equipment Removal after Construction).

6.6.2 Pre-construction (Site Establishment) and Construction

Soil, Surface and Water Quality

1. Mitigation Measures to Potential Impact to Soil and Sediment Quality

Measure	Source of Measure
The following mitigation measures are in place and will be implemented for the site establishment stage of the project: • All the construction material will be stored in dedicated storage areas; • A designated machinery and equipment storage area will be developed for the Project; • Fuels, lubricants will be stored in dedicated storage area having secondary containment; • On completion of work all temporary structures, surplus materials and wastes will be completely removed from site; • Construction and demolition waste (inert materials) will be utilised for filling of site, stored in designated area and finally disposed through third party vendor; • Separate bins will be provided at construction area for collection of segregated waste as per a waste management plan, and finally disposed through third party; • Different types of hazardous waste collection bins will be provided for oily substances and non-oily hazardous waste at construction area; • Hazardous wastes generated from the site establishment stage will be stored in designated waste storage area, having secondary containment; • Hazardous waste will be finally disposed through third-party subcontractors. • A spill response procedure and associated spill kits to contain any incidental spillage of fuel, • chemicals and hazardous waste;	Bespoke

Residual Impact

Post-mitigation the residual impact can be considered to be Not Significant.

2. Mitigation Measures to Potential Impact to Coastal Morphology

Measure	Source of Measure
Coastline Alteration: Design structures to minimize erosion and maintain natural features. Continuously monitor shoreline changes and adapt management strategies accordingly.	
Offshore Soil Disposal: Analyse soil properties before disposal to ensure compatibility with the seabed. Implement habitat restoration projects to compensate for any disturbance caused.	
Salinity Control: Leverage rainwater and flood resources to establish a long-term leaching mechanism. This helps reduce soil salinity over time. Plant vegetation adapted to local conditions to enhance salt leaching and stabilize the ecosystem[1].	
Sustainable Dredging: If sand extraction is necessary, follow sustainable dredging practices to maintain sediment balance. Community Engagement and Awareness: Stakeholder Communication: Engage with local communities, workers, and businesses to raise awareness about the project's impacts and mitigation measures.	Section 1.3, page 28, General EHS Guidelines Performance Standard 1
Health and Safety Training: Provide training to workers on health and safety practices during construction. Collaborate with other stakeholders with adherence to best practices, and continuous monitoring.	

Residual Impact

Post-mitigation the residual impact can be considered to be Not Significant.

3. Mitigation Measures to Flooding, Erosion and Sedimentation Impact

Measure	Source of Measure
For a wholistic measure involve environmental experts, engineers, and etc for successful project implementation while minimizing adverse impacts. Ensure Regular monitoring and adaptive management are crucial to ensure the long-term sustainability of project **Flooding Impact** Designate and preserve natural buffer zones along the coastline, especially the opposite side to act as protective barriers against storm surges and high tides. Construct infrastructure at an elevated level to reduce vulnerability to flooding. Implement efficient drainage systems to manage excess water during heavy rainfall or storm events. Develop and deploy early warning systems to alert all stakeholders about potential flooding. **Erosion Impact**:	World Bank EHS Guidelines World Bank EHS Guidelines World Bank EHS Guidelines World Bank EHS Guidelines

Measure	Source of Measure
Regularly replenish eroded areas with sand to maintain their protective function. Install breakwaters strategically to reduce wave energy and prevent erosion. Introduce native vegetation to stabilize soil and prevent erosion. Plan infrastructure in a way that minimizes disruption to natural sediment transport patterns. **Sedimentation Impact** Develop sediment management plans to ensure a balanced deposition and erosion cycle. This may involve controlled sediment and redistribution. Deploy artificial reefs to encourage sediment accumulation and enhance marine biodiversity. Implement ecosystem-based approaches that consider sediment dynamics and promote healthy habitats. Continuously monitor sediment levels and adjust management strategies accordingly. **Long-Term Leaching Mechanism**: Capture and utilize rainwater and floodwater for leaching purposes. This helps flush excess salts from the soil over time. Plant salt-tolerant vegetation to aid in leaching and stabilize the soil. **Ecosystem Restoration and Maintenance**: Plan the structure of soil layers in advance, considering vegetation types and their ability to stabilize soil. Enhance the natural salt leaching process through proper irrigation and drainage practices. Choose vegetation species based on local conditions and ecological suitability.	

4. Mitigation Measures to Potential Impact on Marine Environment, Hydrology, and Ecosystem Services

Measure	Source of Measure
Habitat Destruction: • Implement **ecosystem-based management** during construction to minimize habitat loss. • Designate **protected zones** along the area to safeguard critical habitats. • **Rehabilitate** or create alternative habitats elsewhere to compensate for any losses.	World Bank EHS Guidelines **IUCN**
Pollutants: • **Strictly regulate** the handling and disposal of pollutants during construction. • Use **environmentally friendly materials** and construction techniques.	WHO World Bank EHS Guidelines

Measure	Source of Measure
• Establish **emergency response plans** to address accidental spills promptly. • Monitor water quality and conduct regular **pollution assessments**.	
Hydrology: • **Model water flow patterns** to understand alterations caused by proposed infrastructure. • Design **flow control structures** (e.g., weirs, channels) to maintain natural hydrological processes. • **Mitigate sediment accumulation** by implementing effective sediment traps . • **Monitor sediment transport** and adjust management practices accordingly.	World Bank EHS Guidelines
Ecosystem Impact: • Enhance the **existing environment** by creating artificial reefs or underwater structures. • **Restore coastal habitats** (e.g., mangroves, seagrass beds) to support marine life where necessary • **Educate stakeholders** about the importance of maintaining ecological balance.	IUCN, Global Biodiversity Framework World Bank EHS Guidelines
Loss of Protective Services: • **Design buffer zones** to protect against storm surges and erosion. • **Implement shoreline stabilization measures** using vegetation planting. • **Raise awareness** about the value of these protective services among policymakers and the public.	IUCN, Global Biodiversity Framework World Bank EHS Guidelines
Compensatory Actions: Offset negative impacts by creating positive contributions through tree planting and vegetal cover	IUCN
Adaptive Management: Continuously monitor and adjust mitigation measures based on real-time data and feedback	
Legal and Regulatory Compliance: Ensure that mitigation measures go beyond existing laws and regulations. They should be above-and-beyond requirements to effectively address impacts.	
Reclamation Planning: Carefully plan reclamation activities to minimize disruption to coastal morphology. Consider reusing dredged material for beach nourishment or habitat creation. Monitor the impact of dredging on nearshore habitats and adjust practices accordingly.	
Stakeholder Engagement: Involve local communities, experts, and relevant authorities in the decision-making process. Their insights can lead to better mitigation strategies.	

Measure	Source of Measure
Collaborate with other stakeholders with adherence to best practices, and continuous monitoring.	

Residual Impact
Post-mitigation the residual impact can be considered to be Not Significant.

5. Mitigation Measures to Potential Impact due to Mobilisation of Pollutants from Contaminated Land Encountered during Earthworks

Measure	Source of Measure
Prepare plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land in Section 1.6 of the EHS Guidelines. This should include consideration of what level of Personal Protective Equipment is appropriate for employees working in the immediate vicinity of the contaminated land (e.g. face masks).	Section 4.1, page 89-91, General EHS Guidelines
The waste management plan should make provision for the handling and disposal of obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section 1.6 of the EHS Guidelines. Successful implementation of any management strategy may require identification and cooperation with whoever is responsible and liable for the contamination.	Section 4.1, page 89-91, General EHS Guidelines
Engage a contaminated land specialist to assess and classify the material. Obtain the necessary FMENv approvals for storage, removal, transport, reuse, treatment, or disposal of the contaminated material.	
Containment and Remediation: Implement measures to contain and remediate pollutants. Address the specific contaminants found in the soil.	
Monitoring and Compliance: Regularly monitor soil quality during and after earthworks to ensure compliance with environmental regulations.	
The waste management plan should make provision for the handling and disposal of improperly disposed materials encountered during earthworks.	

Residual Impact
Post-mitigation the residual impact can be considered to be Not Significant.

Air Quality

1. Mitigation Measures to Potential Impact on Ambient Air Quality

Measure	Source of Measure
• Proper traffic management is necessary to minimize congestion and emissions. • Monitor air quality and take steps to minimize the impact of construction activities and truck movements to prevent air quality impairment.	Section 1.3, page 28, General EHS Guidelines Performance Standard 1

Residual Impact

Post-mitigation the residual impact can be considered to be Not Significant.

2. Mitigation Measures to Potential Impacts Associated with Dust Emissions

Measure	Source of Measure
Prepare and implement a Dust Management Plan (or equivalent). The dust management measures should include measures such as those set out below. This should include both management measures and monitoring measures to control and verify dust levels, as well as details on who will be responsible for implementing these controls. The suitability of these measures shall be verified on an ongoing basis, considering monitoring results and any dust-related community grievances received. **Preparing and Maintaining the Site** Measures should be implemented to avoid site water or mud runoff. Remove materials that have the potential to generate significant dust from the site as soon as possible (e.g. <48 hrs) unless being re-used on site. Where this is not possible, these materials will be covered. Cover or fence any stockpiles of dusty materials. Use enclosed chutes and conveyors and covered skips. Ensure equipment is readily available on-site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods. Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems. After all site works are completed, all remaining exposed land should be verified as stable in dust. Suitable water carts in good working condition and of not less than 10,000 Liters capacity, or other appropriate alternatives, shall be available to commence watering on the site within 2 hours of being required per the Dust Management Plan. **Vehicle Trackout** Vehicles will be kept clean and free of residual dirt and mud	World Bank EHS Guidelines

Measure	Source of Measure
Access gates are to be located at least 10m from receptors where possible. **Monitoring** Monitoring may include dust deposition, dust flux, and visual inspections. Ensure adequate quality assurance/quality controls (e.g., equipment calibration) are in place for all monitoring.	
The Project will monitor air quality at several strategic locations along the route before construction (including urban areas and near quarries/borrow pits). This will include an analysis of PM10 and PM2.5, collected over at least three months. This monitoring will consist of upwind and downwind locations and associated meteorological tracking (i.e., wind direction and strength). Suppose ongoing dust complaints are received as part of the Project's stakeholder grievance mechanism. In that case, this monitoring will be extended throughout the duration of the construction, and the results will be used to inform the effectiveness of the dust suppression measures identified in the dust management plan.	
The Project will implement a community grievance mechanism to manage any complaints from surrounding community members, including dust-related ones. In responding to such complaints, the Project will consider dust abatement measures (e.g., dust suppression, suspension of activities during dry and windy periods, and screens) to help manage these impacts.	IFC Performance Standard 1

Residual Impact
Post-mitigation, the residual impact can be considered to be Not Significant.

3. Mitigation Measures to Impacts of Other Pollutants/Emissions

Measure	Source of Measure
• Use low-emission construction equipment and vehicles that meet or exceed emission standards to reduce air pollutant emissions. • Implement vehicle idling reduction policies and practices to minimize unnecessary emissions from construction vehicles and equipment. • To reduce overall vehicle emissions, encourage carpooling, alternative transportation options, and the use of electric or hybrid vehicles among construction workers. • Regardless of the size or type of vehicle, fleet owners/operators should implement the manufacturer-recommended engine maintenance programs. • Drivers should be instructed on the benefits of driving practices that reduce fuel consumption, including measured acceleration and driving within safe speed limits.	World Bank EHS Guidelines

Residual Impact

Post-mitigation, the residual impact can be considered to be Not Significant.

4. Mitigation Measures to Potential Impact on Human Health Associated with Combustion Emissions

Measure	Source of Measure
• Use low-emission construction equipment and vehicles that meet or exceed emission standards to reduce air pollutant emissions. • Implement vehicle idling reduction policies and practices to minimize unnecessary emissions from construction vehicles and equipment. • Encourage carpooling, alternative transportation options, and the use of electric or hybrid vehicles among construction workers to reduce overall vehicle emissions. • Regardless of the size or type of vehicle, fleet owners / operators should implement the manufacturer recommended engine maintenance programs. • Drivers should be instructed on the benefits of driving practices that reduce fuel consumption, including measured acceleration and driving within safe speed limits. • Open burning of solid materials will be prohibited on-site • Open burning of improperly disposed materials will be prohibited on-site.	EHS Guidelines

Residual Impact

Post-mitigation, the residual impact can be considered to be Not Significant.

Noise and Vibrations

1. Mitigation Measures to Potential Impact on Ambient Noise Quality

Measure	Source of Measure
Design Options: • Consider design modifications that minimize noise generation during construction. For example, using noise-absorbing materials or altering construction layouts.	Section 4.1, page 89-91, General EHS Guidelines
• Arrange construction activities to minimize noise propagation towards sensitive areas.	Section 4.1, page 89-91, General EHS Guidelines
• Plan the order of construction tasks to reduce noise impact.	
• Include noise-related provisions in sub-contracts to guide contractors' behaviour.	Section 4.1, page 89-91, General EHS Guidelines
Mitigation at the Source: • Opt for quieter equipment models. • Regular maintenance and inspection can also reduce noise emissions. • Choose low-noise machinery. Proper training for equipment operators is essential. **Mitigation Along the Path**: • Utilize existing structures or topography to block noise transmission.	World Bank Environmental, Health, And Safety Guidelines

Measure	Source of Measure
• Erect barriers or enclosures around noisy activities. • Construct permanent noise barriers or walls. **Health Considerations**: • Minimize disruptions to operations around project area to reduce stress for workers and residents. • Generate Awareness Campaigns. • Recognize that prolonged exposure to elevated noise levels can impact human health.	
The Project will implement a community grievance mechanism to manage any complaints from surrounding community members, including those related to noise. In responding to any such complaints, the Project will consider noise abatement measures (e.g., provision of earplugs, temporary noise barriers, rescheduling of noisy activities) to help manage these types of impacts. Additionally, if significant noise complaints are received, the Project may need to implement ongoing noise monitoring at affected receptors, following the methodology set out in in accordance with *ISO 1996-1: 2016: Acoustics – Description, Measurement and Assessment of Environmental Noise - Part 1 Basic Quantities and Assessment Procedures.*	IFC Performance Standard 1, Section 4.1, page 89-91, General EHS Guidelines

Residual Impact

Post-mitigation the residual impact can be considered not significant.

2. Mitigation Measures to Potential Impact on Human Health Associated with Increased Noise Levels from Construction Activities to other sub contractors in the area

Measure	Source of Measure
• Establishing noise deflection walls • Paving and levelling the terminal area. • Replacing forklifts and reach-stackers with gantry cranes with rubber tires. • Substituting diesel engines with electric power • Reducing noise from warning bells • Insulating machinery and generators	General EHS Guidelines
• Schedule activities during daytime hours and limit noisy activities during early morning or late evening hours to minimize disturbance to nearby residents. • Use noise barriers, sound-absorbing materials, and acoustic enclosures to reduce noise emissions from construction equipment and machinery. • Provide personal protective equipment (PPE) such as earplugs or earmuffs to workers exposed to high levels of noise to mitigate potential health effects.	General EHS Guidelines
Local residents must be informed (i.e., through notice boards and/or direct community consultation) of any periods of night work that may be necessary.	

Measure	Source of Measure
• Erecting noise barriers around construction areas can reduce noise propagation to nearby residential or sensitive zones. • Restricting noisy activities to specific hours (e.g., daytime) can mitigate the impact on nearby communities. • Regular monitoring of ground vibrations during pile driving and machinery operation can help assess their effects and adjust construction practices accordingly. • Implementing traffic management strategies to minimize congestion and associated vibrations on access roads.	
Prior to pre-construction, the Project will conduct a noise baseline survey in accordance with *ISO 1996-1: 2016: Acoustics—Description, Measurement, and Assessment of Environmental Noise—Part 1 Basic Quantities and Assessment Procedures*. This survey should include representative noise-sensitive receptors adjacent to the yard and other working areas.	
The Project will implement a community grievance mechanism to manage any complaints from surrounding community members, including those related to noise. In responding to any such complaints, the Project will consider noise abatement measures (e.g., provision of earplugs, temporary noise barriers, rescheduling of noisy activities) to help manage these types of impacts. Additionally, if significant noise complaints are received, the Project may need to implement ongoing noise monitoring at affected receptors, following the methodology set out in in accordance with *ISO 1996-1: 2016: Acoustics – Description, Measurement and Assessment of Environmental Noise - Part 1 Basic Quantities and Assessment Procedures.*	Performance Standard 1

Residual Impact

Post-mitigation the residual impact can be considered to be Minor.

3. Mitigation Measures to Potential impact to community structures from Vibration Emissions from Construction Activities

Measure	Source of Measure
Vibration Control: • **Pile Driving**: To reduce ground vibrations from pile driving, consider using vibration-damping materials or techniques. Pre-drilling holes, using vibratory hammers, or adjusting pile driving techniques can help mitigate vibrations. • **Equipment Operation**: Limit the use of heavy machinery during sensitive hours (e.g., night time) to minimize vibrations. Isolating equipment from the ground using rubber pads or shock absorbers can also help. • **Traffic**: Control vehicular traffic near sensitive structures during construction. Use alternative routes if possible.	, EHS Guidelines, *ISO 1996-1: 2016: Acoustics – Description, Measurement and Assessment of Environmental Noise - Part 1 Basic Quantities and Assessment Procedures.*
Structural Protection: • **Sensitive Buildings**: Implement protective measures like installing vibration isolation systems or reinforcing foundations.	EHS guidelines

Measure	Source of Measure
• **Monitoring**: Continuously monitor vibrations during construction. If levels exceed safe thresholds, adjust construction methods accordingly. **Noise Management**: • **Construction Noise**: Use noise barriers, acoustic enclosures, or schedule noisy activities during off-peak hours. Inform nearby residents about construction schedules. • **Quality of Life**: Address noise pollution concerns by minimizing disruptive noise. Consider community feedback and adjust construction practices accordingly. **Safety Precautions**: • **Falling Debris**: Erect safety barriers to prevent debris from falling onto nearby structures. Regularly inspect and maintain these barriers. • **Heavy Equipment Movement**: Ensure safe movement of heavy equipment. Use designated routes and avoid congested areas.	
Regularly communicate with host communities and nearby residents, provide updates, and address their concerns. Collaborate with local authorities, environmental agencies, and experts to ensure a successful and community-friendly rehabilitation process.	

Residual Impact

Post-mitigation the residual impact can be considered to be not significant.

Waste

1. Mitigation Measures to Potential Impacts from Project Generated Waste Affecting Local Environment or Community Receptors

Measure	Source of Measure
Generally, adopt Circular economy principles to promote sustainability, reduce waste, and optimize resource utilization.	Nigeria National Waste Management Policy
• Segregation and Sorting: Different types of demolition waste such as concrete, steel, and wood will be separated and sorted at the source to facilitate recycling and proper disposal. • Recycling and Reuse: Concrete debris will be crushed to create recycled aggregate for use in new construction. Steel reinforcement bars will be salvaged for reuse or recycling. Wood waste will be repurposed for other projects or biomass. • Erosion Prevention: Erosion control measures will be implemented to prevent soil runoff. • Hazardous Material Handling: Hazardous will be identified and safely removed. Hazardous waste will be disposed of according to regulations. • Waste Management Plan: A comprehensive waste management plan will be developed that outlines procedures for handling different waste types.	Section 4.1, page 89-91, General EHS Guidelines Section1.6, page 46-51, General EHS Guidelines Performance Standard 3

Measure	Source of Measure
• On-Site Recycling Centres: Designated areas will be set up for sorting and recycling construction debris. Workers will be encouraged to segregate waste properly. • Reducing Packaging Waste: Packaging materials will be minimized by ordering bulk supplies. Packaging will be reused where possible. • Safe Chemical Handling: Chemicals will be stored and handled properly. Chemical waste will be disposed of through authorized channels.	
• Generally though the project provides sanitary facilities with capacity to meet sanitation requirements of personnel at all project locations. All personnel must have access to toilet facilities within 500 m of their place of work. Personnel must use the provided facilities, which shall be serviced daily to ensure hygienic conditions. • No facilities containing sewage may be located within 100 m of a surface water resource. • Raw sewage must be contained and subject to treatment and disposal by a registered service provider at an appropriately permitted facility. Records of safe treatment and disposal of sewage must be maintained.	
The project will implement a community grievance mechanism to manage any complaints from surrounding community members, including those related to waste management.	Performance Standard 1

Residual Impact

Post-mitigation waste management practices significantly reduce environmental harm, enhance project sustainability, and promote community well-being and so residual impact is considered Not Significant.

2. Mitigation Measures to Post-Construction Clean-Up Project Generated Waste Affecting Local Environment or Community Receptors during the Phases of the project

Measure	Source of Measure
Generally, adopt Circular economy principles to promote sustainability, reduce waste, and optimize resource utilization.	Nigeria National Waste Management Policy
• An inventory of unused materials and equipment will be created. • Reusable items will be salvaged for future projects. • Residual soil and sediment will be disposed of in accordance with environmental guidelines. Metal scraps, wood, and plastic waste will be recycled. • Vegetation will be replanted, and disturbed areas will be restored. • Water quality will be monitored during clean-up. • Any damage caused during construction will be repaired. • Monitoring and Compliance: Compliance with waste disposal regulations will be ensured.	Section 4.1, page 89-91, General EHS Guidelines Section1.6, page 46-51, General EHS Guidelines Performance Standard 3 Nigeria National Waste Management Policy

Measure	Source of Measure
The project will implement a community grievance mechanism to manage any complaints from surrounding community members, including those related to waste management.	Performance Standard 1

Residual Impact

Post-mitigation waste management practices significantly reduce environmental harm, enhance project sustainability, and promote community well-being and so residual impact is considered Not Significant.

Hydrology

1. Mitigation Measures to Spills or Leaks Resulting in Contamination of Groundwater and Surface Water

Measure	Source of Measure
Strict Control: Implement strict control measures during refuelling and maintenance.	
Emergency Response Plans: Develop protocols for handling spills promptly.	
Training: Train workers on spill prevention and response.	
Prior to taking water from a borehole or well: ● Identify all other boreholes and wells within 100 m of the source. ● Measure the quality of water in these wells. Thereafter measure quality of water on a monthly basis, continuing until two months after abstraction ceases. If monitoring indicates a material reduction in water quality, then abstraction should cease. If the reduction is substantial enough to affect the usability of supply to the users, then the contractor will need to provide and fund an alternate supply.	
Stormwater should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge.	Section 1.3, page 28, General EHS Guidelines World Bank Environmental, Health, And Safety Guidelines
Surface runoff from process areas or potential sources of contamination should be prevented, or where not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff.	Section 1.3, page 28, General EHS Guidelines
Oil water separators and grease traps should be installed and maintained as appropriate at refuelling facilities, workshops, wash bays, fuel storage and containment areas.	Section 1.3, page 28, General EHS Guidelines
Where discharging surface water runoff into the environment, water should meet the following levels: • pH 6-9 • TSS 50mg/l • Oil and grease 10mg/l	Section 1.3, page 28, General EHS Guidelines

Measure	Source of Measure
Maintain the mechanised fleet to accepted industry standards as documented in a Fleet Maintenance Plan. Maintenance or repair of mechanised fleet to primarily take place off-site at designated workshop facilities with bunded, impervious floor and oil traps. Where it is not possible or practical to conduct maintenance and repair offsite, such maintenance and repair on-site must be undertaken at a designated maintenance area, fitted with bunded, impervious floor and oil traps. The maintenance area floor will not discharge to stormwater, sewer, sewage holding tanks, soak-away trenches or to any other external connection. Stormwater runoff, rainwater, and other drainage sources from areas outside of the maintenance area will be prevented from entering the area. Where it is not practicable to move damaged equipment to the designated maintenance area, secondary containment such as catch pans, drip trays, and ground protective sheets must be used during emergency works to prevent contamination of soil or water.	
Develop and implement an Emergency Response Plan. This plan should be communicated to local stakeholders.	Performance Standard 1
Store and handle all hazardous materials to accepted industry standards as documented in a Hazardous Materials Management Plan. Hazardous materials, including chemicals and fuels, shall only be stored only in the ancillary sites, in a dedicated place. Such sites shall be located away from high risk areas including significant pedestrian or vehicle traffic, residential areas and water flow paths (> 50 m). Storage methods shall be in terms of the MSDS and manufacturers' instructions, typically in facilities with bunded, impervious floor and with provision to exclude rainfall and runoff. The bund for hydrocarbons should have 110% of the maximum storage capacity of the facility. Hazardous material storage sites shall have adequate signage in place identifying hazardous the materials and the nature of hazard. Incompatible materials shall not be placed in common containment and different class of chemicals will be stored separately. Leaking containers will be removed immediately and be appropriately disposed. Maintain an inventory at the site office for all chemicals and their types and quantity stored on the project site. Material Safety Data Sheets for all chemicals must be kept at the site office and in every vehicle used to transport such chemicals. Personnel involved in handling hazardous materials, particularly those specifically assigned to storage areas, must be trained on how to respond in case of spill. Spill containment and clean-up kits, appropriate to the volume and type of materials stored, will be kept on-site.	

Measure	Source of Measure
Refuelling of mechanised fleet to primarily take place in designated refuelling area at the Ancillary Sites. Refuelling sites shall be located away from water flow paths (> 50 m) and any well. Fuel will only be stored in an industry approved and certified tank, with integrated bunding. The refuelling area will be equipped with a bunded, impervious floor. The refuelling area will not discharge to stormwater, sewer, sewage holding tanks, soak-away trenches or to any other external connection. Stormwater runoff, rainwater, and other drainage sources from areas outside of the refuelling area will be prevented from entering the area. Personnel involved in handling refuelling, particularly those specifically assigned to refuelling areas/equipment, must be trained on how to respond in case of spill.	
Where refuelling in the designated area is not possible due to the mobility of machinery, implement secondary containment such as catch pans or drip trays during refuelling. Refuelling vehicles / mobile delivery tanker will have the following: i. metal drip tray/s of sufficient capacity; ii. ground protective sheet/s; iii. a labelled, sealable container for storing spilled fuel; iv. any equipment required for transferring fuel captured in drip trays into the storage drum; v. a suitable spill clean-up kit vi. a shovel for use in spill clean-up	
If a project related leak or spillage has the potential to impact on groundwater usability/acceptability to a local user then the contractor must investigate and provide an alternate, equivalent water supply for the duration of the period that an effect occurs.	
Daily visual inspections shall be undertaken and especially at material stockyards, hazardous material storage sites, fleet parking areas and stockpile areas for signs of hazardous material spillages. Daily visual inspections of the mechanised fleet shall be undertaken to observe leaks of hydrocarbons.	

Residual Impact

Post-mitigation the residual impact can be considered to be Not Significant.

Biodiversity

1. Mitigation Measures to Potential Impact on Ecosystem Services

Measure	Source of Measure
• Incorporate green spaces, native vegetation, and wetlands within the project area to enhance ecosystem services. • Implement effective stormwater management systems to prevent runoff pollution. • Protect and restore habitats to maintain biodiversity and ecosystem resilience. • Regularly monitor ecosystem services and adjust management practices based on feedback.	Environmental, Health, And Safety Guidelines Ports, General EHS Guidelines. National Policy on Environment

Residual Impact

Not Significant

2. Mitigation Measures to Potential impact to Marine Ecology

Measure	Source of Measure
• Implement habitat restoration programs to compensate for any loss of the remaining marine ecosystems. • Enforce strict protocols to prevent the introduction of invasive species. • Monitor water quality, sediment deposition, and marine biodiversity regularly. • Ensure compliance with environmental regulations.	Environmental, Health, and Safety Guidelines General EHS Guidelines. National Policy on Environment

Residual Impact

Applying the recommended mitigation measures set out would reduce the probability of affecting the marine ecology, with the residual impact significance still considered to be Not Significant.

3. Mitigation Measures to Potential Impact on Avifauna during construction phase

Measure	Source of Measure
• Create buffer zones around sensitive bird habitats to reduce direct impacts. • Avoid construction near important bird breeding sites or migratory routes. • Use bird-friendly lighting designs to reduce light pollution. • Regularly monitor bird populations to assess the effectiveness of mitigation efforts.	

Residual Impact

Not Significant.

4. Mitigation Measures to Potential Impact of Introduction of Marine Invasive Species (MIS)

Measure	Source of Measure
• Implement strict biosecurity measures to prevent unintentional transport of invasive species. • Monitor and report any signs of invasive species.	

• Designate specific areas for incoming materials and equipment and quarantine them until verification. • Educate workers and contractors about preventing invasive species. • Develop a plan for swift removal of invasive species • Establish monitoring programs to detect NIASs early. • Regular surveys, sampling, and reporting mechanisms are crucial. • Develop protocols for rapid response in case of NIAS detection. Quarantine and eradication measures should be swift and effective.	

Residual Impact

Applying the recommended mitigation measures set out would reduce the probability of introducing invasive alien species, with the residual impact significance still considered to be Not Significant.

5. Mitigation Measures to Potential Impact due to ***sea dredging, and soil placement***

Measure	Source of Measure
Dredging and Soil Placement: • Dredging from the sea plays a crucial role in reclaiming lost shoreline areas. • Ensure proper soil placement ensures stability, functionality, and long-term viability of the highway. • Recognise the environmental sensitivity which guides these activities to minimize disruption to marine ecosystems and coastal habitats. • Use sediment containment methods (such as silt curtains or geotextile tubes) to prevent dispersion. **Soil Compaction Quality Assurance-Engineers employ several techniques:** • Ensure field testing: Soil samples should be analyzed for density, moisture content, and compaction properties. • Use proper equipment: Compactors (rollers) achieve uniform compaction during soil placement. • Ensure compaction control: Density gauges or nuclear density meters monitor compaction levels. • Adopt layer-by-layer approach: Soil is placed, compacted, and verified incrementally. • Provide for quality checks: Independent inspectors verify compaction quality. **Provide Marine Sand Watch Platform** to monitors dredging activities . • This will tracks sand, clay, silt, gravel, and rock extraction	

• This type of platform uses Automatic Identification System (AIS) signals from vessels and Artificial Intelligence (AI) for detection.	

Residual Impact
Applying the recommended mitigation measures set out would reduce the probability of introducing invasive alien species, with the residual impact significance still considered to be Not Significant.

6. Mitigation Measures to Potential Impact due Ecotoxological impacts

Measure	Source of Measure
• Implement erosion control measures during construction to minimize sediment runoff. • Proper treatment of labor camp wastewater to reduce pollutant levels. • Regular monitoring of water quality during construction and post-construction phases.\	

Residual Impact
Applying the recommended mitigation measures set out would reduce the probability of introducing invasive alien species, with the residual impact significance still considered to be Not Significant.

Social

Mitigation measures to Potential Impact on Population Resettlement/Displacement

Measure	Source of Measure

• Community Engagement:
  ○ Engage with affected communities to understand their preferences and concerns.
  ○ Involve community leaders, NGOs, and local representatives in decision-making processes.
	Section 2.3, page 64-69, General EHS Guidelines

• Compensation and Relocation:
  ○ Affected residents and property owners should be compensated fairly for their losses. This compensation can help them relocate to alternative areas.
  ○ The government should provide financial support to facilitate the transition.
• Resettlement Planning:
  ○ A comprehensive resettlement plan should be developed, considering the needs of displaced individuals and communities.
  ○ The plan should address housing, infrastructure, healthcare, education, and livelihood opportunities in the new locations.
• Infrastructure Development:
  ○ Develop infrastructure (such as roads, schools, and healthcare facilities) in the new resettlement areas to ensure a smooth transition.
  ○ Ensure that basic amenities are available to the relocated population.
• Livelihood Analysis of Resettlement Outcomes:
  ○ For the vulnerability communities, in addition to individual compensation create access to livelihood assets
  ○ use of involuntary resettlement in highway project to alleviate poverty and improve living conditions
• Environmental Mitigation:
  ○ Implement measures to mitigate environmental impact during construction.
  ○ Preserve natural habitats and ecosystems where possible.
• Legal Framework:
  ○ Establish legal provisions to protect the rights of displaced individuals.
  ○ Ensure adherence to international standards for involuntary resettlement.
	The World Bank

Residual Impact

Post mitigation the impact will be Moderate.

Mitigation measures to Potential Road alignment siting/routing

Measure	Source of Measure
• Areas of Exceptional Aesthetic Quality: ○ Ensure the balancing development with aesthetic preservation. • Overcrowded Areas: ○ Ensure proper planning and traffic management to prevent further overcrowding. • Tourism Attraction Sites: ○ Since the highway's path intersects with tourism sites, including beaches and coastal areas, ensure careful design to protect these attractions. • Subsisting Infrastructure Network: ○ The highway should be made to integrate seamlessly with existing infrastructure networks. This requires coordination with utilities, transportation, and other services • Market Emergence Due to Traffic Volume: ○ High traffic volume can lead to spontaneous markets along the road. Manage these markets with the stakeholders and ensuring safety. Create zones for such road side markets • Reclining Disturbed Areas: ○ The highway's construction disrupts existing ecosystems and communities. Resettlement plans, compensation, and environmental mitigation are essential in managing the impacts raised. • Integrated Land Use and Transport Planning: ○ Coordinate land use planning with transport planning to reduce travel distances and promote sustainable development. ○ Encourage mixed-use developments near transportation hubs. • Public Participation and Stakeholder Engagement: ○ Involve local communities, transport agencies, and other stakeholders in decision-making processes. • Traffic Management Strategies: ○ Develop and enforce traffic management strategies, including traffic signal optimization, lane management, and congestion reduction. • Road Maintenance and Upgrades:	Performance Standard 1 Resolution 74/299 adopted by the UN General Assembly on August 31, 2020

Measure	Source of Measure
○ Prioritize road maintenance and rehabilitation to improve highway conditions. ○ Upgrade existing roads to accommodate increasing traffic demands and enhance safety. • Smart Traffic Lights: ○ These lights use artificial intelligence (AI) to manage traffic flow. ○ They respond to real-time conditions, adjusting signal timings based on traffic volume and congestion • Traffic Data Collection and Monitoring: ○ Implement regular traffic surveys using modern technology (e.g., automated counters, sensors) to collect accurate and up-to-date traffic data. ○ Monitor traffic patterns, volume, and flow continuously to inform planning decisions.	
• Develop and implement a community grievance mechanism to provide a means for raising concerns. The process should be understandable and transparent, and provide timely feedback to those concerned, without retribution. • Engage with local communities (including the pastoralists) on the traffic management measures being applied and respond to any feedback received. • Use of the mechanism shall be communicated to local communities through the Project's stakeholder engagement process.	

Residual Impact

Post mitigation the impact will be Moderate.

Mitigation Measures to Potential Road congestion during Construction

Measure	Source of Measure
Traffic Diversion: • Divert traffic away from construction zones using alternative routes. • Temporary detours and signage guide drivers to avoid congested areas. Off-Peak Construction: • Schedule construction during off-peak hours (e.g., nights or weekends) to reduce impact on daily commuters. • Minimize lane closures during rush hours. Phased Construction: • Divide the project into phases to maintain traffic flow. • Complete one section before moving to the next.	Performance Standard 1

Measure	Source of Measure
Temporary Traffic Signals and Signs: • Use temporary signals and signs to manage traffic at work zones. • Communicate lane closures, speed limits, and detours clearly. Work Zone Speed Limits: • Enforce reduced speed limits in construction zones. • Fines for speeding in work areas deter reckless driving. Public Awareness Campaigns: • Inform the public about construction schedules and alternate routes. • Use media, websites, and social platforms to raise awareness. Safety Measures: • Enhance road safety through measures such as pedestrian crossings, speed limits, and traffic calming techniques. • Educate the public about safe road behavior and enforce traffic rules. Public Transportation Promotion: • Encourage use of public transit during construction. • Provide incentives for commuters to switch modes. Real-Time Traffic Monitoring: • Monitor traffic flow using cameras and sensors. • Adjust traffic management strategies based on real-time data.	
• Ensure effective coordination among construction teams, transportation agencies, and the public for successful traffic management during the highway construction	
• Develop and implement a community grievance mechanism to provide a means for raising concerns. The process should be understandable and transparent, and provide timely feedback to those concerned, without retribution. • Engage with local communities (including the pastoralists) on the traffic management measures being applied and respond to any feedback received. • Use of the mechanism shall be communicated to local communities through the Project's stakeholder engagement process.	

Residual Impact

Post mitigation the impact will be Moderate.

Mitigation Measures to Potential Impact on Road Traffic and Transport Risk of Project Vehicle Traffic Accidents

Measure	Source of Measure
Traffic Management Plan: • Develop a comprehensive traffic management plan that includes speed limits, designated routes, and safe zones. • Clearly mark pedestrian crossings and vehicle paths. **Driver Training and Awareness**: • Train project vehicle drivers on safe driving practices. • Raise awareness about potential hazards and the importance of vigilance. **Regular Vehicle Inspections**: • Ensure that project vehicles are well-maintained and meet safety standards. • Regularly inspect brakes, lights, tires, and other critical components. **Emergency Response Preparedness**: • Establish protocols for handling accidents promptly. • Train staff in first aid and emergency response **Community Engagement**: • Engage with local residents and businesses to raise awareness about traffic safety. • Encourage responsible behaviour among all road users. **Speed Control**: • Enforce speed limits within the project area. • Use speed bumps or other traffic calming measures where necessary.	
• Train vehicle operators in the safe operation of specialized vehicles, including safe loading/unloading practices and load limits. • Ensure drivers undergo medical surveillance • Ensure moving equipment with restricted rear visibility is outfitted with audible back-up alarms	Section 2.3, page 64-69, General EHS Guidelines
• Develop and implement a Traffic Management Plan (or equivalent) that evaluates potential routes for the main project related vehicle movements for construction machinery, goods (e.g., deliveries of aggregates, bitumen and concrete), worker transport, and waste removal vehicles. This plan should prioritise routes that, where possible, avoid noise sensitive areas included but not limited to schools and residential areas. If avoidance is not possible, the plan will consider alternative minimisation measures such as timing of vehicle movements, speed restrictions, staff training etc.	Section 2.3, page 64-69, General EHS Guidelines

Measure	Source of Measure
Develop and implement a community grievance mechanism to provide a means for raising concerns. The process should be understandable and transparent, and provide timely feedback to those concerned, without retribution. Engage with local communities (including the pastoralists) on the traffic management measures being applied and respond to any feedback received. Use of the mechanism shall be communicated to local communities through the Project's stakeholder engagement process.	Performance Standard 1

Residual Impact

Post mitigation the impact will be Moderate.

1. Mitigation Measures to Potential impact on occupational health and safety

Measure	Source of Measure
• Carry out risk assessment of various tasks, situation and of new equipment • Proper training, personal protective equipment (PPE), and clear signage are essential. • Strict handling protocols, proper disposal, and air quality monitoring are crucial. • Respiratory protection, dust control, and regular health checks for workers. • Ear protection, noise reduction strategies, and awareness campaigns. • Record near misses and other incident or accidents. • Ensure zero fatalities (whether directly employed or subcontracted) especially accidents that could result in lost work time, different levels of disability, or even fatalities. • The working environment should be monitored for occupational hazards relevant to the specific project. • Monitoring should be designed and implemented by accredited professionals • Maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. • Evaluate Occupational health and safety performance against internationally published exposure guidelines, examples of which include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),56 the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),57 Permissible Exposure Limits (PELs) published by the	• General EHS Guidelines. • International Labour Organization (ILO) Code of Practice for Safety and Health in Ports (2005); • General Conference of the International ILO Convention concerning Occupational Safety and Health in Dock Work, C-152, (1979); • General Conference of the ILO Recommendation concerning Occupational Safety and Health in Dock Work, R-160; • IMO Code of Practice for Solid Bulk Cargo (BC Code); • International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code); • International Code for the Safe Carriage of Grain in Bulk (International Grain Code); • Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code); and • International Maritime Dangerous Goods Code (IMDG Code) •

Measure	Source of Measure
Occupational Safety and Health Administration of the United States (OSHA),58 Indicative Occupational Exposure Limit Values published by European Union member states,59 or other similar sources	

Residual Impact

Not significant if impacts are adequately implemented

2. Mitigation Measures to Potential impact on Community health and safety at construction phase

Measure	Source of Measure
Physical Injury and Accidents: • Implement clear signage and barriers to keep the public away from construction zones. • Provide safety training for workers and enforce strict safety protocols. • Regularly inspect equipment and machinery for maintenance and safety compliance. **Exposure to Hazardous Materials**: • Properly handle, store, and dispose of hazardous materials. • Monitor air quality and conduct regular health assessments for workers. **Respiratory Effects from Air Emissions**: • Implement dust control measures (e.g., water spraying, covering materials). • Use low-emission construction equipment. • Monitor air quality and provide health education to affected communities. **Spread of Communicable Diseases**: • Promote hygiene practices (handwashing, sanitation). • Monitor disease outbreaks and provide healthcare access. • Educate the community about disease prevention. • Develop a community awareness programme	• Environmental, Health, And Safety Guidelines • General EHS Guidelines. • International Labour Organization (ILO) Code of Practice for Safety and Health •

Residual Impact

Not significant if impacts are adequately implemented.

3. Mitigation Measures to Potential Impacts on Socio-economic Opportunity

Measure	Source of Measure
Set up a local labour desk and ensure the staff recruitment policy is transparent.	
Give employment priority to local community members in the project environment, along the project's axes during recruitment in line with requests made during engagement with local communities	
Issue end-of-contract work certificates or attestations to employees to enable them to be more competitive if they are offered another opportunity for similar jobs.	
As far as possible, subcontract certain work to local SMEs.	

Residual Impact

Post mitigation the impact will be Positive**.**

4. Mitigation Measures to Potential Infringement on Workers' Human Rights

<table>
<tr><th>Measure</th><th>Source of Measure</th></tr>
<tr><td>Health and Safety Protocols:
• Implement robust safety protocols, including personal protective equipment (PPE), training, and hazard assessments.
• Regularly inspect equipment and machinery to ensure they meet safety standards.</td><td rowspan="4">African Charter on Human and Peoples' Rights (Ratification and Enforcement)

ILO

UN's Universal Declaration of Human Rights

and IFC PS2</td></tr>
<tr><td>Fair Labor Practices:
• Ensure fair wages, overtime compensation, and adherence to labour laws.
• Monitor working hours to prevent excessive fatigue.
• Provide access to medical care and welfare facilities.</td></tr>
<tr><td>Subcontractors and Workers' Rights:
• Extend these protections to subcontractors and all workers involved in the project.
• Educate workers about their rights and avenues for reporting violations.</td></tr>
<tr><td>Emergency Preparedness:
• Develop emergency response plans for accidents or health crises.
• Train workers on evacuation procedures and first aid.
Training
• All employees should be trained on the Occupational Health Management Plan, with particular focus on those risks specific to their roles.</td></tr>
<tr><td>Ensure fair wages, overtime compensation, and adherence to labour laws.</td><td></td></tr>
<tr><td>Develop a Human Resources Management Plan (or equivalent). This Plan will specify clear contracting procedures and worker rights in accordance with national law and IFC PS2. The Human Resources Management Plan will incorporate human rights and non-</td><td>Performance Standard 2</td></tr>
</table>

Measure	Source of Measure
discrimination principles as well as standards regarding accommodation, salaries etc. A copy of this document will be provided to each worker and training will be given on how workers can raise any concerns regarding their treatment via the Grievance Mechanism. Priority will be given to local workers provided they are suitably qualified to undertake the work. Implement training for all workers, including contract workers, on the principles of the Human Resources Management Plan including worker rights, non-discrimination, and human rights and the use of the Worker's Grievance Mechanism.	
All contracts for workers, including contract workers, will be in accordance with applicable national labour law and IFC PS2 requirements. Worker contracts must clearly detail workers' rights.	Performance Standard 2
Develop and implement a grievance mechanism for all workers (including direct employees and contractors) to provide a means for raising workplace concerns. The process should be understandable and transparent, and provide timely feedback to those concerned, without retribution. The mechanism shall be communicated to all workers, including subcontractors via accessible means (e.g., notice boards) and in employment contracts.	Performance Standard 2
Ensure the project, including subcontractors will utilise no child or forced labour (as defined by Performance Standard 2).	Performance Standard 2, ILO Conventions 138 and 182

Residual Impact

Post mitigation the impact will be Moderate**.**

5. Mitigation Measures to Potential Impact on Local Content and Procurement

Measure	Source of Measure
Community Engagement Programs: • Organize workshops, skill-building sessions, and vocational training for local residents. • Foster community participation in project-related activities. **Local Procurement and Contracting**: • Prioritize local businesses for supplying materials and services. • Encourage subcontractors to hire local labour. **Social Infrastructure Investment**: • Invest in local schools, healthcare facilities, and community centres. • Support education and healthcare access for residents. **Environmental Education**: • Raise awareness about environmental conservation among local communities. • Engage schools and community groups in eco-friendly initiatives.	,

Measure	Source of Measure
Job Placement Services: • Assist workers in transitioning to other employment opportunities after project completion. • Facilitate job placements or entrepreneurship support. **Cultural Preservation**: • Celebrate local culture and traditions through events and festivals. • Preserve historical sites and landmark	
Making meal breaks available and allowing for goods from local vendors to directly supply the work force will be of particular benefit.	
Investing in workforce development, such as employing and training local workers, and developing local suppliers, services, and products, creates additional value known as local content.	The Local Content Act, 2003

Residual Impact

Post mitigation the impact will be a Moderate positive.

6. Mitigation Measures to Potential impact related to Influx of People to the Project Area

Mitigation

The Table below details recommended mitigation.

Measure	Source of Measure
Ensure equal access to healthcare services, including preventive care, primary care, mental health services, and reproductive health services, for migrant populations.	
Promote social integration and community engagement through neighbourhood associations, cultural events, sports clubs, and other community-based initiatives that welcome and include migrants.	
Offer training in job readiness skills, vocational skills, and entrepreneurship development to enhance the employability of migrant and host communities in order to promote peace in the communities.	

Residual Impact

Post mitigation the impact will moderate.

6.6.3 **Specific Mitigation Measures for the Decommissioning (Site Clean-Up and Equipment Removal after Construction) Soil, Surface and Water Quality**

1. Mitigation Measures to Increased Turbidity and Suspended Solids Due to Site Clean-Up and Equipment Removal

Measure	Source of Measure
Implement robust sediment and erosion control measures, such as silt curtains or sediment traps, to minimize the release of suspended solids during the piling activities.	WHO World Bank Environmental, Health, And Safety Guidelines
Conduct thorough characterization of the sediments and develop a sediment management plan to ensure proper handling and disposal of contaminated materials.	IMO, 1973/1978 World Bank Environmental, Health, And Safety Guidelines

Measure	Source of Measure
Monitor the water quality in the project basin and adjacent surface waters to detect any changes in turbidity, suspended solids, and associated contaminants. These should limit turbidity of discharge water to ≤ 5 NTU	WHO World Bank Environmental, Health, And Safety Guidelines
Develop and implement a response plan to address any significant increases in turbidity or sedimentation that could adversely affect the aquatic environment.	

Residual Impacts

Increased turbidity and suspended solids are expected to have minor, manageable impacts on surface water, while groundwater residuals are expected to be negligible due to their primary effects.

2. Mitigation Measures to Saline Water Intrusion into the Freshwater Aquifer System: Due to Dewatering Activities

Measure	Source of Measure
Careful planning and execution of site grading, drainage, and landscaping to maintain natural groundwater flow patterns and hydraulic gradients.	
Proper management and disposal of dewatering effluent, ensuring it does not directly or indirectly recharge the freshwater aquifer.	Dewatering and Groundwater Control by the American Society of Civil Engineers (ASCE), ASCE Manual of Practice No. 110, ISBN: 978-0-7844-0750-8.
Comprehensive site restoration and stabilization to minimize the potential for surface water infiltration and saline water intrusion.	
Groundwater monitoring, including regular testing for salinity levels, to detect any changes in water quality.	
Implementation of groundwater recharge measures, such as infiltration basins or permeable surfaces, to maintain freshwater aquifer levels and prevent saline water intrusion.	

Residual Impacts

Residual impact is expected to minimal, localized, temporary and not significant

3. Mitigation Measures to Increased surface runoff and pollutant mobilization

Measure	Source of Measure
Implement effective sediment and erosion control methods, such as silt fences, sediment traps, and temporary soil stabilization, to reduce sediment and pollutant transmission in surface runoff.	International Erosion Control Association (IECA) Best Management Practices (BMP) Handbook, ISBN: 978-0-9853220-0-2.
Ensure that construction debris, garbage, and hazardous materials created during demobilization are thoroughly cleaned up and disposed of properly.	

Measure	Source of Measure
Create and implement strict conventions for the dealing with, capacity, and transfer of powers, oils, and other unsafe materials utilized amid the operation and up keep of the offices to avoid coincidental spills or spills.	
Conduct routine monitoring and maintenance of waste frameworks and stormwater treatment facilities to ensure their continued effectiveness in managing water quality.	
Provide specific spaces for equipment maintenance and fluid storage complete with suitable containment and spill control measures.	
Monitor surface water quality and take remedial measures if pollution levels increases.	

Residual Impact

With the implementation of the proposed mitigation measures, the residual impacts on surface water and groundwater are considered not to be Significant.

Social

1. Mitigation Measures to Potential impact on Socio-economics

Measure	Source of Measure
• **Traffic Management**: Develop site-specific traffic management plans to minimize disruptions. • **Notification**: Notify neighbours and stakeholders about equipment removal schedules. • **Fenced Construction Area**: Install fences around the area to reduce wind-blown dust dispersion and dust clouds. • **Control Material Drop Heights**: Reduce material drop heights to control fugitive dust emissions during material handling	General EHS Guidelines.
Businesses and food vendors near the project sites may rely on the project activities. During equipment removal, their operations could be disrupted. Reduced business activity can lead to financial losses and affect employment.	
The Human Resources Management Plan should consider the following: • **Communication and Engagement:** Establishing clear communication channels with employees and stakeholders to provide information about potential job impacts, timelines, and support services available. • **Training and Development:** Providing training opportunities for employees to acquire new skills that align with the project's needs and future job opportunities. • **Redeployment and Retraining:** Offering redeployment options within the organization or retraining programs to help employees transition to new roles or industries.	

Residual Impact
Positive

2. Mitigation Measures to Potential impact on occupational health and safety at post construction phase

Measure	Source of Measure
• Proper training, personal protective equipment (PPE), and clear signage are essential. • Strict handling protocols, proper disposal, and air quality monitoring are crucial. • Adequate ventilation, rescue plans, and continuous monitoring are necessary. • Respiratory protection, dust control, and regular health checks for workers. • Ear protection, noise reduction strategies, and awareness campaigns.	• General EHS Guidelines. • International Labour Organization (ILO) Code of Practice for Safety and Health • General Conference of the International ILO Convention concerning Occupational Safety and Health.

Residual Impact
Not significant if impacts are adequately implemented

6.7 Additional Measures Common to Construction - Related Impacts

6.7.1 Environmental and Social Management System (ESMS)

An effective ESMS integrates environmental considerations into day-to-day operations, promotes continual improvement, and goes beyond regulatory compliance. Thus for minimising environmental hazards during both the construction and operation phases of the project, the following components are necessary**:**

a. Risk Identification and Ranking:

The hazard risk analysis conducted during the Environmental and Social Impact Assessment (ESIA) identifies potential risks. Build on this and manage effectively based on the mitigation measures suggested. Others come rear their heads, provide measures for them. Risks are assessed based on their likelihood of occurrence and the magnitude of consequences. This ranking informs decision-making and risk mitigation strategies. Follow the patten set in Chapter 5, in risk assessment**.**

b. Standard Operating Procedures (SOPs):

1. SOPs provide clear guidelines for safe and environmentally responsible operations.
2. They cover aspects such as cargo handling, waste management, and emergency procedures.
3. Continue to implement the existing one and develop detailed SOPs for all project activities.

c. Emergency Preparedness and Response Plans:

1. Comprehensive plans are established to address accidents or incidents.
2. These plans consider various scenarios (e.g., spills, fires, structural failures).
3. Protocols for worker safety, community protection, and environmental containment should continue to be implemented.

d. Health and Safety Focus:

1. The ESMS prioritizes the health and safety of workers, nearby residents, and the environment.
2. Training programs ensure that personnel understand emergency protocols.
3. Regular drills and exercises test the effectiveness of response plans.

6.7.2 Specific Measures to Address Air and Water Pollution

- **Air Pollution:**
        - Trucks and Machinery: Regular maintenance and emission standards for project vehicles and equipment.
    - Health Monitoring:
        - Respiratory Health: Regular health check-ups for project workers and nearby residents.
        - Air Quality Sensors: Install monitoring stations to track pollutant levels.
- **Water Pollution:**
    - Fuel Spills Mitigation:
        - Spill Response Plans: Train personnel to handle fuel spills promptly.
        - Containment Booms: Deploy barriers to prevent spilled fuel from spreading.
    - Wastewater Treatment:
        - Runoff: Treat runoff water before it enters rivers or oceans.
        - Oil-Water Separators: Install systems to remove oil and contaminants.
- **Noise and Vibrations:**
    - Noise Reduction:
        - Quieter Equipment: Invest in quieter machinery and engines.
        - Noise Barriers: Erect soundproof walls around noisy areas.
    - Community Engagement:

        - Communication: Inform nearby residents about construction schedules and noise levels.
        - Nighttime Restrictions: Limit noisy activities during nighttime hours.
- **Traffic Congestion:**
    - Traffic Management:
        - Alternate Routes: Divert cargo traffic away from residential areas.
        - Peak Hours: Schedule cargo movements during off-peak hours.
        - Public Transport: Encourage use of public transportation for project workers.
- **Health Risks:**
    - Worker Safety:
        - Protective Gear: Provide proper gear for handling hazardous materials.
        - Training: Train workers on safe practices.
    - Community Awareness:
        - Health Education: Educate nearby residents about risks and precautions.
        - Emergency Response: Ensure quick medical assistance in case of accidents.

- **Stakeholder Involvement and Continuous Monitoring**
    - Ensure a wholistic approach that ensures stakeholder involvement, and continuous monitoring are caused for sustainable operations.

6.4.3 Measures for Handling Hazardous Materials

A proactive approach, continuous training, and adherence to safety protocols are critical for handling hazardous materials effectively. To ensure safety and environmental protection, the following key guidelines must be followed:

- **Proper Labelling and Storage:**
    - Ensure all hazardous materials are properly marked.
    - Adequately label hazmat containers.
    - Store chemicals in appropriate containers.
    - Keep hazardous materials in dry, cool, and ventilated areas.
    - Separate incompatible materials to prevent reactions.
- **Emergency Preparedness:**
    - Develop emergency response plans specific to hazardous materials.
    - Train personnel on proper handling procedures.
    - Use personal protective clothing and equipment to prevent exposure.
    - Be familiar with emergency contact information and procedures.
- **Safe Handling Techniques:**
    - Use mechanical handling equipment (e.g., hydraulic hoists) to minimize manual lifting.
    - Encourage workers to adopt safe lifting techniques.
    - Avoid manual handling of heavy or hazardous loads whenever possible.
- **Spill Prevention and Response:**
    - Implement spill prevention measures:
        - Properly secure containers.
        - Regularly inspect storage areas.
    - Have spill kits readily available for immediate response.
    - Train personnel on spill containment and cleanup procedures.
- **Chemical Compatibility:**
    - Understand the compatibility of different chemicals.
    - Avoid storing incompatible substances together.
    - Refer to Material Safety Data Sheets (MSDS) for guidance.
- **Worker Training and Awareness:**
    - Regularly train personnel on hazardous material handling.
    - Raise awareness about risks and safe practices.
    - Encourage reporting of any incidents or near misses.

CHAPTER SEVEN
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.0. Introduction

The Environmental and Social Management Plan (ESMP) is a critical component of infrastructure projects designed to integrate mitigation measures and environmental and social management objectives. This Chapter thus outlines the ESMP for the proposed project with several critical aspects designed to contribute to the successful implementation. The ESMP adheres to international and national standards for environmental and social (E&S) performance. It covers the entire project life cycle, from planning to implementation and operation.

Upfront, it should be noted that the ESMP ensures that mitigation measures are incorporated into project planning and design. It outlines specific impacts identified and corresponding mitigation measures. It establishes institutional arrangements for implementing and monitoring these measures with focus on Lagos – Calabar Coastal Highway (Section 1)

7.1 Purpose and Benefits of ESMP

The Environmental and Social Management Plan (ESMP) plays a crucial role in ensuring that a project achieves its objectives while minimizing adverse environmental, social, and health impacts. The ESMP) for the Lagos - Calabar Coastal Highway is a comprehensive framework designed to ensure responsible project implementation while minimizing environmental impact. The ESMP serves as a roadmap for responsible project management, emphasizing environmental protection, social well-being, and compliance with statutory instruments and applicable laws.

With regard to benefits, the ESMP:

- Monitors the effectiveness of mitigation measures
- Ensures compliance with environmental standards.
- Minimizes negative impacts on the environment, social aspects, and health.
- Enhances safety policies.

7.2 Objectives of ESMP.

The core objectives of the ESMP for the proposed project are outlined below:

- Demonstrate that environmental aspects and potential impacts of the proposed project activities have been thoroughly identified and evaluated.
- Implement measures to mitigate significant adverse impacts.
- Present the management system that ensures compliance with relevant environmental regulations, standards, guidelines, and codes of practice throughout all project phases.
- Monitor adherence to all mitigation measures and commitments outlined in the Environmental and Social Impact Assessment (ESIA) report during project implementation.
- Commit to continuous improvement in environmental performance by adopting best management practices.
- Monitor compliance with legal standards and limits for waste discharges.
- Provide early warning signals regarding potential environmental degradation, enabling timely actions to prevent or minimize adverse consequences.

7.2 Environmental and Social Management System

The ESMP for this project serves as a comprehensive framework which emphasizes responsible project management, environmental protection, and social well-being. The key aspects of the Environmental and Social Management System (ESMS) are outlined below:

1. **Legislative Framework**:

The legislative framework encompasses the legal context, laws, regulations, and policies at various levels (internation, local and company/organisation). As they relate to the project were well espoused in Chapter 1.

Thus FMW and its contractor, HITECH are committed to abiding to all the relevant instruments in the course of the project implementation, using this ESMP. Adhering to these regulations ensures responsible environmental and social practices and minimizes negative impacts.

2. **Corporate Environmental Responsibility:**

The Contractor working with FMW recognizes that an environment, health and safety friendly workplace along with environment, safety and health conscious personnel are core values of driving the business sustainability. The contractor is committed to ensuring environmentally sustainable and responsible operations to achieve the highest standards of excellence.

As part of the corporate environmental responsibility the contractor and FMW are committed to sustainable practices and minimizing the project's ecological footprint. To this end, initiatives like reducing waste, conserving energy, promoting biodiversity, and supporting community environmental and social projects shall be key in the implementation.

3. **Organizational Structure and Responsibility:**

The Federal Ministry of Works (FMW) and contractors commit to implementing the outlined mitigation measures through this ESMP. Responsibilities include operation, supervision, enforcement, monitoring, remedial action, financing, reporting, and staff training.

To achieve the success of this ESMP and indeed the overall project outcome, the **FMW** has the core mandate to co-ordinate the project programmes and actions; plan, coordinate, manage and develop the various project activities; prepare plans for project management and development. To achieve this, the FMW shall liaise with the various levels of government and other stakeholders identified with their institutional roles and responsibilities below:

The Contractor will have ultimate responsibility for implementing the provisions of the ESMP. This role will include the management of environmental impacts, monitoring of subcontractors performance as well as development of mechanisms for dealing with environmental and social problems.

The contractors will also ensure that the activities of its subcontractors during establishment, construction and decommissioning phases are conducted in accordance with 'good practice' measures and the project ESMS, implementation of which will be required through contractual documentation. In order to facilitate this and to demonstrate commitment to the ESMP, the contractor will conduct regular internal site inspections and audits, the results of which will be documented.

The organisation structure of the project EHS Team is presented in the Figure 7.1. This structure might be subject to changes based on project needs during implementation.

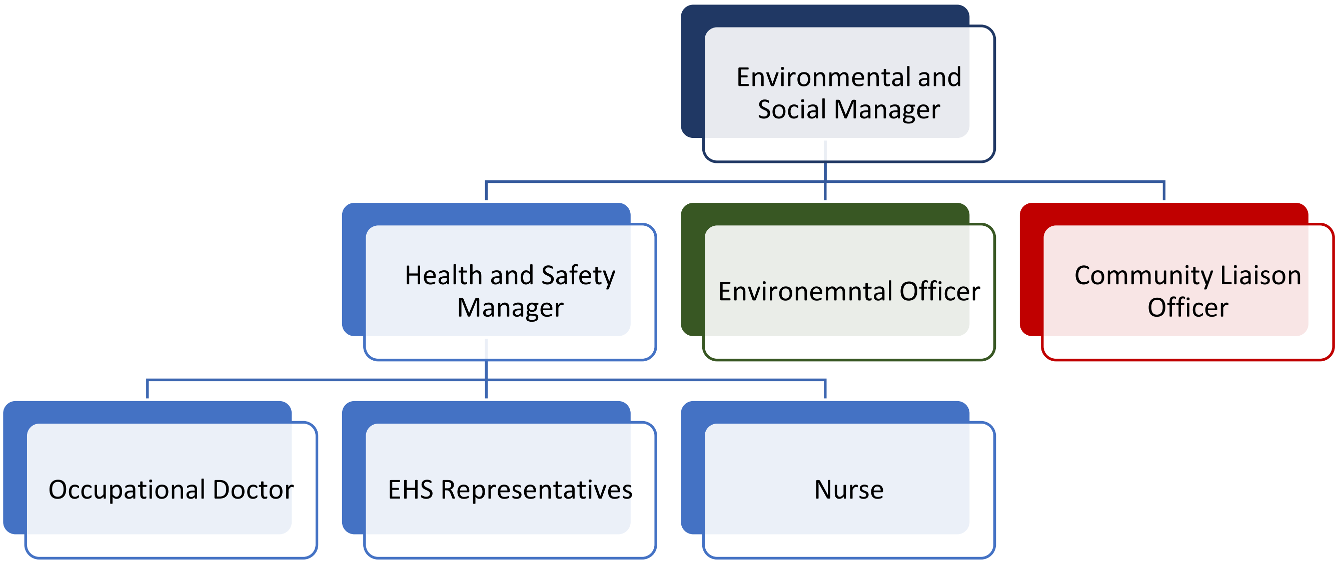


Figure 7.1: Organizational Structure of the EHS Team

Table 7.1: Roles and Responsibilities of Institutions

Role	Responsibility
FMW and Contractor EHS Team	
FMW	• Implementing authority • Co-ordinate all policies, programmes, and actions relating to the project • Ensure that the project is carried out in a sustainable manner. • Ensure all environmental and social commitments are implemented during the life cycle of the project • Ensure adequate implementation and compliance of the ESMP by all parties. • Appoint Environmental and Social Safeguard officer who have the responsibility to ensure compliance with the ESMP and other safeguard documents and provides training schedule on environmental and social matters
E&S Manager	• Responsible for developing, implementing, and overseeing the ESMP the project. • Ensure project activities comply with legal and regulatory environmental and social requirements. • Facilitate the participation and consultation of stakeholders, including local communities, in the planning and implementation of environmental and social measures. • Evaluate and report on the E&S performance of the project on ongoing basis.
Health and Safety Manager	• Responsible for establishing, supervising, and evaluating health and safety management measures at the project site. • Ensure all activities are conducted in safe and healthy working conditions. • Ensure workers are trained and equipped to minimize the risks of accidents and occupational illnesses.

Role	Responsibility
Environmental Officer	• Responsible for ensuring appropriate measures are taken to mitigate environmental impacts and monitoring their effectiveness. • Prepare environmental performance and monitoring reports for review and approval by the Environmental and Social Manager.
Community Liaison Officer	• Responsible for communication and coordination between the project and local communities. • Ensure that the concerns and needs of communities are considered in the planning and implementation of the project. • Facilitate the participation and consultation of communities in the implementation of environmental and social measures.
EHS Representatives	• Support the Health and Safety Manager in implementing health and safety measures. • Ensure compliance with health and safety regulations and standards. • Participate in the investigation of accidents and incidents.
Occupational Doctor	• Responsible for the medical surveillance of personnel. • Prevent occupational risks and manage health issues within the project. • Coordinate with internal and external stakeholders as necessary.
Nurse	• Responsible for providing first aid in emergencies and incidents, as well as managing the clinic. • Operate under the coordination of the Occupational Doctor to ensure responsiveness and effective management of health situations within the project.
Subcontractors	• Inclusion of environmental and social mitigation measures in construction activities and budgets as specified in the project ESMP. • Responsible for ensuring the project adheres to national law and the policy of the lender, including social and environmental safeguards. • Comply with the project ESMS and Contractor E&S policies and procedures. • Day-to-day project management and coordination: project administration; technical oversight (engineering and environmental); review, supervise and approval of the work of the employees. • Environmental and social supervision to ensure that all mitigation is provided as specified in the project ESMP by their own staff. • Monitor the environmental and social compliance of the project according to the ESMP.
ESIA Consultant	• Provide support in the relevant fields of concern to ensure robust implementation. • Support in monitoring activities • Support in ESMP update
	Authorities and Other Stakeholders
Federal Ministry of Environment (FMEnv)	• Provide lead role with advice on screening, scoping, review of draft ESIA report (in liaison with State Ministry of Environment and Water Resources), receiving comments from stakeholders, public hearing of the project proposals and social liability investigations, monitoring and evaluation process and criteria.
National Environmental Standards and Regulations	• Ensures compliance with a range of environmental laws, guidelines, policies, and standards related to the Lagos Ports. This includes monitoring and enforcing regulations on air quality, water quality, and pollution abatement

Role	Responsibility
Enforcement Agency (NESREA)	
State Ministry of Environment/EPA	• Review of draft ESIA report (in liaison with Federal Ministry of Environment) • Site assessment and monitoring of ESIA implementation. • Environmental monitoring and compliance overseer at the State level
LGAs	• Provision of oversight function across project within its jurisdiction for ESIA compliance. • Monitoring of activities related to public health, sanitation, waste management amongst others.
Affected Community	• Promote environmental awareness. • Review environmental and social performance report made available by SPIU. • Provide comments, advice and/or complaints on issues of nonconformity. • Attend public meetings organized by the SPIU to disseminate information and feedback.
NGOs/CSOs	• Assisting in their respective ways to ensure effective response action, conducting scientific research alongside government groups to evolve and devise sustainable environmental strategies and techniques.
Funders	• Overall supervision and provision of technical support and guidance. • Recommend additional measures for strengthening management framework implementation performance; • Supervising the application and recommendations of sub project ESMPs.
General Public	• Identify issues that could derail the project and support project impacts and mitigation measures, awareness campaigns.

7.3 Implementation

7.3.1 Management Control

Prior to start of proposed project activities, equipment and procedures will be designed to achieve the levels of EHS and social performance by all personnel and subcontractors. Implementation of the ESMP will involve the Contractor staff and its subcontractors. This will involve the implementation of the commitments contained in the ESMP, including relevant mitigation and control measures, working practices and overall management procedures as appropriate.

7.3.2 EHS Awareness and Training

Environmental and social awareness training will be developed by the EHS Team, the objective of which will be to provide all personnel working on the Project with:

- A broad understanding of the local environment and the potential impacts of the project, in particular information about environmentally or socially-sensitive areas;
- An understanding of what each Contractors responsibilities are, as outlined in the ESMP;
- A means of developing a culture of compliance with the Project environmental requirements; and
- A means to improve the environmental awareness of the workforce through the education of Project field personnel;
- The HSE team will arrange to provide the required training during project initiation.

The EHS Training Programme will be provided on Monthly basis for internal documentation as per

7.3.3 Project Induction

A site-specific EHS induction training module will be developed by the Contractor Project EHS Team. Induction records will be kept and used to verify that all personnel working onsite have duly completed the process of EHS induction.

- The content of the site induction training is to include, at a minimum:
- Roles and responsibilities of all personnel in achieving EHS performance;
- Management of EHS incidents and operation of accidental spill control equipment;
- Management of waste; and
- Response to EHS incidents.

7.3.4 EHS Toolbox Talks and Training

A toolbox talk involves the dissemination of information to project personnel at the field level. Generally, toolbox talks focus on EHS aspects with reference to certain Project jobs or tasks. They can, however, also be used to disseminate environmental and social management information. Toolbox talks are to be held regularly and will cover aspects, such as:

- Explanation of any new project requirements (if any);
- Explanation of the key EHS risks associated with an activity or specific procedure(s) which could have potential environmental and social impacts;
- Explanation of mitigation strategies with reference to an activity or specific procedure(s), which could have potential environmental and social impacts;
- Reinforcing the importance of specific or generic environmental commitments;
- Obtaining feedback related to EHS issues; and
- Any other relevant purpose related to the implementation or review of the ESMP.

Toolbox talks will allow relevant information to be communicated to the workforce and will also provide a forum for providing feedback on issues of interest or concern. Toolbox talks will generally be organized by the Contractor Project EHS Team but may also be delivered by the Project Management team. Possible Toolbox Talk topics will include:

- Management of works in port premises;
- Air emission suppression measures during project activities;
- Noise and vibration reduction;
- Waste management, reduction and recycling;
- Waste-water management, treatment facility operation and monitoring
- Fire safety at site;
- Spill management;
- Unloading and lifting of heavy machineries and equipment;
- Occupational health and safety, especially COVID-19 protocols.

Table 7.2 provides a summary of training modules on environment and social management for the stakeholders

Table 7.2: Training Modules on Environment and Social Management

Programme	Description	Participants	Form of Training	Duration/ Location	Training Conducting Agency	Budget $
Sensitization Workshop	Introduction to Environmental and Social Management	Engineers and EHS Team of FMW and contractor	Workshop	½ Working Day	Environmental & Social Specialists of Design Consultant/External Agency engaged for capacity building	1,500

Table 7.2: Training Modules on Environment and Social Management

Programme	Description	Participants	Form of Training	Duration/ Location	Training Conducting Agency	Budget $
Module I	Introduction to Environment: Basic Concept of Environment, Environmental Regulations and Statutory requirements as per Government	Engineers and EHS Team of FMW and contractor	Lecture	¼ Working Day	Environmental & Social Specialists of Design Consultant/External Agency engaged for capacity building	2,000
-Module II	Environmental Considerations in projects Management: Environmental components affected by project, Environmental Management Good Practices, Stakeholder and Community project Participation	Engineers and EHS Team of FMW and contractor	Workshop	1 Working Day	Environmental & Social Specialists of Design Consultant/External Agency engaged for capacity building	4,200
Module III	ESMP and its integration into Designs: Methodology of Assessment of Pollution Monitoring, Methodology for site selection of waste disposal areas, e.t.c.	Engineers and EHS Team of FMW and contractor	Lecture and Field Visit	½ Working Day	Environmental & Social Specialists of Design Consultant/External Agency engaged for capacity building	5,000
Module VI	Civil works for Road Construction in environmental management practices: Roles and Responsibilities of officials/contractors/consultants towards protection of	Engineers and EHS Team of FMW and contractor	Workshop	½ day	Environmental & Social Specialists of Design Consultant/External Agency engaged for capacity building	3,200

Table 7.2: Training Modules on Environment and Social Management

Programme	Description	Participants	Form of Training	Duration/ Location	Training Conducting Agency	Budget $
	environment and Implementation Arrangements Monitoring mechanisms					
Module VII	Gender and GBV Awareness raising/mainstreaming in project, GBV prevention, mitigation and response	Engineers and EHS Team of FMW and contractor	Workshop	1 day	Environmental & Social Management Consultant/External Agency engaged for capacity building	4,500
Module VIII	Training on Code of Conduct, OHS, HSE, C-ESMP, GRM including field visit for Case Studies.	Engineers and EHS Team of FMW and contractor	Workshop	2 days spread across the project Planning & Construction Phase	Environmental & Social Management Consultants	5,000
Total						**25,400**

7.4 Grievance Redress Mechanism

The Workers and Community Grievance Redress Mechanism (GRM) provides a systematic means to capture and resolve to all valid grievances that are related to both base business and development projects. The steps used in the GRM are:

- Record
- Investigate
- Communicate
- Resolve
- Close

Grievances are regularly discussed at the periodic Grievance Resolution Committee (GRC) meeting which is chaired by EHS Team and Project Team, as required to promote uniform awareness and to properly investigate and resolve grievances with the overview of the EHS Team.

7.4.1 Introduction

A Grievance Redress Mechanism (GRM) that helps record, assess, and resolve grievances and complaints during the implementation of a project in as efficient, effective, and transparent manner as possible is essential to the success of the project. It also informs the Government and donors/financiers of design and implementation changes that can be used to improve the systems. The GRM aims to record and address any complaints that may arise during the Project's implementation phase. It is designed to address concerns and complaints promptly and transparently with no impacts (cost, discrimination) for project-affected people or those submitting the grievance. It works in compliance with the IFC Performance Standard 1 and 2 as well as legal and cultural frameworks, providing an additional opportunity to resolve grievances.

The GRM procedures to be followed will be presented to the community representatives as needed so that they are easily accessible to all stakeholders. Information on the steps to be followed in handling grievances will be incorporated into the consultation process with local community by the CLO. A Grievance Log will be used in this project to guarantee that the project is conducted in compliance with relevant environmental and social principles. The GCLS will be used to collect and store grievances and complaints in a single database, as well as track their progress until they are resolved. The figure below shows the flow process of the GRM.

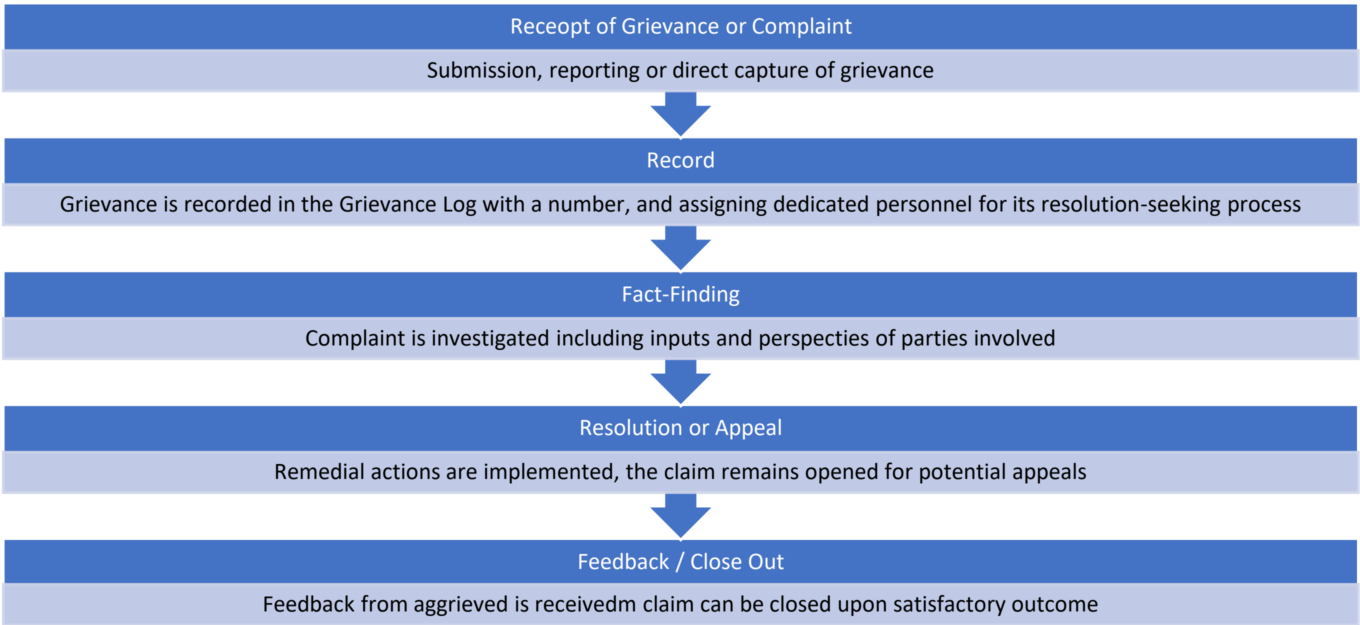


Figure 7.2: GRM Process

7.4.2 GRM Process

The process operates as follows:

- A Grievance Redress Committee (GRC) will be established. The CLO will be responsible to monitor and facilitate resolution of complaints.
- The affected peoples (AP) (or his/her representative) may submit his/her complaint in a number of ways e.g. by filling the **Error! Reference source not found.** in the Project site, calling on t he provided phone number, SMS messages and email to the GRC, or, alternatively, raise his/her voice in a public or individual meeting with project staff. Anonymous grievances will be accepted in case that the AP prefer to not disclose his/her identity. However, it is important to include an address that can be used for the Community Liaison Officer to send a reply.
- Contact details for complains are below.

    - Address:
    - Telephone:
    - Email:

Depending on their nature, grievances will be addressed at the site level, terminal levels for related issues, host community level, State, and national levels. A complainant also retains the right to bypass this procedure and can address a grievance directly to the HITECH Office or FMW. The complaint could make a recourse to the law court where the various levels of grievance redress fail the Office of the National and Provincial Assembly, as provided for by law in the Togolese Republic. At each level, grievance details, discussions, and outcomes will be recorded in a grievance log, and the data will be provided to the GRC for recording. The status of grievances submitted and the grievance redress will be reported to the FMW management through the monthly reporting generated by the grievance committee to be set up by FMW GCLS.

The GRM will ensure the following:

- To provide a means for raising concerns. The process will be understandable and transparent, and provide timely feedback to those concerned, without retribution.
- To communicate the use of the mechanism to local communities through the Project's stakeholder engagement process. (on-going)
- To manage any complaints from surrounding community members, including those related to noise, vibrations, emissions, discharges, human rights violations, etc.
- To allow for the issues potentially associated with the loss of trade to be tracked and managed. (on-going)

All incoming grievances will be reflected in a Grievance Log to assign an individual reference number and inform the complainant about the reference number assigned to his/her complaint, either on the date of filing (if a complaint is delivered personally or over the telephone) or within seven days of receipt (if a complaint is sent by ordinary or electronic mail). The Grievance Log will also be used to track the status of a grievance, analyses the frequency of complaints arising, typical sources and causes of complaints, as well as to identify prevailing topics and any recurrent trends. the registration of the grievance to the log, significance of the grievance will be assessed within five to seven days.

The GRC will meet to try and resolve the matter at community level and make a recommendation within 7 working days from receipt of complaint. Each complaint and grievance will be analyzed and monitored according to type, accessibility and degree of priority. The status of grievances submitted, and grievance redress will be reported by the CLO. If a complainant is not satisfied with the proposed resolution, further negotiations can take place until the matter of the complaint is resolved and the case is closed. If negotiations between the Project parties and the complainant do not achieve a satisfactory result leading to the closure of the complaint, then the grievance is escalated to higher levels to be defined in the course of the Project's procedures setting.

A Worker Grievance Mechanism will be established by the Project prior to construction within the scope of the Human Resources Management Plan to manage the complaints from all Project employees. This mechanism will be structured with an intention of it being an effective approach for early identification, assessment and resolution of grievances throughout the Project's phases.

7.4.3 Record Keeping

A record keeping system will be developed and implemented to support accurate and timely maintenance of Project records. Systems to be established, which are directly relevant to the environmental and social management aspects of the Project, include:

- Trainings Log
- Incidents, non-conformances, and grievance records;
- Inspection reports, checklists, and observation logs;
- EHS Dashboard including Environmental monitoring results and EHS KPIs on monthly basis
- Minutes of Meetings (MOM)s;
- Stakeholder Consultations Register

7.4.5 Inspections, Verification and Validation

The EHS Team will undertake and document regular site inspections for the purpose of verifying compliance with the ESMP, licenses, permits and approvals, and other environmental and social requirements. Where inspections determine that environmental and social management measures are not effective, corrective and preventative measures will be implemented. The weekly observations log will include positive observations and areas of improvement recorded by the EHS representatives.

7.4.6 Monitoring

The inspections will be further supported by monitoring i.e. documenting practical achievement of implementation of required actions. Sampling and analysis as per the identified monitoring plan will be implemented to check level of compliance of discharges, emissions and required environmental conditions. The environmental and social monitoring program has been provided in Section 7. 6

7.4.7 Preventive and Corrective Actions

The E&S Manager will be responsible for directing monitoring of the following aspects, to determine trends and recommend actions to be taken to reduce the potential for EHS incidents:

- Project, activity, or area-specific EHS risks;
- Any exceedance of environmental and social standards;
- Legislative changes; and
- Inspection outcomes.

Deficiencies identified on the Project will, if possible, be rectified immediately by the person identifying the deficiency, and reported to the EHS Team. This includes submission of a corrective action request at the earliest on any of the following:

- A major deviation from agreed upon or approved procedure, approval conditions or Project Environmental and Social management objectives;
- A major non-compliance with the ESMP performance criteria; and/or
- Any perceived breach of the legislative requirements.

The corrective action request will include details of the environmental impact, action taken to correct the problem and proposed measures to prevent the occurrence of a similar incident. The identification, reporting and rectification of environmental deficiencies should be encouraged at Project induction and in toolbox discussions.

7.4.8 Reporting

The Contractor Project EHS Team will prepare a quarterly Environmental and Social report summarizing monitoring and inspection outcomes, EHS Performance as well as details of any non-compliances and actions taken/recommended. The reporting procedures presented in Table 7.3 have been developed in order to ensure that the FMW and contractors is able to receive feedback from the implementation of the ESMP on an ongoing basis and to take rapid corrective actions if there are issues of non-conformance.

Table 7. 3: Reporting Procedures

Phase	Responsibility	Deliverables	Frequency	Accountability
Preconstruction	Contractor	Report of monitoring activities including any specific events	Once	HITECH reports to FMW
Construction	Contractor	Two (2) monitoring Reports. First to be prepared mid-way into the civil works and the other upon completion of all construction activities.	Twice	HITECH reports to FMW
	Contractor	Additional Reports according to specific conditions e.g. Accidents, serious environmental/social impacts	Once	HITECH reports to FMW

Phase	Responsibility	Deliverables	Frequency	Accountability
Completion of Construction and demobilization of contractor from site	Contractor	Final Monitoring Report including all monitoring activities Throughout project implementation	Once	HITECH reports to FMW

7.4.9 Record Keeping and Control

It is mandatory that the contractor keeps records of ongoing mitigation activities. These records may include site monitoring plan, HSE Policy, Site Specific HSE Plan, Waste Management Plan, Traffic Control Plan, Emergency response and preparedness procedures, site instructions, training records, complaints records, incident report, Inspection, maintenance and equipment calibration records. These documents are to be made available to the Safeguard Unit as the need arises.

In the same vein, the EHS team is to keep records to provide evidence of monitoring activities and effectiveness of the monitoring plan. The site monitoring Plan identified problems/corrective actions and monitoring Reports highlighted in subsection 7.6 are to be kept by the HITECH and be made available to relevant regulators upon request. In addition, all significant communications with FMEnv, and other relevant authorities should be documented and kept. These documents are required to track performance in order to achieve and demonstrate compliance with the monitoring plan and applicable regulatory requirements.

7.4.10 Management Review

The contractor management will review the performance against the required actions of the proposed Project

7.5 Environmental and Social Management and Monitoring Plan

As part of the ESMP, a project specific E&S management and monitoring plan has been designed. This plan establishes E&S action plans with well-defined desired outcomes and actions to address all potential impacts identified for the road rehabilitation project. The plan also includes elements such as parameters to be measured, methods of measurement, location of measurement, performance indicators (targets or acceptance criteria) that can be tracked over defined time periods, and with estimates of the resources and responsibilities for monitoring.

The major indicators to be measured will include:

- The state of biological conditions
- The state of physical environment
- The state of key social concerns eg as it relates to project beneficiaries
- All operational and environmental problems encountered
- Suggested options to address the problems
- The status of social performance line with measures adopted

The plan is presented in Table 7.4. It should be noted that all relevant aspects of the identified impacts and mitigations measures have been reframed with indicators listed in in the Table 7.4

The method of implementation of the ESMP monitoring programme shall be carried at two layers **Layer 1 Monitoring (Control) FMW and FMENv and funders.**

- Focuses on validating claims, assessing mitigation measures, and evaluating effectiveness.
- Collaborates with FMEnv and receives support from NESREA.
- Roles include reviewing contractor's worksite ESMP, appraising adverse effects, monitoring mitigation implementation, assessing effectiveness, and proposing remedies.

   - Environmental compliance and assessment occur at the project's end.
   - Recommended frequency: every six months.
2. **Layer 2 Site Activity Monitoring:**
   - Contractor conducted regularly by the Monitoring Team (HITECH).
   - Guided by national and international environmental standards.
   - Ensures compliance with relevant Nigerian laws.

Table 7.4 : Environmental and Social Management and Monitoring Plan – Pre-Construction Phase.

ES Table 2: Environmental and Social Management and Monitoring Plan – Pre-Construction Phase.

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**PRE-CONSTRUCTION PHASE**										
	Site Clearing and Mobilization										
Environmental Impacts											
1.	Increase in fugitive dust, exhaust fumes and GHGs from heavy-duty vehicles and equipment movement into the work area.	A sprinkling of water via spraying devices to limit dust.	Contractor	4000	Fugitive dust	Visual Observation	Minimal dust on the project site & surroundings	Project site & surroundings	Daily	Supervision Consultant/ FMEnv FMW	1000
		Ensure that vehicles are serviced undergo vehicle emission testing (VET) and vehicle exhaust screening (VES) as laid down in the NESREA guidelines.	Contractor	1000	Greenhouse gases Vehicle emission	In-situ Air Quality. Measurement Vehicle emission testing (VET) and vehicle exhaust screening (VES Report	FMEnv air pollutants permissible limit	On-site and surroundings	Monthly	Supervision Consultant/ FMEnv FMW	
2	Loss of topsoil and soil compaction due to the movement of vehicles to the site and stacking of heavy-duty equipment	Limit zone of vehicle and equipment weight impacts (designate an area for parking and stacking equipment)	Contractor	500	Visible demarcation of vehicles and equipment limit zone	Visual observation Soil Compaction test	Visual observation Soil Compaction test	Project campsite and equipment packing zone.	Monthly	Supervision Consultant/ FMEnv FMW	500

Activity	**Potential Impact**	**Mitigation Measures**	**Responsibility for Mitigation**	**Mitigation Cost (USD)**	**Parameters to be measured**	**Method of measurement**	**Performance indicator**	**Sampling Location**	**Monitoring Frequency**	**Institutional Responsibility (Monitoring)**	**Costs (USD)**
B	**PRE-CONSTRUCTION PHASE**										
	Leakages from stacked equipment and subsequent oil and chemical substances intrusion into the soil.	Ensure fastening of loose parts (bolts, nuts); Install impermeable surface at the limit zone to contain potential leakages.	Contractor	1000	Installation of the impermeable platform at the limit zone.	Project campsite and equipment packing zone.	Soil quality test	Project campsite and equipment packing zone	Monthly	Supervision Consultant/ FMEnv FMW	
3	Increase in noise level above permissible noise level (90dB) during equipment movement	Equipment should be transported early (6-7.00 am) when it will cause the least disturbance. Retrofit machines with soundproof	Contractor	-	Number and frequency of complaints in the project area	In-situ measurement of noise level	Noise level test (Not to exceed 90dB(A) for 8 hour working period	Project site	As required	Supervision Consultant/ FMEnv FMW	500
4	Displacement of soil fauna and damage to flora.	Limit vegetation clearing to the minimum area required to create an access path.	Contractor	-	The radius of the cleared path	Visual Observation	Evidence of re-vegetation	Non-Access pathway in Project site	One-off	Supervision Consultant/ FMEnv FMW	
5	Occupational accidents and injuries from the use of machineries and equipment	• Provision of PPE to workers; • Worker Education • Incident/accident reporting; • Provision of First Aid onsite • Ensure that staging areas for contractor equipment are adequately delineated and cordoned off with reflective tapes and barriers • Workers should get a	Contractor	2000	Contractors Compliance.	Routine inspection	Use of PPEs by Workers Training Records	Construction site	Daily	FMEnv FMW LSMEnv LASEPA	FMEnv – 500 LASEPA – 500 LSMEnv – 500

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**PRE-CONSTRUCTION PHASE**										
		daily induction/toolbox before going on the site and a refresher of what happened on site a day before • appropriate security measures in place to prevent harassment or kidnapping of workers									
6	Accidents involving vehicles or pedestrians during vehicle and equipment movement to the site.	Training of drivers on safe driving practices Install safety signage	Contractor	500	Accident Report	Site Inspection Consultations	Training Report Accident/ Incident Report	Routes to the Project site	Every two weeks	Supervision Consultant/ FMEnv FMW	500
Social Impacts											
7	Nuisance to nearby Hospitals and School Blocks	Retrofit with suitable, cost-effective vehicle soundproofing materials/ technologies.	Contractor	-	Number and frequency of complaints in the project area	In-situ measurement of noise level	Noise level test (Not to exceed 90dB(A) for 8 hour working period	Routes to the project site	Weekly	Supervision Consultant/ FMEnv FMW	500
8	Labour Influx could lead to an increase in sexual activities, leading to the possible spread of STDs/STIs in the	Awareness campaign against sexual diseases and distribution of male and female condoms.	Contractor	200	Level of Awareness and Education No new STI Cases.	Rapid health survey	Level of awareness and knowledge of preventive measures. % of reported STI/ STD	Nearby communities Health care facilities	Twice during Construction	FMEnv FMW	100

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**PRE-CONSTRUCTION PHASE**										
	project host communities.						cases among workforce				
9	The potential risk of Sexual Exploitation and Abuse (SEA)/ Gender Based Violence (GBV) Influx of workers (non-locals) to the project location	All contractor workers are to sign a Code of Conduct (CoC) (see Annex for sample CoC) and be sensitized on zero tolerance for sexual integration with the host community. CLOs to sensitize the community on appropriate conduct with contractors Appoint an NGO at the state level to manage the project area's social risks associated with GBV/SEA. Provide Referral Centres for survivors of GBV/SEA.	PIU GBV Specialist Contractor Management	400	Stakeholders are concerned about the risk of GBV	Consultations GBV Incident Report	Signed CoCs with the PIU Conduct sensitization campaigns	Host communities	Twice during Construction	FMEnv FMW Supervision Consultant	3000
10	Child labour and school drop out	• Ensure that children and minors are not employed directly or indirectly on the project. • Communication on hiring criteria, minimum	Contractor Supervision Consultant	500	Visual observation	Routine inspection	No. of cases observed & recorded	Project site	Daily	FMEnv FMW Project Engineer	300

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**PRE-CONSTRUCTION PHASE**										
		age, and applicable laws should be ensured.									
Sub Total				**10,100=**							**7,300=**

ES Table 2: Environmental and Social Management and Monitoring Plan - Construction Phase.

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**CONSTRUCTION PHASE**										
	Construction activities and installation works										
Environmental Impacts											
1	Fugitive dust	Sprinkling of water during activities	Contractor	See A1	Fugitive dust	Visual Observation	Minimal dust	On-site	Daily	LSMEnv LASEPA	500
	Release of exhaust fumes, hazardous gases (NOx, CO, SOx, SPM), Oxides from machinery GHG Emissions	Fuel switching from high- to low-carbon content fuels (where available) is a cost-effective means to mitigate GHG emissions during this phase. Energy efficiency-Machines, e.g. generator plants, could be turned off when not in use to reduce carbon emissions.	Contractor	See A1	Gaseous pollutants: SO_2, NO_2, CO_2, CO,VOCs, H_2S, PM	In-situ Air Quality Measurement Vehicle emission testing (VET) and vehicle exhaust screening (VES Report	FMEnv air pollutants permissible limit	Project area	Every two months	FMEnv FMW Supervision Consultant	
2	Pollution of the environment from open defecation by contractors' workers	The contractor is to provide mobile toilets for workers or rehabilitate existing toilet facilities at the Project Site. Sensitize workers against open defecation.	Contractor	500	Evidence of faecal waste within the project site & surroundings	Site inspection	Absence of faecal—waste on-site & surroundings	Campsite and working zone	Weekly	Supervision Consultant FMEnv FMW	500

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**CONSTRUCTION PHASE**										
3	Surface soil compaction from Movement of heavy vehicles/Stationary vehicles and equipment	Creation of limit zone Minimize compaction during stockpiling by working in the dry state Rip compacted areas to reduce runoff and re-vegetate where necessary	Contractor	200	Visible demarcation of vehicles and equipment limit zone	Visual observation Soil Compaction test	Visual observation Soil Compaction test	Project campsite and equipment packing zone	Monthly	Supervision Consultant FMEnv FMW Project Engineer	200
4	Pollution of soil and groundwater contamination by oil spills, lubricants and other chemicals	All oil and lubricants should be sited on an impervious base and should have drip pans The storage area should be far from boreholes; all containers should be clearly labelled	Contractor	1000	Soil quality parameters (especially hydrocarbon contaminants) Compliance with fuel storage procedures	In situ/ Laboratory Analysis Visual Observation	FMEnv Soil pollutants permissible limit	Project area	Twice during construction	FMEnv LSMEnv LASEPA FMEnv FMW	300
5	Construction waste on-site can pollute the environment, leading to community and public health issues.	Implement site-specific waste management plan in Annex Liaise with State Waste Management Authority and affected LG Environmental Unit for effective waste management and safe handling/disposal of waste.	Contractor	200	Presence of construction waste on-site & surroundings	Site inspection	Compliance with the site waste management plan Good Housekeeping	Project site & surroundings	Weekly	LAWMA FMEnv FMW Project Engineer	200

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**CONSTRUCTION PHASE**										
6	Air quality deterioration	Suppress dust emission by sprinkling water	Contractor	500	Fugitive dust	Visual Observation	Emission of noxious gases	Location of work on project site	Daily	Supervision Consultant FMEnv FMW	200
7	Increase in noise level above permissible noise level (90dB) during construction activities and OHS issues	Adequate maintenance of equipment and machinery to reduce noise Retrofit machines with soundproof Implement the OHS Plan in the Annex	Contractor	-	Number and frequency of complaints in project site & surroundings	In-situ measurement of noise level	Noise level test (Not to exceed 90dB(A) for 8 hour working period	Location of work on project site	Weekly	Supervision Consultant FMEnv FMW	200
8	Risk of occupational accidents (OHS), Injuries and diseases	Implement project OHS Plan in Annex Provide and enforce the usage of appropriate PPE. Demarcate/cordon off construction areas and light up adequately at night, Fence out danger zones and keep them out of reach. Restricted access is to be placed at the construction site using caution signs and staffed personnel Use caution tapes.	Contractor	See A5	HSE Plan Developed Compliance with the HSE Plan	Consultations Accident Report	increase/decrease in Lost Time Injuries	Project area	Monthly	FMEnv FMW	200

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**CONSTRUCTION PHASE**										
		Develop and implement visitors' management protocol Ensure that staging areas for contractor equipment are adequately delineated and cordoned off with reflective tapes and barriers Workers should get a daily induction/toolbox before going on the site and a refresher of what happened on site a day before Appropriate security measures in place to prevent harassment or kidnapping of workers									
Social Impacts											
9	Grievances and negative perceptions by job seekers, Community Members and CBOs	Conduct consultation at every phase of the project	Contractor PIU	2,000	No complaints by affected persons	Consultations Review grievance log	Minimal number of reported cases	Host Communities	Every two months	Grievance Committees FMEnv FMW	300

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**CONSTRUCTION PHASE**										
10	Increase in sexual activities leading to possible spread of STDs/STIs from influx of workers (non-locals) to project location	Awareness of sexual diseases and distribution of male and female condoms.	Contractor	See A 8	Level of Awareness and Education No new STI cases	Rapid health survey	Level of awareness and knowledge of preventive measures. % of reported STI/ STD cases among workforce.	Host Community	Twice during Construction	FMEnv FMW Supervision Consultant	See A 8
11	The potential risk of Sexual Exploitation and Abuse (SEA)/ Gender Based Violence (GBV) Influx of workers (non-locals) to the project location	All contractor workers are to sign the Code of Conduct (CoC) see Annex for sample CoC) and be sensitized on zero tolerance for sexual integration with job seekers, CDA and CBOs to educate the community on appropriate conduct with contractors.	PIU GBV Specialist	See A 9	Stakeholders are concerned about the risk of GBV	Consultations GBV Incident Report	Signed CoCs with the FMWR Conduct sensitization campaigns	Project Community	Twice during Construction	FMEnv FMW Supervision Consultant	See A 9
12	Conflicts between contractors and host community members over labour intake	Good work enforcement program Grievance Redress Mechanism Regular consultations	Contractor Grievance Redress Committee (GRC)	500	No complaints received	Consultation Review Grievance redress Log	No cases handled by the GRC	The project area of influence	Continuous	Grievance Redress Committee	500
13	Increase demand for existing Hospital	Provide basic amenities (water, sanitation, etc to workers)	Contractor	3000	There are no amenities in the worker's	Visual observation	Availability of all essential amenities in	Workers camp & project site	Monthly	FMEnv FMW	300

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost (USD)	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
B	**CONSTRUCTION PHASE**										
	sanitation infrastructure due to the influx of temporary workers				camp & project site		workers' camp & project site			Supervision Consultant	
14	Child labour and school drop out	• Ensure that children and minors are not employed directly or indirectly on the project. • Communication on hiring criteria, minimum age, and applicable laws should be ensured.	Contractor	See A 10	Visual observation	Routine inspection	No. of cases observed & recorded	Project site	Daily	FMEnv FMW Supervision Consultant	A 10
Sub Total				**7,900=**							**3,400=**

ES Table 2: Environmental and Social Management and Monitoring Plan –Operation Phase

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
C	**OPERATION PHASE**										
	Demobilization of equipment and construction materials from the site.										
Environmental Impacts											
1	Potential oil contamination of soil and water	Cart away all spoils through the relevant authorities Clean out impact areas	Contractor	2000	Oil Spillages, Littered construction waste and spoilt equipment/parts	Site inspection	Good Housekeeping	Workers Campsite	Quarterly for one year	FMEnv FMW Project Engineer Supervision Consultant	300
2	Increasing vehicular movements will lead to increased air pollution from exhaust fumes.	In collaboration with the state government, regular sensitization via mass media on	Contractor FRSC; VIO	1000	Gaseous Pollutants such as SO_2, NO_2, CO_2, CO, VOCs, H_2S, TSP, PM 10 and PM 2.5	In-situ measurement of air quality	General Compliance	Project site	Quarterly	LSMENV LASEPA FMEnv FMW	300

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
C	**OPERATION PHASE**										
		allowable vehicular emissions should be implemented to limit the need for regular vehicle maintenance and the effect of excessive emissions into the atmosphere. Routine inspection of motorists' compliance									
3	The drainages may become conveyors for surface debris and improperly disposed wastes during heavy rain, leading to drainage blockage and	Routine maintenance of drainages Proper waste management system in the communities	Contractor FMW	1500	The flow rate of water through the drainage systems Adequate waste treatment in the communities	Visual observation	Implementation of proffered mitigation	Project site and community	Quarterly	LSMENV FMEnv FMW Project Engineer	500

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
C	**OPERATION PHASE**										
	disruption of free flow. This may result in stagnated water and water contamination downstream.										
4	Possibility of culvert collapse, flooding, or erosion from post-construction, which may result from poor designs, non-compliance to designs, sub-standard materials, poor maintenance	To follow proper design and best available practices for rural road construction Strict adherence to terms of reference and specifications of engineering design for bridge and road construction Adequate and regular maintenance	Contractor Project Engineer FMW	300	Structural and performance integrity of hydraulic features		Efficient Durability of roads and hydraulic structures	Project Sites	Quarterly	FMEnv FMW LSMENV LASEPA	200

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
C	**OPERATION PHASE**										
D	**Demobilization of equipment and construction materials from the Site**										
Social Impacts											
1	The project area & host communities will become more accessible, and thus, there will be an improvement in security, business & commerce, etc.	Vigilance & surveillance to sustain and enhance business and commerce	NPF Lagos State Command; Community executives and Traditional Leaders	1,500	Incidence of a security breach	Routine interview	Absence of security threat	Communities along the project path	Quarterly for two years	Lagos State Police Force	300
2	Accidents involving vehicles or pedestrians are likely due to increased vehicle density, operation and speed on community roads.	Adequate road signs for motorists and pedestrians Routine maintenance of roads. Routine inspection of motorable roads and road users. Training of road users on	FRSC	1,000	Road accidents/animal crushing	Routine interview	No complaints from the community	Communities	Quarterly	Road Marshals	300

Activity	Potential Impact	Mitigation Measures	Responsibility for Mitigation	Mitigation Cost	Parameters to be measured	Method of measurement	Performance indicator	Sampling Location	Monitoring Frequency	Institutional Responsibility (Monitoring)	Costs (USD)
C	**OPERATION PHASE**										
		interpretation of road signs									
3	Discrimination against gender and vulnerable group Gender Based violence Grievance and conflicts among members	Continue sensitization and awareness programs and ensure that community-level programs allow gender inclusiveness. Reporting GBV SEA VAC cases properly and timely Implement requirements of GRM that address such issues	project monitoring committee	500	Reports and awareness	Number of cases indicated	General Compliance	communities	Quarterly	NGO Women Affairs GBV/SEA Referral Units	200
Sub Total				**7,800=**							**2,100=**
TOTAL A+B+C				**302,800**							**202, 100**

NB: FMEnv – Federal Ministry of Environment; LSMEnv – Lagos State Ministry of Environment, LASEPA – Lagos State Environmental Protection Authority; LAWMA – Lagos State Waste Management Authority; EHS Team – Environmental, Health & Safety Team (Contractor), GRM – Grievance Redress Mechanism; VAC – Violence Against Children

NB: FMEnv – Federal Ministry of Environment; LSMEnv – Lagos State Ministry of Environment, LASEPA – Lagos State Environmental Protection Authority; LAWMA – Lagos State Waste Management Authority; EHS Team – Environmental , Health & Safety Team (Contractor), GRM – Grievance Redress Mechanism; VAC – Violence Against Children

7.6 ESMP and relevant Plans

The Environmental and Social Management Plans have been prepared based on the outcome of the project Environmental and Social Impact Assessment study. The commitments made in these plans are applicable to the Contractor personnel and subcontractors. The principal purpose of formulating this ESMP is to mitigate all the impacts identified in the ESIA study. The overview of the ESMP is presented for both phases as shown in Tables 7.7 – 7.8

Table 7.5: Overview of ESMP during establishment and construction phase

Site Development and Construction Phase	
Key Activities	• List of activities • Establish temporary access to work areas and create clearance zones while controlling access. • Construct temporary diversions for roads that need upgrading to manage existing traffic. • Clear and level the corridor and perform major earthworks such as cuttings and embankments. • Locate and develop borrow pits and quarries, and import materials like gravel, clay, and • bitumen as needed. • Source and establish a water supply from surface and/or groundwater. - Improve existing drainage and introduce new road drainage, including culverts if necessary. • Surface and seal the carriageway, including using bitumen mixing plants where applicable. • Build water crossings such as bridges and culverts, including concrete batching for structures. • Establish or improve safety arrangements such as modifying camber, barriers, and sight lines. • Perform landscaping as needed.
Objective	• To manage the activities undertaken during site development and construction phase of the Project in a manner which reduces potential negative impacts on both the local environmental and the local community • To comply with all statutory and approvals requirements pertinent to site development and construction phase of the Project
Performance Criteria	• Worksites prepared in accordance with designs providing for the management and mitigation of potential project impacts • All site development and construction works are managed to avoid, mitigate, and/or manage potential impacts on the social and environmental conditions within the AOI. • All community complaints are recorded and investigated and, if appropriate, actioned
Target	• Zero accidental releases • Compliance with relevant regulatory requirements • All appropriate project related community concerns are appropriately actioned and recorded
Monitoring	• Review the ESMP and relevant Management Plans if any significant changes are made to the Project scope or methodology • Verify and validate the implementation of the ESMP on an ongoing basis
Reporting	• EHS to report as required by statutory authorities with respect to environmental and social management performance. • Community complaints register should be filed for each complaint

Table 7.8: Overview of ESMP during Decommissioning phase

Decommissioning	
Key Activities	• List of activities Activities include site Clean-Up and Equipment Removal After Construction. The Stages of Construction Clean-Up: Rough Cleaning: • It occurs once the structural elements are in place and heavy installation work is largely completed. • Address potential hazards, such as unstable structures or hidden debris. • Thoroughly sweep and clean the site to remove dust, dirt, and loose debris. • Implement proper signage to enhance the safety and order Final Touches: • Remove temporary construction site signs and message boards directing traffic. • Deploying reliable traffic safety equipment (such as delineators, attenuators, and signs) to enhance safety during clean-up. • Prioritize safety and efficiency in your work zone
Objective	• The goal of post-construction clean-up goes beyond mere aesthetics. It involves removing all construction debris, hazardous materials, and dust that remain after a project is finished. • Ensure proper clean-up of work areas and facility and site that is presentable, safe, and ready for occupation, signalling completion and readiness. • Comply with all statutory and approvals requirements pertinent to site development and construction phase of the Project
Performance Criteria	• Worksites free of debris, hazardous materials, and dust • Worksite free of hazardous substances and objects, safe and clean • No complains from stakeholders and all community complaints are recorded and investigated and, if appropriate, actioned
Target	• Zero accidental releases • Compliance with relevant regulatory requirements • All appropriate project related community concerns are appropriately actioned and recorded
Monitoring	• Review the ESMP and relevant Management Plans if any significant changes are made to the Project scope or methodology • Verify and validate the implementation of the ESMP on an ongoing basis
Reporting	• EHS to report as required by statutory authorities with respect to environmental and social management performance. • Community complaints register should be filed for each complaint

7.6.1 Monitoring Management

The Environmental and Social Management and Monitoring Programme (ESMMP) has been developed with the following objectives:

- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment, workers and the community as per prescribed/ applicable standards for the Project;
- To identify the need for improvements in the management plans;
- To verify compliance with regulations and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project AOI.

7.6.2 Performance Indicators

Management of components linked with physical, biological and socioeconomic environment of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented below. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, and responsibilities.

7.6.3 Reporting

A reporting system will provide the Project with the necessary feedback mechanisms to verify quality and timely implementation of the works. The reporting system will provide a mechanism to verify that the measures proposed in the Project's ESMP are implemented.

7.6.4 Relevant Management Plans

As part of the proposed mitigation measures and monitoring and implementation activities included in the ESMP, additional Management Plans should be developed. These management plans include the detail activities to be done by each E&S aspect of the project to ensure full implementation with both international and local regulations as indicated. Table 7.9 provides an overview.

Table 7.9: Overview of Relevant Management Plans

Management Plan	Description	Mitigation Measures, Protocols and Procedures
Biodiversity Management Plan	An implementation plan for conserving, restoration and enhancement of biodiversity value of a farm. The BMP sets the objectives and describes the management actions necessary to deliver the desired outcomes. The actions should be specific, measurable, achievable, and time-bound.	• Develop a Biodiversity Action Plan which identifies threats and sets out steps to be taken to protect and improve the area to preserve and enhance its biodiversity for the future
Heritage/Cultural Management Plan	An overarching plan that stipulates how affected cultural heritage will be managed throughout an asset's lifecycle.	• Features of the design or other measures of the proposed development that can be adopted to avoid, prevent, reduce or offset negative effects.
Shoreline and coastal erosion management Plan	Support localized, effective and sustainable responses to shoreline erosion issues within specific communities.	• Using barriers, such as rocks, sediment control logs, perimeter control fencing, and vegetation, to slow down the flow of water and wind and prevent erosion.
Gender Management Plan	A progressive and efficient mainstreaming of gender dimensions throughout the project phase.	• Tackle stereotypes about gender roles in families and society. ... • Take paternity leave to build stronger families. ... • Call for family-friendly workplaces. ... • Share the care. ... • Empower women and girls. ... • Respect reproductive rights and bodily autonomy.
Dust Management Plan	This plan identifies sources of dust, outlines measures to control emissions, and includes monitoring strategies to protect air quality and public health	• Automatic dust suppression systems, such as misting cannons and water sprays, are highly effective in reducing dust pollution. These systems work by spraying a fine mist of water over the construction site, which helps to bind dust particles and prevent them from becoming airborne.

Management Plan	Description	Mitigation Measures, Protocols and Procedures
Environmental Construction Method Statement	This statement describes environmentally friendly construction methods and practices to minimize environmental impacts during project implementation	• Grade fine materials from un-surfaced haul roads • Keep in compacted condition using static sprinklers, bowsers, commercially available additives and binders.
Emergency Management Plan	This plan outlines procedures for responding to emergencies, including natural disasters and accidents, to minimize harm to people, property, and the environment	• Mitigation involves structural and non-structural measures taken to limit the impact of disasters and emergencies. Structural mitigation actions change the characteristics of buildings or the environment; examples include flood control projects, raising building elevations, and clearing areas around structures.
Human Resources Management Plan	This plan outlines strategies for managing human resources, including recruitment, training, and welfare, to ensure a safe and healthy work environment	• It is a process used to ensure that businesses have employees with the right skills, at the right time, and with the appropriate capacity to meet strategic goals.
Waste Management Plan	This procedure outlines the proper management of construction and hazardous waste, including storage, handling, transportation, and disposal, to minimize environmental impacts	• The long-recognized hierarchy of management of wastes, in order of preference consists of prevention, minimization, recycling and reuse, biological treatment, incineration, and landfill disposal.
Wastewater Management Plan	This plan outlines procedures for managing wastewater generated during construction activities, including treatment and disposal methods to protect water quality	• Mitigation involves physical, biological, chemical, and sludge water treatment.
Construction Contaminated Land Management Plan	This plan outlines procedures for managing contaminated land during construction activities, including remediation measures to protect human health and the environment	• The remediation methods are broadly classified as physico-chemical, biological, electrical, thermal and combination of these methods. One of the simplest physical methods for remediation is by removing the contaminated soil and replacing it with clean soil. Essentially it is a dig, dump and replace procedure.

Management Plan	Description	Mitigation Measures, Protocols and Procedures
Soil and Water Management Plan	This plan outlines measures to protect soil and water resources during construction activities, including erosion and sediment control measures	• Agronomic measures include mulching, crop management and agroforestry. These measures use the effect of surface covers to reduce erosion by water and wind.
Occupational Health and Safety Management Plan	This plan outlines measures to ensure the health and safety of workers, including training, protective equipment, and monitoring, in accordance with international standards	• Clearly communicate your health and safety policy. ... • Deal with hazards quickly. ... • Make health and safety part of your culture. • Equip employees for health and safety.
Community Health and Safety Management Plan	This plan addresses health and safety concerns of local communities near the project site, focusing on mitigating risks from construction activities and promoting community well-being.	• It gives due consideration to health outcomes, as well as related health determinants, in considering potential changes in the health status of communities or groups within the potentially affected stakeholders.
Contractor and Supplier Management Plan	This plan outlines procedures for selecting, contracting, and managing contractors and suppliers to ensure compliance with environmental, social, and health and safety requirements	• To mitigate these risks, businesses can employ strategies such as supply chain mapping, weighted ranking, Value at Risk (VaR) assessment, supplier segmentation, diversification, inventory management adjustments, scenario planning, and building strong supplier relationships.
Resettlement Action Plan (RAP)	The RAP addresses the impact of the project on Project Affected Persons (PAPs). It outlines compensation and assistance measures.	• Detailed entitlements for PAPs are specified. Protocols for land acquisition, involuntary resettlement, and loss of assets are established. Procedures for compensation and relocation are defined. Detailed mitigation measures and entitlements for these PAPs are outlined in the standalone Resettlement Action Plan (RAP), which complements ESIA report. The RAP ensures that affected individuals and entities receive compensation and support during the project implementation. The compensation process for the PAPs has been initiated by the Honourable Minister of Works on May 5, 2024.

Management Plan	Description	Mitigation Measures, Protocols and Procedures
Stakeholder Engagement Plan	This plan outlines strategies for engaging with stakeholders, including local communities, to address their concerns and ensure their participation in decision-making processes	• Define the stakeholders and their roles in the project. • Analyze the stakeholders' interests, expectations, and influence. • Plan how to engage with the stakeholders and communicate with them effectively. • Implement the engagement plan and measure its effectiveness

1. **Biodiversity Action Plan (BAP)**

Proactive measures must be taken to address biodiversity impacts associated with the Lagos-Calabar Coastal Highway project. Conservation parks along the route stand ready to contribute their expertise, facilities, and services for biodiversity protection and rescue. It is crucial to consider the proximity to protected areas, riverine ecosystems, and wetlands in project planning, with the establishment of a trust fund to ensure sustainable funding for conservation initiatives.

1. **Current Biodiversity Impacts:**

The project's proximity to protected areas, conservation project sites, rivers,/rivulets, streams, wetland and the shoreline of the Atlantic Ocean underscores the need for careful consideration of environmental impacts. Potential impact to note in this BAP

- Potential habitat fragmentation and disturbance to wildlife populations.
- Disruption of ecological processes, especially in riverine and wetland ecosystems.
- Increased risk of wildlife mortality due to road traffic and infrastructure development.
- Importance of maintaining connectivity between habitats and protected areas for species survival and genetic diversity.
- Habitat Fragmentation: Ongoing construction is causing habitat fragmentation, disrupting ecosystems and wildlife habitats.
- Wildlife Disturbance: Construction activities are disturbing wildlife populations, leading to stress and displacement.
- Road Mortality: Increased traffic is resulting in road mortality for various species.

2. **Conservation Centres & Nature Park**

Table 7.4: Conservation Centres & Nature Park

S/No	Name of Sanctuary	Brief Description
	Lekki Conservation Centre - Location Lekki, Lagos State, Nigeria Coordinates 6°26′11″N 3°32′8″E Area 0.78 square kilometres (78 ha) Established 1990 Governing body Nigerian Conservation Foundation Website www.ncfnigeria.org Species: Monkeys, Crocodiles, Snakes, and various Birds	The Nigerian Conservation Foundation is a non-governmental organisation dedicated to sustainable development and nature conservation. It also serve as an area of biodiversity conservation and environmental awareness center. The foundation aims to preserve Nigeria's species and ecosystems, promote sustainability when using natural resources and advocates actions that minimise the impact on the environment and prevent resource wastage. NCF has worked tirelessly to raise environmental awareness and promote responsibility. The center is located along the Lekki-Epe Expressway in the Lekki Peninsula, opposite Chevron. The reserve area which covers a land area of 78 hectares (192.74 acres) is located on Lekki Peninsula, next to the Lekki Lagoon, and near the Lagos Lagoon. It protects the wetlands of the Lekki peninsula which consists of swamp and savannah habitats. Approaching the reserve, there's a boulevard of

Table 7.4: Conservation Centres & Nature Park		
S/No	**Name of Sanctuary**	**Brief Description**
		coconut trees that leads to a well-laid-out car and Visitors Park. It is endowed with an abundance of plant and animal life. Its huge tract of wetlands is set aside for wildlife viewing. Raised walkways enable the viewing of animals like monkeys, crocodiles, snakes, and various birds. There is also a conservation center and a library.
	LUFASI - Lekki Urban Forestry and Animal Shelter Initiative Cordinates: 6.46581/ 3.65447 Size: 40 hectares Location: Awoyaya, Lekki Express way	LUFASI is an acronym for Lekki Urban Forestry and Animal Shelter Initiative: a non-governmental organisation established in 2013 and dedicated to the preservation of natural habitats in urban areas for use as a field laboratory to interact with and learn from nature. LUFASI attempts to address the issue of limited green spaces in urban areas like Lagos Nigeria, which can provide recreation and aesthetic satisfaction, and likewise enlighten the populace to clear the ambiguity of climate change through practical learning. The shelter for rescued animals (wild and domestic) serves to educate on conservation with an extra aesthetic and recreational incentive for the centre. To conserve LUFASI's forest by bridging the knowledge gap and safeguarding the biodiversity, while exploring possibilities for expanding forest cover in Lagos State and across the nation. To promote awareness among students / the public and develop relevant capacity on biodiversity conservation and climate change issues needed to trigger a behavioral change. Whilst highlighting the health benefits of Urban forests. Our Animal Sanctuary serves as a refuge for distressed and persecuted animals. These animals are rescued, rehabilitated before reintegration into the wild, where possible. We also lend a voice to the global cause against wildlife persecution and sensitize the public on the need to appreciate and understand the link between man, animals and the natural environment. **Species: ungulates, avifauna, primates and small mammals. Some of these include the: African Wild Donkey (Equus africanus), West African Barb Horse (Equus ferus callabus), Mona Monkey**

Table 7.4: Conservation Centres & Nature Park		
S/No	**Name of Sanctuary**	**Brief Description**
		(Cercopithecus mona) and Helmeted Guinea fowls (Numida meleagris).
	Eco-Park Mangrove Sanctuary & Research Centre Location: Akodo Ise Community, Ibeju-Lekki Size 74 hectares Coordinates: 6.39071, 4.21882 Governing body: Eco-Restoration Foundation (ERF) website: www.erf.ng	The Eco-Park Mangrove Sanctuary & Research Centre is nestled in a stunning 74-hectare mangrove-filled site, we are dedicated to the protection, restoration, and conservation of coastal ecosystems. Our park features vibrant animal and bird sanctuaries, scenic walkways, cozy chalets, and thrilling kayaking adventures through the mangrove creeks. As a premier tourist attraction and research hub, we focus on environmental studies and mangrove product research. It's sanctuary is home to and rehabilitates a diverse range of wildlife, including snakes, pangolins, manatees, sea turtles, monkeys, and alligators. Currently, our park is undergoing audits to certify as a carbon sink, aiming to trade carbon credits and promote sustainable practices. Explore nature, research, and relaxation all in one unique destination. **Species: Snakes, Pangolins, Manatees, Sea Turtles, Monkeys, Euguana's, Alligators, Birds**

Current Assessment of Conservation Parks Readiness:

- **Facilities:**

Conservation parks have the space, advantage of professional personnel and location advantages. Infrastructure such as access roads, water sources, and waste management facilities support conservation activities exist within the centers.

- **Infrastructure:**

They are currently not fully equipped with facilities for wildlife rescue and rehabilitation, including veterinary care, enclosures, and rehabilitation areas.

- **Expertise and Personnel:**

Trained personnel, including veterinarians, wildlife biologists, and animal care specialists, are available to manage rescue and rehabilitation operations effectively.
Conservation parks have experience in handling diverse species and possess valuable knowledge of local biodiversity.

- **Collaborative Networks**:

Collaborative networks with wildlife authorities, NGOs, and stakeholders facilitate coordination of rescue efforts and resource sharing.
Regular communication channels have been established for reporting stranded or injured animals and coordinating response actions.

Proposed Biodiversity Protection:

a. **Wildlife crossings**

Incorporating wildlife crossings into road design is a win-win: it benefits both ecosystems and human safety Wildlife crossings are essential structures that allow animals to safely cross human-made barriers such as roads and highways. These crossings serve two critical purposes: habitat connectivity and reducing wildlife-vehicle collisions. Let's explore how road design can incorporate wildlife crossings:

1. **Types of Wildlife Crossings:**

- Underpass Tunnels: These tunnels run beneath roadways, allowing animals to move freely without encountering traffic.
- Overpasses or Green Bridges: Elevated structures that span over roads, providing safe passage for large or herd-type animals.
- Amphibian Tunnels: Specifically designed for amphibians (e.g., frogs, salamanders) to avoid road mortality.
- Fish Ladders: Assist fish in navigating around dams or other barriers.
- Canopy Bridges: Especially useful for monkeys and squirrels, these bridges connect tree canopies.
- Tunnels and Culverts: Designed for small mammals like otters, hedgehogs, and badgers.
- Green Roofs: Benefit butterflies and birds by creating vegetated pathways.

2. **Benefits of Wildlife Crossings:**

- Habitat Connectivity: Crossings allow animals to move between fragmented habitats, promoting genetic diversity and species survival.
- Reduced Roadkill: By providing safe routes, crossings minimize wildlife-vehicle collisions.
- Human Safety: Prevents accidents caused by animals on roads, protecting both humans and property.

3. **Design Considerations:**

- Natural Appearance: Wildlife crossings should blend seamlessly into the landscape, resembling natural features.
- Fencing: Install fencing along roads to funnel wildlife toward crossings.
- Location: Place crossings where animals naturally move (based on their behavior and habitat preferences).
- Size and Height: Ensure crossings accommodate various species, from small mammals to large ungulates.

b. **Wildlife Rescue and Rehabilitation:**

- Conservation parks will actively participate in rescuing stranded or injured animals, providing immediate care and stabilization.

- Animals will undergo rehabilitation processes, receiving medical treatment, rehabilitation exercises, and behavioral conditioning.

c. **Establishment of Rescue Centers**
   - Set up temporary and permanent rescue centers for affected wildlife.
   - Equip centers with necessary medical and rehabilitation facilities.

d. Rescue and Rehabilitation Operations
- Train and deploy rescue teams to capture and transport impacted organisms.
- Provide medical care, feeding, and rehabilitation for injured and displaced wildlife.

e. Release and Monitoring:
- Upon recovery, animals will be released into suitable habitats, and monitoring programs will track their post-release survival and adaptation.

- Identification, Geo-Tagging & Protecting such critical ecosystem hotpots and the various Conservation Sites across the length of the project and the adjoining biodiversity **migratory pathways.**

f. Appointment of a Biodiversity or ESG Manager

- Federal Government Involvement: The Ministry of Works should appoint a Biodiversity or ESG Manager or a Special Assistant to the Honourable Minister on ESG. This role should not be a political appointment but rather a selection from existing conservation practitioners or operators along the impacted areas. This will help with smoother inter-organizational cooperation and provide an army of existing volunteers and networks to add credibility to the project.
- Contractor Involvement: Hi-Tech Construction should also appoint an ESG Manager to ensure the contractor's adherence to high environmental standards. This role will coordinate with the government-appointed manager to implement the plan effectively.

g. Documentation and Reporting

- Ensure all activities, progress, and outcomes are thoroughly documented.
- Prepare detailed reports highlighting the ESG values of the project proponent and the contractor. This documentation is crucial for international funding and climate-friendly financing.

h. Real Commitment, Not Green-washing

- Emphasize the genuine commitment of both the government and the contractor to biodiversity protection, ensuring that this initiative is not perceived as green-washing or a government-sponsored PR exercise.

i. . Leveraging Local Expertise and Networks

- Engage local conservation experts and community volunteers to enhance the credibility and effectiveness of the plan.
- Use existing networks to foster community support and involvement, ensuring a sustainable impact.

j. Community Engagement and Education

- Conduct awareness campaigns to involve local communities in conservation efforts.
- Train local volunteers to assist in rescue and rehabilitation operations.


ESIA Team & Conservation Stakeholders

k. Monitoring and Evaluation

- Regularly monitor biodiversity indicators to assess the effectiveness of the action plan.
- Adjust strategies based on monitoring data and feedback.

2. **Responsibility**

- Emphasis is placed on the need for Hi-tech Construction Company and the Federal Government to be committed to & provide resources for effective action during the construction & operational phases, to mitigate biodiversity losses effectively. This is urgent and immediately required, considering the impacts already being seen while the ESIA is still going on.
- Regular stakeholders meeting will kick-start collaboration and coordination efforts among stakeholders, project authorities, and conservation parks.

Proposed Trust Fund for Conservation:

- To ensure continuous availability of funding for conservation efforts, we propose the establishment of a trust fund supported by a fraction of toll revenues during the project's operational phase. This trust fund would:

- Provide financial support for ongoing wildlife rescue, rehabilitation, and release programs.
- Fund research and monitoring initiatives to assess the effectiveness of conservation measures.
- Support community outreach and education programs on biodiversity conservation and environmental stewardship.
- Enable adaptive management strategies based on scientific data and feedback from conservation partners.

3. **Carbon footprint Management Plan**

A holistic approach that considers materials, energy, and long-term impact will help minimize the carbon footprint of the Lagos-Calabar Coastal Highway. Thus Minimizing the **carbon footprint** of the **Lagos-Calabar Coastal Highway** project involves adopting sustainable practices and considering environmental impact throughout its lifecycle. The strategies are outlined below:

1. Materials Selection:
   - Use Recycled Materials: Opt for construction materials with a lower carbon footprint, such as recycled concrete or asphalt.
   - Locally Sourced Materials: Choose materials sourced locally to reduce transportation emissions.
2. Energy Efficiency:
   - Construction Phase: Use energy-efficient machinery and equipment during construction.
   - Lighting and Facilities: Implement energy-saving lighting and HVAC systems in highway facilities.
3. Green Infrastructure:
   - Vegetation: Incorporate green spaces, trees, and vegetation along the highway. Trees absorb carbon dioxide and improve air quality.
   - Permeable Surfaces: Use permeable pavements to allow rainwater infiltration and reduce runoff.
4. Transport Logistics:
   - Construction Materials: Optimize transportation routes for delivering construction materials to minimize fuel consumption.
   - Maintenance Vehicles: Use fuel-efficient vehicles for maintenance and repairs.
5. Carbon Offsetting:
   - Afforestation and Reforestation: Plant trees in nearby areas to offset emissions from construction and operation.
   - Renewable Energy Projects: Invest in renewable energy projects (solar, wind) to balance emissions.
6. Lifecycle Assessment:
   - Conduct a life cycle assessment (LCA) to evaluate the environmental impact from cradle to grave.
   - Consider emissions during construction, operation, and eventual decommissioning.
7. Public Transportation Integration:
   - Design the highway to accommodate public transportation (buses, commuter trains).
   - Encourage people to use mass transit, reducing individual car emissions.
8. Maintenance Practices:

- Regularly maintain the highway to prevent deterioration and ensure optimal performance.
- Well-maintained roads reduce fuel consumption and emissions.

9. Education and Awareness:
    - Educate workers, contractors, and the public about environmental responsibility.
    - Promote eco-friendly practices during and after construction.
10. Monitoring and Reporting:
    - Continuously monitor emissions, energy usage, and environmental impact.
    - Report progress and improvements transparently.

Roles and Responsibilities for Managing the Carbon Management Plan

By incorporating these nature-based practices, the Lagos-Calabar Coastal Highway can serve as a model for sustainable infrastructure development, benefiting both people and the environment. Integrating nature-based management practices can enhance its sustainability and minimize environmental impact through the following nature-based approach:

1. Ecosystem Restoration:
    - Identify and restore ecologically sensitive areas along the highway route.
    - Implement afforestation and revegetation programs to enhance biodiversity and stabilize soil.
    - Create green corridors with native plants and trees to support wildlife habitats.
2. Wetland Conservation:
    - Protect and restore coastal wetlands, mangroves, and estuaries.
    - These ecosystems act as natural buffers against storms, absorb carbon, and provide habitat for aquatic species.
3. Natural Drainage Systems:
    - Design the highway to work with natural drainage patterns.
    - Avoid disrupting existing watercourses and wetlands.
    - Use permeable surfaces to allow rainwater infiltration.
4. Climate-Resilient Infrastructure:
    - Construct bridges and culverts that accommodate sea-level rise and extreme weather events.
    - Consider natural shoreline protection (e.g., mangrove belts) to prevent erosion.
5. Biodiversity Corridors:
    - Create wildlife corridors by preserving or restoring natural habitats.
    - These corridors allow animals to move freely, reducing roadkill incidents.
6. Green Spaces and Buffer Zones:
    - Integrate green spaces (parks, rest areas) along the highway.
    - Buffer zones between the road and sensitive ecosystems can mitigate noise, pollution, and visual impact.
7. Community Engagement:
    - Involve local communities in planning and decision-making.
    - Educate residents about the importance of nature-based management.
8. Monitoring and Adaptive Management:
    - Regularly assess the effectiveness of nature-based interventions.
    - Adjust strategies based on monitoring results and changing environmental conditions.

4. Constructing roads near sensitive ecosystems

When constructing roads near sensitive ecosystems, it's crucial to adopt practices that minimize environmental impact as outlined below:

1. Build the Roadbed Formation Once and Be Done:
    - Construct the roadbed with care to minimize disturbance. Avoid repeated excavation or grading, which can harm ecosystems.
    - Properly compact the soil to prevent erosion and maintain stability.
2. Build to the Minimum Width Necessary:
    - Design roads with the minimum necessary width to accommodate traffic flow.
    - Narrower roads reduce the area of disturbance and minimize habitat fragmentation.
3. Limit Lateral Road Access:
    - Restrict lateral access points (side roads, trails) near sensitive areas.
    - Unauthorized access can lead to habitat destruction, soil compaction, and disturbance to wildlife.
4. Focus Infrastructure Investment Where Land Tenure and Access Is Secure:
    - Prioritize road construction in areas where land ownership and access rights are well-defined.
    - Secure land tenure ensures long-term management and reduces the risk of illegal activities.

5. Smart Emergency Response System for Lagos Coastal Road

This Smart Emergency Response System (SERS) is part of the management plan for the Lagos Coastal Road. By incorporating this Smart Emergency Response System into the Lagos Coastal Road management plan, we can enhance safety, minimize response time, and protect lives and infrastructure. This system will enhance emergency preparedness, search and rescue operations, and risk mitigation

1. System Overview

The Smart Emergency Response System (SERS) integrates cutting-edge technology, real-time data, and efficient resource allocation to ensure rapid and effective emergency response along the Lagos Coastal Road. Its components include:

1. **Real-Time Sensors and Data Collection**:
    - Deploy sensors for gas levels, temperature, humidity, and structural integrity.
    - Cameras capture live video feeds.
    - Environmental monitoring (e.g., flooding, landslides).
2. **Communication Infrastructure**:
    - Establish a robust communication network:
        - Broadband WiFi Networks: Deploy commodity drones with directional antennas for extended coverage (up to 5 km range).
        - Ad-Hoc Wireless Networks: Utilize cellphones for citizen communication.
        - Satellite Communication: Backup for remote areas.
3. **Mission Command and Control Center**:
    - Located centrally, this center coordinates emergency responses.
    - Real-time visualization using Google Earth or GIS software.
    - Dynamic resource allocation based on real-time data.

2. Emergency Response Phases

1. **Preparedness Phase**:
    - Conduct regular drills and training for first responders.
    - Educate citizens about emergency procedures.
    - Ensure all SERS components are functional.
2. **Detection and Alert Phase**:

- Real-time sensors detect anomalies (e.g., gas leaks, structural damage).
- Citizens can report emergencies via a dedicated app.
- Alerts sent to the command center.

3. **Response Phase**:
   - Command center dispatches:
     - **Human First Responders**: Equipped with real-time data.
     - **Autonomous Vehicles (Drones)**: Aerial surveillance and delivery of supplies.
     - **Tele Robots**: Remote-controlled robots for hazardous areas.
     - **Search and Rescue Dogs**: Trained to locate survivors.
4. **Recovery Phase**:
   - Assess damage and prioritize recovery efforts.
   - Coordinate with other agencies (firefighters, medical teams).
   - Use SERS data for informed decision-making.

3. Risk Mitigation Strategies

- Climate Resilience:
  - Design infrastructure to withstand extreme weather events (storms, sea-level rise).
  - Elevate critical road sections.
  - Implement natural buffers (mangroves, dunes) to reduce erosion.
- Early Warning Systems:
  - Integrate weather forecasting and early warning alerts.
  - Notify residents and travelers in advance of potential hazards.
- Community Engagement:
  - Educate communities about evacuation routes and safe zones.
  - Encourage citizen participation in emergency drills.
  - Continuous Improvement
- Data Analytics:
  - Analyze historical data to identify patterns and improve response strategies.
  - Machine learning algorithms for predictive modeling.
- Feedback Loop:
  - Gather feedback from first responders and citizens.
  - Regularly update and enhance SERS based on lessons learned.

6. Cultural Heritage Preservation Management Plan for

Cultural Heritage Preservation Management Plan for the Lagos Coastal Road (Section 1) involves integrating cultural heritage considerations into the infrastructure planning process.Cultural heritage preservation is not only about protecting the past but also enhancing the quality of life for present and future generations. By integrating heritage considerations into infrastructure planning, we create more resilient and culturally rich communities. Key steps and components to include in the plan:

- Introduction:
  - Provide an overview of the project, including its purpose, scope, and objectives.
  - Explain the significance of cultural heritage preservation within the context of the road development.
- Legislative Requirements and International Frameworks:
  - Describe relevant international treaties, conventions, and standards related to cultural heritage preservation.

    - Highlight the importance of complying with legal obligations.
- Roles and Responsibilities:
    - Identify key stakeholders responsible for cultural heritage management.
    - Define their roles and responsibilities in preserving and promoting heritage.
- Inventory and Assessment:
    - Conduct a comprehensive inventory of cultural heritage sites along the road corridor.
    - Assess the significance, condition, and vulnerability of each site.
- Mitigation Measures:
    - Develop strategies to minimize adverse impacts on cultural heritage during construction and operation.
    - Consider alternative alignments or designs to avoid significant heritage sites.
- Community Engagement:
    - Involve local communities, experts, and heritage organizations.
    - Seek their input on preservation priorities and strategies.
- Monitoring and Adaptive Management:
    - Establish a monitoring system to track the impact of the road on cultural heritage.
    - Be prepared to adjust plans based on monitoring results.
- Education and Awareness:
    - Raise awareness among project teams, contractors, and the public about the importance of cultural heritage.
    - Educate them on best practices for preservation.

- Emergency Preparedness:
    - Develop contingency plans for emergencies (e.g., natural disasters, accidents) that may affect heritage sites.
    - Ensure rapid response and recovery measures.
- Integration with Urban Planning:
    - Coordinate with urban planners to ensure that cultural heritage preservation aligns with broader city development goals.
    - Explore opportunities for heritage-led regeneration and sustainable tourism.

Also, the socio-economic impacts of proposed infrastructure projects, such as the Lagos Coastal Road section, are multifaceted and interconnected. understanding local dynamics, involving communities, and considering multidimensional impacts are essential for effective infrastructure development.

Some key aspects:

- Improved Accessibility:
    - Enhancing accessibility through infrastructure development positively influences people's lifestyles.
    - Better road connectivity allows for faster travel, efficient transportation of goods, and improved market access.
    - Accessibility also attracts investment and economic activities to previously underserved areas.
- Economic Opportunities:

  - Infrastructure projects create economic opportunities by stimulating trade, supporting industries, and generating employment.
  - Improved transportation networks facilitate the movement of goods and services, benefiting local businesses and entrepreneurs.
- Community Participation:
  - Engaging local communities in the planning and implementation of infrastructure projects is crucial.
  - Community participation ensures that projects align with local needs, aspirations, and cultural context.
  - It fosters ownership, transparency, and accountability.
- Local Context Matters:
  - Infrastructure impacts vary based on the specific location and community characteristics.
  - Consider factors such as demographics, existing services, environmental conditions, and social dynamics.
  - Tailor infrastructure solutions to address local challenges and opportunities.
- Positive and Negative Impacts:
  - While infrastructure development brings benefits, it can also have adverse effects.
  - Positive impacts include economic growth, improved services, and enhanced quality of life.
  - Negative impacts may involve displacement, environmental changes, or social disruptions.
- Policy Formulation:
  - Policymakers should consider local contextual factors when designing infrastructure projects.
  - Holistic planning involves balancing economic gains with social and environmental considerations.
  - Sustainable decision-making ensures long-term benefits for communities.

CHAPTER EIGHT
DECOMMISSIONING AND RESTORATION PLAN

8.1 Introduction

Decommissioning covers the project cessation of operations and the removal of inventory to obtain a state of passive safety. Though this phase is unlikely for a Project like the Lagos -Calabar Highway Road, such a possibility should be discussed for the completeness of this ESIA report as required by procedural guidelines and best practice.

In planning the commissioning and restoration plan for Lagos – Calabar Coastal Highway (Section 1), it is vital to devise plans for recovering and restoring the site to its original state after the project is lost or decommissioned. This necessitates a thorough understanding of all the effects of the project's environmental components on the ecosystem during its lifespan. Considering this component during the planning stage demonstrates the project's environmental commitment and contributes to a sustainable future, motivating us to do better.

8.2 Decommissioning Activities and Anticipated Impacts

During the decommissioning phase of the **Lagos-Calabar Coastal Highway** project, several activities will take place to ensure a proper transition and site restoration.

The anticipated activities and/or impacts are presented in Table 8.1

Table 8.1: Project Anticipated Activities and/or Impacts

No	Focus	Activity:	Impact:
1	Decommissioning, Mantling, and Removal of Road Infrastructure and Ancillary Equipment:	Disassemble and remove road components such as asphalt, barriers, signs, and lighting.	Restoration of the landscape but potential disruption during dismantling.
2	Excavation, Dismantling, and Removal of Underground Cables, Water Pipes, and Power Transmission Facilities:	Unearthing and removing buried utilities (cables, pipes, etc.).	Soil disturbance, potential damage to existing infrastructure, and safety risks.
3	Removal of All Structures (Plant Houses, Administrative Buildings, Equipment Removal Techniques etc.):	Demolishing and clearing all buildings and structures associated with the project. Dismantling and removing equipment can disrupt the landscape.	Altered landscape, waste generation, and potential soil contamination. Soil compaction, ground disturbance, and altered topography may occur.
4	Reinstatement of Excavated Portions and Buried Structures:	Reinstatement of Excavated Portions and Buried Structures	If excavated soil is not properly reinstated, erosion can occur. Unstable slopes, sediment runoff, and loss of topsoil may impact nearby ecosystems. Increased Particulate Emission (Dust):

			During decommissioning, dust emissions can increase, especially in dry conditions. Dust pollution affects air quality and can have health implications. Hazards and Accidents Associated with Decommissioning: Workers involved in dismantling and removal face occupational risks.

8.3 Rehabilitation and Restoration Activities

The restoration programme at the end of the Lagos-Calabar Coastal Highway project's economic life is crucial for environmental sustainability. The statutory regulations emphasize the importance of rehabilitating areas to be relinquished after a project. In this context, the biological objective of rehabilitation programs is to establish an ecologically functional system that supports satisfactory flora growth, such as outlined below:

1. **Rehabilitation Purpose**:
    - When a project concludes, the site must be restored to its original or improved state.
    - Rehabilitation ensures that disturbed ecosystems recover and regain functionality.
2. **Ecologically Functional System**:
    - The goal is to create an ecosystem that functions naturally and supports life.
    - This involves restoring soil health, water cycles, and nutrient cycling.
3. **Satisfactory Flora Growth**:
    - Flora (plants) play a crucial role in ecosystem stability.
    - Successful rehabilitation ensures that native plants thrive, enhancing biodiversity.

8.4 Specific Activities for the Restoration

In this subsection, the specific activities for the restoration are outlined. Also shown in Table 8.1 is an ESMP designed for the decommissioning phase.

1. **Site Restoration Upon Completion (Suspension or Abandonment)**:
    - When the project concludes, the site must be restored to its original state or improved.
    - Removal of equipment, dismantling structures, and reclamation of disturbed areas are essential.
2. **Backfilling Excavations**:
    - All excavated areas should be properly backfilled.
    - Ensuring soil stability and preventing erosion are key goals.
3. **Integrated Study for Cleared Areas Restoration**:
    - Ecological and hydrological specialists will assess the site.
    - Strategies for site restoration, including vegetation, soil, and hydrological aspects, will be determined.
4. **Detailed Field-Specific Restoration Plan**:
    - Ensure the study results in a comprehensive plan for each specific area.
    - Ensure restoration goals include achieving vegetation similarity to the surroundings.
5. **Soil Compaction/Cementing**:

- Compacted or cemented soil inhibits re-vegetation, so put mechanisms in place for regrowth, such as ripping apart these areas for successful restoration.

6. **Intensive Management Over Several Years**:
    - Restoration efforts require ongoing monitoring, maintenance, and adaptive management.
    - Ensuring long-term success involves active stewardship.
7. **Site Remediation Measures Based on Environmental Characterization**:
    - Assess potential impacts and characterizing the environment guide remediation.
    - Tailor measures to specific conditions to ensure effective restoration.
8. **Hazards and Accidents Associated with Decommissioning**:
    - Ensure proper safety protocols and training to prevent accidents.
9. **Management Challenges**:
    - Coordinate decommissioning activities, waste disposal, and site restoration with effective management and relevant stakeholders involvement.
    - Ensure compliance with safety standards to minimise disruptions
10. **Removal of Equipment and Infrastructure**:
    - All project-related equipment, structures, and materials should be removed from the environment.
    - Proper disposal or recycling methods must be followed.
11. **Reinstatement of Excavated Portions**:
    - Backfill and restore excavated areas to their original state to help minimize environmental impact.
    - Ensure soil stability and prevent erosion.
12. **Grading and Erosion Prevention**:
    - Grade the site back to its original landscape to help prevent erosion.
    - Ensure proper soil management and vegetation restoration.
13. **Waste Management Plan**:
    - A robust waste management plan ensures proper disposal of construction debris and materials.
    - Recycling, reusing, or safely disposing of waste is critical.
14. **Pension Schemes for Workers**:
    - Providing appropriate pension schemes ensures financial security for project workers after decommissioning.
    - Addressing their well-being during project closure is essential.

Table 8.2: Environmental and Social Management Plan (ESMP) of the proposed Lagos Coastal Highway Road for Decommissioning

Project Activities	Decommissioningscription of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Demolition and Evacuation	Interference with road transportation	M	• The proponent (FMW) shall monitor the number of trucks daily to determine whether there is a need to create other access roads. • FMW shall develop a transport management plan specifying routes, speeds, times of travel, and key roads/waterways regarding local services. • Consideration shall be given to avoid reliance on public transport, and contractors must use private vehicles.	L
	Noise and vibration nuisance	M	FMW shall ensure that: • Electric power generators are fitted with effective silencers. • Vehicles and generators shall be regularly maintained. • Generators and cars are switched off when not in use. • Soundproof electric power generators are engaged. • PPEs are used	L
	Impairment of air quality	H	FMW shall ensure the following:	L

			• Engine to comply with international standards for exhaust gases; Maintenance of engines and exhaust gas check; Adoption of engine-off policy at the construction site. • Site workers wear nose masks and earmuffs during excavation. • That water shall be sprayed on construction sites to reduce dust levels, especially during the dry season.	
	Contamination of surface and Groundwater & soil by oil spill from decommissioning equipment	M	FMW shall ensure: • Soil disturbance shall be kept to the minimum required for operation and safety. • Oil spill containment shall be provided to reduce oil spills. • From getting to the soil and surface/ groundwater. • Follow all regulatory-FMENv and State FMEnv guidelines on waste management. • Cleanup in compliance with relevant national and	L

			• International guidelines involving the removal of the • waste, etc. • Restore the condition in no way inferior to before the commencement of work.	
	Poor disposal of wastes generated during this phase	H	• FMW shall treat and dispose of all wastes using approved contractors following regulatory requirements and best practices. • FMW shall ensure that none of these wastes are disposed of into any water body or on land. • Follow safety measures while disposing of waste. • FMW shall keep all waste consignment, treatment, and disposal records for regulatory verification. • Proper disposal of solid waste from labour camps. • Storage of lubricants, fuels, and other hydrocarbons in self-contained enclosures. • Sanitation arrangements at worksites/facilities to avoid the release of wastewater to the environment.	M

			• All other wastes generated, including environmentally deleterious materials generated by construction activities, will be disposed of offsite appropriately, legally, and safely. • There is a minimum generation of waste. • Unsuitable excavated materials shall be systematically carried away from areas prone to erosion. • Reuse waste materials wherever possible. • An accredited state waste collector shall segregate, store, and dispose of waste.	
	The threat of Naturally Occurring Radioactive Material (NORM) to the environment	H	FMW shall ensure: • Regular maintenance or servicing of all infrastructure and production equipment as and when due. • Regular NORM monitoring programs to detect materials and equipment with NORM. • carrying out personal dosimetry for external radiation exposures to confirm that exposures fall into the range expected from external radiation surveillance monitoring.	M

			• measuring airborne radioactive dust during maintenance activities to check that the assumptions upon which respirator selections were made are accurate – or if respirators are needed at all. • a surface contamination survey in a workshop to confirm that NORM contamination controls are working. • sampling and analysis of waste streams to verify that they remain within regulatory limits. • materials used in NORM control procedures, such as gloves, plastic sheeting, disposable coveralls, etc., if an area, materials, or equipment is affected by NORM. • Equipment with NORM shall be recycled or incinerated at an approved recycling or incineration center.	
		H	The proponent – • shall ensure and require that contractors implement the following fall prevention and	

	Tripping/falling from heights because of Climbing and working on electric poles		protection measures for all workers exposed to the hazard of falling while working on power projects: • Test structures for integrity before undertaking work. • Implement a fall protection program that includes training in climbing techniques and the use of fall protection measures, inspection, maintenance, and replacement of fall protection equipment, and rescue of fall-arrested workers, among other things. • Establish criteria for using 100 percent fall protection (typically when working over 2 meters above the working surface. The fall protection system shall be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point. • Install fixtures on tower components to facilitate the use of fall protection systems.	L

			• Provide adequate work-positioning device system for workers. • Ensure proper rating for hoisting equipment. • Ensure proper maintenance of hoisting equipment and properly train hoist operators. • Use Safety belts that are at least 16 millimeters (mm) (5/8 inch) of two-in-one nylon or a material of equivalent strength. • When operating power tools at height, require that workers use a second (backup) safety strap. • An approved tool bag should be used to raise or lower tools or materials for workers on structures.	
	The kidnapping of workers and visitors on-site	H	The proponent • shall ensure that the contractor and FMW personnel develop a high-security consciousness within and outside the work area. • The FMW Project Manager shall review daily security reports.	M

			• A special security force shall be established and deployed for the project. This shall include deploying some of the FMW police to strengthen security in the area. • FMW shall ensure that a liaison is established and sustained to foster a partnership with the community and guarantee security for the project. • To beef up security for the project, FMW shall support FMW authorities by assisting with equipment, such as patrol vehicles. • FMW shall ensure that safety workshops to identify, evaluate, and recommend contingency plans for all security risks are regularly organized.	

CHAPTER NINE
CONCLUSION AND RECOMMENDATIONS

9.1 Background Information

According to the ESIA (Environmental and Social Impact Assessment) study of the construction and operation of the Lagos Coastal Highway Section 1 would have minimal negative effects on the environment, provided that the recommendations outlined in the environmental and social management plan developed during the study, along with other additional provisions, are strictly adhered to.

9.2 Conclusion

The Lagos-Calabar Coastal Highway Project Section 1 Environmental and Social Impact Assessment (ESIA) initial draft was prepared *with a strong commitment to comply with the Environmental Impact Assessment (EIA) Act CAP E12, LFN 2004.* The report results from a rigorous scoping of the proposed alignment, areas of influence, and the existing baseline environmental and social impact based on previous studies. The report presents compelling and inspiring findings demonstrating the importance of responsible and sustainable development practices.

The ultimate objective of the ESIA process was to ensure that the Project has no major residual impacts on the environment, be it in the long term or over a vast area. Consequently, after implementing the delineated mitigation measures, the residual impacts of the Project were significantly reduced to mostly short-term, localized, and reversible. Alongside this, we provided recommendations to optimize the beneficial effects of the Project and sustain them for the long term.

An Environmental and Social Management Plan (ESMP) was developed to ensure that the Project meets its operational requirements and delivers its stated business objective in an environmentally responsible manner. The ESMP outlines the mitigation/enhancement measures to action points and recommends performance indicators monitoring and audit programmes. This helps maintain all impact indicators for the various environmental components within statutory limits throughout the Project's life.

9.3 Recommendations

9.3.1 Management Action Plan

The Federal Government of Nigeria, through the Federal Ministry of Works (FMW) is committed to adhering to the following management recommendations to ensure sustainability and continual environmental performance of the Project. Therefore, the Government (FMW) shall:

- Always support green initiatives in all phases of the proposed Project to reduce the effect of greenhouse gas emissions
- Implement the Environmental and Social Management Plan (ESMP) designed for the Lagos - Calabar Coastal Highway project through its phases of development, covering construction, operation, and decommissioning. The ESMP shall also be reviewed as the need arises;

- Develop and implement a standard Environmental Management System (EMS) for the Project, such as ISO 14001:2015 EMS and ISO 14064-1:2006 on *Greenhouse gases*.
- Develop and implement a standard Safety Management System (SMS) in line with FMEnv and best practice standards,
- Implement the Project's waste management plan (WMP)
- Implement the Project's performance indicator monitoring programme as recommended. Monitoring (inspection and measurements) shall be monitored at least three (3) times during the construction phase and operation quarterly.
- Carry out a 3-year post-ESIA environmental auditing. A competent third-party person shall carry out the audit to ensure objectivity.
- Develop and implement a public complaint and grievance redress system to handle stakeholders' concerns effectively.
- Provide adequate resources for managing the Project's environmental aspects (including noise, air emissions, water etc.)
- Obtain relevant regulatory permits and approvals before the commencement of the Project and as when due.

9.3.2 Operations Environmental Action Plan

The Project will implement a range of environmental management and pollution control action including scheduled inspection and maintenance of mobile and immobile equipment and noise and emissions mitigation measures as recommended.

.

The ESIA report confirms that these mitigation measures will prevent any significant negative impact**,** and FMW is now seeking approval from FMEnv for the report.

Therefore, in view of the fact that the stakeholder communities shall be carried along during the project construction and operation, and that there is no stern environmental, health, social or cultural issues that may warrant the cancellation of the proposed project**,** it is therefore advised that the project be embark upon as proposed.

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APPENDICES

Appendix 1.1: Environment-Related Institutions in Nigeria

A. Environment-Related Federal Institutions

1. National Council on Environment

This is the apex policy-making organ on the environment. The Council:

- The Council consists of the Minister of Environment, Minister of State for Environment, and State Commissioners of Environment
- Participates in the formulation, coordination, harmonization and implementation of national sustainable development policies and measures or broaden national development.

The Council meets regularly to

- Consider and receive States' reports on environmental management.
- Consider national environmental priorities and action plans as it affects Federal and State governments; and
- Exchange ideas and information where necessary with the Federal Government on environmental issues.

2. Federal Ministry of Environment (FMEnv)

Set up by Presidential Directive No. Ref. No. SGF.6/S.221 of October 12, 1999, and empowered with regulation of all environmental matters protecting, enhancing and preserving the Nigerian environment.

In line with her mandate, developed far reaching legal instruments for achieving environmentally sound management of resources and sustainable development across all major sectors of the economy.

Regulatory instruments are enforced through the activities of the following agencies:

1. **Forestry Research Institute of Nigeria (FRIN)**:
   - FRIN focuses on forestry research, conservation, and sustainable forest management.
   - It contributes to environmental protection through research and policy recommendations.
2. **National Biosafety Management Agency (NBMA)**:
   - NBMA regulates modern biotechnology and genetically modified organisms (GMOs) to ensure their safe use and minimize environmental risks.
3. **National Environmental Standards and Regulations Enforcement Agency (NESREA) with** Gazette No. 92, Vol. 94 of 31st July 2007:
   - NESREA is responsible for enforcing environmental standards and regulations.
   - It monitors compliance with environmental laws and promotes sustainable practices.
4. **National Oil Spill Detection and Response Agency (NOSDRA)** established under Act of 2006:
   - NOSDRA addresses oil spill incidents, especially in the oil-producing regions.

Appendix 1.1: Environment-Related Institutions in Nigeria

- It ensures timely response, containment, and cleanup of oil spills to protect the environment.

5. **National** Park Service of Nigeria
   - Responsible for preserving, enhancing, protecting and managing vegetation and wild animals in the national parks of Nigeria.
6. **Environmental Assessment Department**
   - Under the Ministry developed the procedures for Environmental Impact Assessments (EIA) of all development projects in accordance with the provisions of the Environment Impact Assessment (EIA) Act. No. 86 of 1992 and managed by the Environmental Assessment (EA) Department with the following functions:
   - Implementation of the provisions of the Environmental Impact Assessment (EIA) Act of 1992 on development projects.
   - Ensure environmental sustainability of development projects through regulation of activities within the oil and gas, mining, infrastructure, agriculture, manufacturing sectors, etc.
   - Development of guidelines and standards for environmental quality monitoring, eco-labelling, etc; and Accreditation of environmental laboratories. Implementation of Environmental Audit and Environmental Management System (EMS) in Nigeria.

B. Environment-Related State Institutions

State Ministry of Environment/Environmental Protection Agency

Each State of the Federation has an Environment Ministry and/or Environmental Protection Agency (EPA) that is charged with the responsibility of providing a decent, orderly, conducive and habitable environment.

In the State, *inter alia*, the Ministry of the Environment carries out the following:

- Liaison with the Federal Ministry of Environment to achieve healthy or better management of the environment.
- Co-operate with FMEnv and other National Directorates/Agencies in the performance of environmental functions including environmental education/awareness to the citizenry.
- Monitoring waste management standards,
- Responsibility for general environmental matters in the States, and
- Monitoring the implementation of ESIA studies and other environmental studies for all development projects in the State.

Lagos State has a number of Ministries, Departments and Agencies (MDAs) relevant to the Project. These institutions collaborate to safeguard the environment, promote sustainable practices, and enhance the quality of life for Nigerians. The main thrust of these agencies is to **protect and improve the environment**. They assist public and private organizations, industries, businesses, and non-governmental organizations in achieving compliance by providing environment-friendly solutions to varied environmental challenges.

Appendix 1.1: Environment-Related Institutions in Nigeria

Lagos State Ministry of Environment and Water Resources

The **Lagos State Ministry of Environment and Water Resources** in Nigeria has the following:

- **Vision and Mission**:
  - Vision: “A flood-free, hygienic, and beautiful Lagos.”
  - Mission: "To foster a clean, healthy, sustainable environment for the well-being of citizens through the application of best practices in environmental management.".
- **Mandate and Structure**:
  - The ministry’s primary mandate is to secure a **clean**, **healthier**, and **sustainable environment** conducive for **tourism**, **economic growth**, and the well-being of its citizens.

It oversees several **agencies**:

i. Lagos State Environmental Protection Agency (LASEPA): Responsible for environmental protection and regulation and monitors and enforces environmental standards within Lagos State. And with regard to Vehicular Emission Standards, Setting, monitoring, and enforcing standards and guidelines on vehicular emissions.
ii. Lagos State Waste Management Authority (LAWMA): Manages waste disposal through collection, disposal, and recycling in Lagos.
iii. Lagos State Parks and Garden Agency (LASPARK): LASPARK oversees parks, green spaces, and urban forestry.
iv. Lagos Water Corporation (LWC): Deals with water supply.
v. Lagos State Water Regulatory Commission (LSWRC): Regulates water resources.
vi. Lagos State Environmental Sanitation Corps (LAGESC): LAGESC plays a critical role in enforcing environmental sanitation laws in Lagos State. Surveillance and Reporting: Monitoring and maintaining surveillance along highways, streets, and public amenities. Reporting Breaches: Regularly reporting any violations of environmental laws to appropriate enforcement authorities.

These institutions collaborate to safeguard environmental quality, promote sustainable practices, and enhance the well-being of Lagos residents.

- **Office of Environmental Services & Water Resources**:
  - This office handles various aspects, including administration, environmental health, legal services, enforcement, advocacy, environmental management, planning, finance, and more.
- **Office of Drainage Services & Water Resources**:
  - Responsibilities include administration, finance, drainage construction/dredging, drainage maintenance, enforcement, water resources, project planning, and more.

Appendix 1.1: Environment-Related Institutions in Nigeria

- **Climate Change**:
  - Climate change refers to long-term shifts in temperatures and weather patterns.
  - Human activities, such as burning fossil fuels, drive climate change.
  - Greater Lagos aims to address climate challenges and promote sustainable practices.
- **Waste Disposal Management**:
  - The ministry focuses on effective waste management to keep Lagos clean and healthy.

- **Ministry of Physical Planning and The Directorate of Lands and Surveys**

The Directorate deals with land issues, plans, development controls and establishes residential, commercial and industrial layouts. They also execute in the state, the Nigerian Urban and Regional Planning laws.

C. Environment-Related Local Government Institutions

Like the State Government, the Local Government liaise and cooperate with the Federal and State Ministries of Environment to achieve a healthy or better management of the environment within their domains with the relevant byelaws. This is true of the host Local Government, where the proposed project is located.

The local government institutions work diligently with the State Government to safeguard environmental quality, promote sustainable practices, and enhance the well being of Lagos residents.

Appendix 4.1: Environmental Component Sampling Points in the Communities

S/N	Communities	Lat	Long
1	Eko Atlantic	6.419877	3.426037
2	Oniru	6.422716	3.446513
3	Marwa	6.424273	3.468469
4	Elegushi	6.424118	3.493347
5	Jakande	6.428088	3.516501
6	Elesan	6.426124	3.547175
7	Lafiaji	6.426026	3.558781
8	Okun Aja	6.427751	3.585086
9	Akinlade	6.427651	3.620911
10	Mopo Ijebu	6.427817	3.63556
11	Sangotedo	6.43116	3.65526
12	Mosere Ikoga	6.429814	3.683681
13	Iwereku	6.429687	3.728184
14	Lakowe	6.431308	3.739767
15	Iwesolu	6.435072	3.763529
16	Okunsolu	6.439422	3.791136
17	Igando	6.441356	3.819811
18	Badore	6.440752	3.83922
19	Eleko	6.4402	3.853224
Control Points			
1	Eko Atlantic	6.395502	3.404908
2	Eleko	6.436591	3.884671

Water

Appendix 4.2: Values of Physico-chemical Parameters and Microbiology of the groundwater and Surface samples at the Project Locations

A. Values of Physico-chemical Parameters of the groundwater samples at the Project Locations

	Sample identity															
Parameter	Mark On Sample	GW 1 IGANDO	GW ORUNMIJA	GW 1 MARWA	GW 1 JAKANDE	GW 1 BADORE	GW DEBOJO	GW 1 ELEKO	GW OGUNTIME	ONIRU	GW 1 - SOLO ALADE	GW 1 OKUW AJAH	GW 1 LAFIAJI	GW 1	GW 1 ELEGUSHI	
True Colour		Clear	Clear	Slightly Brownish	Clear	Brownish	Clear	Clear	Slightly brownish	Clear	Clear	Clear	Gold en-brown with tiny particles	Golden-brown	Clear	
, Hz	APHA 2120 B	<5	<5	30	5	<5	<5	<5	<5	<5	<5	<5	20	30	<5	
Odour		Unobjectionable	Unobjectionable	Objectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Objectionable	Unobjectionable	Objectionable	Unobjectionable	
Electrical Conducti	ASTM	542	320	578	571	685	181.5	656	214	731	162	226	403	295	1857	530. 1071

A. Values of Physico-chemical Parameters of the groundwater samples at the Project Locations															
	Sample identity														
Parameter	Sample Mark On	GW 1 IGANDO	GW ORUNMIJA	GW 1 MARWA	GW 1 JAKANDE	GW 1 BADORE	GW DEBOJO	GW 1 ELEKO	GW OGUNTIME	ONIRU	GW 1 - SOLO ALADE	GW 1 OKUW AJAH	GW 1 LAFIAJI	GW 1 MOBO	GW 1 ELEGUSHI	
vity, Umhos/Cm	D1175															
Turbidity, Ntu	ASTM D6855-03	NIL	NIL	5.1	NIL	11.6	NIL	NIL	8.1	NIL	NIL	NIL	7.5	5.1	NIL	7.48
Ph, 25 Oc	ASTM D1193	8.2	6.7	6.3	7.4	6.7	6.8	6.7	6.6	8.4	7.1	6.3	6.8	5.4	7.5	6.921429
Total Dissolved Solids, Mg/L	ASTM D5907-03	406.5	240	433.5	428.2	573.8	136.1	492	160.5	548.2	121.5	169.5	302.2	221.2	1392.7	401.85
Total Solids, Mg/L	ASTM D5907-03	421.6	252.1	461.5	447.7	535.7	151.1	505	183.7	567.6	133.6	188.3	335	256.2	1415	418.15
Total Hardness-Edta, Mgcaco3/L	APHA 2340 C	259.1	113.6	182.3	206.55	190.4	6.1	174.2	73.2	194.4	40.9	53	162.11	101.5	250.9	143.4471
Total Alkalinity,	ASTM	94.3	31.4	34.3	131.5	42.9	17.2	31.4	22.9	122.9	14.3	11.4	74.3	5.7	160.1	56.75714

A. Values of Physico-chemical Parameters of the groundwater samples at the Project Locations																
	Sample identity															
Parameter	Mark On Sample	GW 1 IGANDO	GW ORUNMIJA	GW 1 MARWA	GW 1 JAKANDE	GW 1 BADORE	GW DEBOJO	GW 1 ELEKO	GW OGUNTIME	ONIRU	GW 1 - SOLO ALADE	GW 1 OKUW AJAH	GW 1 LAFIAJI	GW 1	GW 1 ELEGUSHI	
Mgcaco3 /L	D1067															
Total Acidity, Mgcaco3 /L	ASTM D1067	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Residual Chlorine, Mg/L	ASTM D1253	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Free Carbondioxide, Mg/L	APHA 4500 C	7	17.3	23	16.5	17.3	17.2	17.3	17.4	9	16.9	25	17.2	60	16.5	19.82857
Ammoniacal Nitrogen, Mg/L	APHA 4500 - NH3 C	0.25	0.12	<0.05	3.4	6.1	0.15	<0.05	0.22	<0.05	<0.05	<0.05	1.2	4.7	3.7	2.204444
Chloride, Mg/L	ASTM D512 B	36	46	60.4	46.9	73.2	21.7	10.2	30.3	51	26	26.9	30.9	20.2	276.7	54.02857
Nitrate, Mg/L	ASTM D922	12.2	12.5	0.28	0.66	8.2	10.3	5	0.53	1.3	9.5	0.19	0.99	0.92	7.9	5.033571

A. Values of Physico-chemical Parameters of the groundwater samples at the Project Locations																
	Sample identity															
Parameter	Sample Mark On	GW 1 IGANDO	GW ORUNMIJA	GW 1 MARWA	GW 1 JAKANDE	GW 1 BADORE	GW DEBOJO	GW 1 ELEKO	GW OGUNTIME	ONIRU	GW 1 - SOLO ALADE	GW 1 OKUW AJAH	GW 1 LAFIAJI	GW 1 MOBO	GW 1 ELEGUSHI	
Nitrite, Mg/L	APHA 4500 A	0.02	0.15	0.06	0.01	0.04	0.097	0.15	0.18	<0.01	0.047	0.06	0.37	0.05	0.24	0.113385
Phosphate (Total), Mg/L	ASTM D515	0.41	0.53	0.45	0.34	0.47	0.38	0.47	0.38	0.58	0.6	0.34	0.09	0.6	1.2	0.488571
Sulphate, Mg/L	ASTM D516	47.8	2.7	183.1	1.6	206.5	0.78	62.5	37.9	172.5	2.2	35.9	5.9	91.2	354.9	86.10571
Silica, Mg/L	ASTM D859-00	6.6	14.1	11.6	8.3	12.4	7.6	13.6	11.2	14.5	16.3	8.5	5.2	16.8	27.6	12.45
Arsenic, Mg/L	ASTM D2972A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<.01	
Cadmium, Mg/L	ASTM D3557	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Calcium, Mg/L	ASTM D511	99.8	38.3	60.1	64.2	73.1	20.5	56.1	24.5	59.3	11.5	17.2	54.4	31.8	79.5	49.30714

A. Values of Physico-chemical Parameters of the groundwater samples at the Project Locations																
	Sample identity															
Parameter	Mark On Sample	GW 1 IGANDO	GW ORUNMIJA	GW 1 MARWA	GW 1 JAKANDE	GW 1 BADORE	GW DEBOJO	GW 1 ELEKO	GW OGUNTIME	ONIRU	GW 1 - SOLO ALADE	GW 1 OKUW AJAH	GW 1 LAFIAJI	GW 1	GW 1 ELEGUSHI	
Chromium (Hexavalent), Mg/L	ASTM D1887	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper, Mg/L	ASTM D1887	0.006	0.004	0.016	0.009	0.011	<0.01	0.004	<0.01	0.005	0.005	0.01	0.014	0.01	0.008	0.0085
Iron (Total), Mg/L	ASTM D1068A	0.08	<0.01	0.88	0.25	1.5	0.11	<0.01	2.1	<0.01	0.06	0.29	0.85	0.68	0.11	0.628182
Lead, Mg/L	ASTM D3559	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Magnesium, Mg/L	ASTM D511	2.5	4.4	7.9	11.3	2	2.5	8.3	3	11.3	3	2.5	6.4	5.4	10.8	5.807143
Manganese, Mg/L	ASTM D858-02	0.01	0.034	0.12	0.04	0.046	0.029	0.016	0.038	<0.01	0.042	0.06	0.12	0.07	0.009	0.048769
Zinc, Mg/L	APHA	0.028	0.033	0.17	0.032	0.029	0.053	0.039	0.015	0.006	0.03	0.06	0.16	0.06	0.013	0.052

A. Values of Physico-chemical Parameters of the groundwater samples at the Project Locations																
	Sample identity															
Parameter	Sample Mark On	GW 1 IGANDO	GW ORUNMIJA	GW 1 MARWA	GW 1 JAKANDE	GW 1 BADORE	GW DEBOJO	GW 1 ELEKO	GW OGUNTIME	ONIRU	GW 1 - SOLO ALADE	GW 1 OKUW AJAH	GW 1 LAFIAJI	GW 1	GW 1 ELEGUSHI	
	D1691A															
Dissolved Oxgen, Mg/L	ASTM D888-03	7	6.9	6.9	6.3	6.4	7.2	7.1	6.5	6.2	7.4	6.2	7	6	7.3	6.742857
Fluoride, Mg/L	APHA 4500 C	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Hydrogen Sulphide, Mg/L	APHA 4500 -	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	

B. Results microbiological Analsyed for Ground Water Samples for the project location

MICROBIOLOGICAL PARAMETER	METHOD	GW 1 - IGANDO	GW - ORUNMIJA	GW 1 – MARWA	GW 1 - JAKANDE	GW 1 – BADORE	GW - DEBOJO	GW 1 – ELEKO	GW - OGUN TIMEYIN	ONIRU	GW 1 - SOLOALADE	GW 1 - OKUWAJAH	GW 1 - LAFIAJI	GW 1 - MOPO IJEBU	GW 1 - ELEGUSHI
Coliforms, , CFU/ml	APHA 9221E	0	16	10	0	0	20	03	0	07	10	05	07	09	54
E.Coli, , CFU/ml	APHA 9221E	0	10	03	0	0	15	0	0	0	07	0	0	05	52
Faecal Streptococci, , CFU/ml	APHA 9215B	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylococcus Aureus,, CFU/ml	AOAC 9610A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonella, , in 25ml	APHA 9260B	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Shigella, , in 25ml	APHA 9260E	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Yeast/Moulds, , CFU/ml	APHA 9610A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total plate count, , CFU/ml	APHA 9215A	168	669	373	27	154	355	695	199	467	125	737	92	380	912
Pseudomonas,, CFU/ml	APHA 9251B	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: *Natural Eco Capital Fieldwork April, 2024*

C. Average microbial counts (cfu/ml) of surface water samples

STATION	Bacteria		Fungi	
	TOTAL HETEROTROPHIC BACTERIA (HB) (cfu x 10^6/ml)	HYDROCARBON UTILISING BACTERIA (HUB) (cfu x 10^6/ml)	TOTAL HETEROTROPHIC FUNGI (HF) (cfu mx 10^6/ml)	HYDROCARBON UTILISING FUNGI (HUF) (cfu x 10^6/ml)
1	67.20	12.10	135.10	81.03
2	89.4	14.70	123.20	87.02
3	121.0	23.20	89.30	24.02
4	99.32	34.12	132.11	36.10
5	92.34	34.40	134.01	34.10
6	45.23	14.23	121.11	48.03
7	49.01	22.10	89.34	38.11
8	55.40	24.10	102.12	69.11
9	98.12	12.10	99.12	26.23
10	45.42	11.11	133.30	13.02
11	67.20	12.10	135.10	81.03
12	89.4	14.70	123.20	87.02
13	121.0	23.20	89.30	24.02
14	99.32	34.12	132.11	36.10
15	92.34	34.40	134.01	34.10
16	45.23	14.23	121.11	48.03
17	49.01	22.10	89.34	38.11
18	55.40	24.10	102.12	69.11
19	98.12	12.10	99.12	26.23

D. Summary of results of physicochemical parameters of surface water in the study area

Parameter	Unit of Measurement	Min	Max	Mean
Temperature	^{O}C	28.89 – 30.59	29.42	
pH		6.9	7.86	7.5
Electrical conductivity	(µs/cm)	36,800.0	51700.00	45,748.0
Salinity	Ppt	26.1	29.7	28.3
TDS	(mg/L)	18,900.0	30274.62	25,967.9
TSS	(mg/L)	3.0	13.35	8.2
Turbidity	(NTU)	2.4	2.38	2.4
DO	(mg/L)	4.0	9.34	6.3
BOD	(mg/L)	0.8	2.57	1.5
COD	(mg/L)	5.3	8.6	7.0
Sodium	(mg/L)	7,396.5	11242.68	9,253.7
Magnesium	(mg/L)	43.4	3771.34	1,604.1
Potassium	(mg/L)	381.1	775.83	552.5
Calcium	(mg/L)	297.7	576.70	414.2
Sulphate	(mg/L)	27.8	19783.40	6,176.8
Phosphate	(mg/L)	0.02	9.12	1.5
Nitrate	(mg/L)	1.5	5.91	3.6
Chloride	(mg/L)	23,040.0	34268.54	26,860.3

Parameter	Min	Max	Mean
Oil & Grease	0.11	4.51	0.69
TPH	0.06	1.37	0.49
BTEX	0.01	0.04	0.03
PAH	0.01	0.08	0.03

Zinc	0.02	18.00	1.29
Mercury	ND		
Arsenic	ND		

Appendix 4.3: Measured Air Quality and Relevant Standard:

The assessment of air quality based on recorded pollutant concentrations compared to National Air Quality Standards and WHO guidelines shows the following:

- The concentrations of gaseous pollutants recorded within the project's area of influence represent background levels or baseline conditions.
- These levels likely reflect the existing state before any significant project-related activities commence.
- The low pollutant concentrations obtained during this study may be attributed to the absence of major pollution sources in the area.
- The air quality in the project's location is generally acceptable for most individuals. However, it's essential to consider sensitive groups (such as children, the elderly, or

Parameter	**LASEPA Standard**	**IFC/WHO standard**	**FMEnv**
Pm $_{2.5}$	*25 µg/m3*	*25 µg/m3*	19.7
Pm $_{10}$	*50 µg/m3*	*50 µg/m3*	48.9
SPM	0	0	250mg/m3
Co	*5000 µg/m3*	0	10ppm
Voc	*8 µg/m3*	0	0
H_2s	*8 µg/m3*	0	0
No	*1,600 µg/m³*	0	0
No_2	*17 µg/m³*	*20* µg/m³	0.01 - 0.1ppm
Nox	0	0	0.04-0.06
So_2	*1,000 µg/m³*	*20* µg/m³	0
Sox	0	0	0.01 -0.10ppm
O2	*20.8%*	*100* µg/m³	20%
Humidity	*56-65%*		
Temperature	*32ºc*		

individuals with respiratory conditions).

- Sensitive groups may experience minor to moderate symptoms from long-term exposure to pollutants.

Table below provides a comparison between the air quality results from this study and the following standards;

- ***National Air Quality Standards***: These are regulatory limits set by national authorities to protect public health and the environment.
- ***World Health Organization (WHO) Guidelines***: The WHO provides global guidelines for air quality to safeguard human health.

The comparison shows that the measured levels are within the set limits. Continuous monitoring and adherence to standards will be crucial for maintaining healthy air quality as the project is implemented.

A. Relevant Ambient Air Quality Standard

Appendix 4.3: Measured Air Quality and Relevant Standard:

Pollutants	Time of Average	FMENV	WHO
$PM_{2.5}$	Daily average of daily		25.0 µg/m^3
PM_{10}	Daily average of daily		50.0 µg/m^3
Carbon monoxide	Daily average of hourly values. 1-hour mean	10ppm (11.4 µg/m^3) 20ppm (22.8 µg/m^3)	
Nitrogen Oxides	Daily average of hourly values (range)	0.04ppm-0.06 ppm (75.0 µg/m3 -112 µg/m3)	
Ozone	Daily average of hourly values	0.65 ppm	
Volatile Organic Compounds (VOCs)	Daily average of hourly values	0.25Pm	

Appendix 4.4: Measured Noise levels and Standards

The National Environmental Standards and Regulations Enforcement Agency (NESREA) provides guidelines for community noise exposure for different land use types ranging from pure residential location to mixed residential, commercial, and industrial. These guidelines are detailed in **Table b**. Also, in Nigeria there are specific noise exposure limits set by FMEnv/NESREA as outlined in **Table c** for workers in industrial facility or workshops and their corresponding durations.

Table b: NESREA Noise Exposure Limits for General Environment

	FACILITY	Maximum Permissible NOISE Limit dBA	
		Day	Night
A	Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental or recreational sites,	45	35
B	Residential Buildings	50	35
C	Mixed Residential (with some commercial and entertainment)	55	45
D	Residential + Industry or Small-scale production + Commercial	60	50
E	Industry (outside perimeter fence)	70	60

Source: *NESREA National Environmental (Noise Standards and Control) Regulations, 2009*

Time frame use	**Duration**
Day	6:00am – 10:00pm
Night	10:00pm – 6:00am

The time frame takes into consideration human activity.

Table c: FMEnv Occupational Noise Exposure Limits for Workers in Factory or Workshop.

Duration per Day, Hour	Permissible Exposure Limit dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Source: *NESREA Guidelines & standards for Environmental Pollution Control in Nig. 1992*

Note: *Exposure to impulsive or impact noise should not exceed 140 dB (A) peak sound pressure level.*

Appendix 4.5 Baseline Condition of The Aquatic Environment

Approach and Methodology

Baseline data on the physico-chemical characteristics of water and sediment, and biological environment of the study area were acquired through an integrated approach, which include the following;

Desk studies and literature review

Consultation with stakeholder

Field sample collection ad laboratory analyses

Selection of sampling locations

Sampling points were predetermined using GPS coordinates of communities along the project stretch in Section One of the Lagos-Calabar high way project. All the sampling points were properly geo-referenced with Differential Geographical Positioning System (DGPS) and major landmarks and existing human activities were recorded. Sampling points were designed to cover the project area from Eko Atlantic City to Eleko. The sampling points and coordinates are presented in Appendix 4.1, while some landmark features at the locations.

These steps were followed to achieve the objectives;

- Conduct a baseline survey of the marine wildlife in the coastal area of Lagos to determine the species present, their distribution, and abundance.
- Implement a monitoring program to assess the potential impact of the coastal road project on marine wildlife, including the use of remote sensing technology, acoustic monitoring, and cameras.
- Conduct habitat assessments to evaluate the quality and quantity of critical habitats for marine wildlife, such as sea grass beds, coral reefs, and mangrove forests.
- Establish a wildlife rescue and rehabilitation program to mitigate potential impacts of the coastal road project on marine wildlife, including the establishment of a network of wildlife experts, veterinarians, and rehabilitation facilities.
- Develop a comprehensive Environmental Impact Assessment (EIA) that considers the potential impacts of the coastal road project on marine wildlife and proposes mitigation measures to minimize negative effects.
- Engage with local communities, stakeholders, and government agencies to raise awareness about the importance of marine wildlife conservation and involve them in the decision-making process regarding the coastal road project.
- Implement a post-construction monitoring program to assess the effectiveness of mitigation measures and ensure the long-term sustainability of marine wildlife in the coastal area of Lagos.

Sampling equipment

The list and photograph respectively of some equipment used during the field sampling exercise.

S/N	STUDIES	Equipment
1	Geo-Location of sampling points	Geographical Positioning System (GPS)
2	Hydrobiology	Phytoplankton, Benthos, fish, microbes
3	Sampling	Plankton net, Grab, Aliminium foil, sieve, masking tape, formalin,
4	Sample Preservation/	Coolers

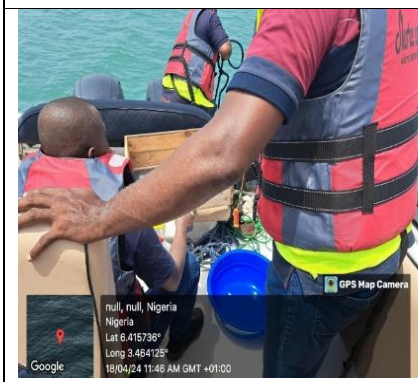
Appendix 4.5 Baseline Condition of The Aquatic Environment

	Quality control/ Quality assurance	
5	Sample containers	Glass bottles, Plastic bottles/ Containers, Polythene bags
6	Data Acquisition	Digital Cameras


Grab Sampler

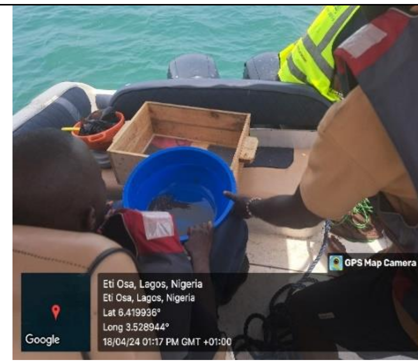

Sieve


Plankton Net



Retrieval of Grab sampler after deployement


Resident Fisher folk



Collection of Plankton sample and processed for Benthos

A. Common Fin-Fisheries of the coastal waters of Nigeria		
FAMILY	SCIENTIFIC NAME	COMMON NAME
Balistidae	*Balistes carpriscus*	Trigger fish
	Balistes punctatus	Trigger fish
Carangide	*Caranx crysos*	Jack fish
	Caranx hippos	Jack fish
	Caranx senegallus	Jack fish
	Selene dorsalis	Moon fish
Clupeidae	*Ethmalosa fimbriata*	Bonga
	Llisha africana	West African shad
	Sardinella maderensis	Sardinella
Cynogblossidae	*Cynolossuscanariensis*	Tongue sole
Drepanidae	*Drepane africana*	Sprade fish
Elopidae	*Elopslacetta*	Ten pounder
Ephippidae	*Chatodipterusgorensis*	Spade fish
Haemulidae	*Pomadasys incises*	Grunter
	Pomadasysjubelini	Grunter
Hemiramphidae	*Hemiramphus brasiliensis*	Half break
Lobotidae	*Lobotessurinamensis*	Grouper
Lutjanidae	*Lutjanus agennes*	Snapper
	Lutjanus dentanus	Snapper
	Lutjanus goreensis	Snapper
Monodactylidae	*Psettussebae*	Angel fish
Mugilidae	*Mugil cephalus*	Mullet
Polynemidae	*Galeoidesdecadactylus*	Threadfin
	Pentanemusquinquarius	Threadfin
Psettodidae	*Psettodesbelcheri*	Black sole
Scianidae	*Pseudotolithus elongates*	Croaker
	Pseudotolithus senegalensis	Croaker
	Pseudotolithus typus	Croaker
Scombridae	*Auxistharzard*	Frigate Mackerel

	Euthynnusalletteratus	Frigate Mackerel
	Sarda sarda	Little tunny
	Scomber japonicas	Mackerel
	Scomberomorous tritor	Mackerel
Serranidae	*Epinephelus aeneus*	Snapper
	Epinephelusgeorrensis	Snapper
Synodontidae	*Trachinocephalusnyops*	Large eye
Tetraodontidae	*Lagocephalus laevigates*	Puffer fish
Triglidae	*Zenopsisconchifer*	Puffer
Zeidae	*Zeus faber*	Angel fish

Source: Natural Eco Capital Fieldwork April, 2024


Fish samples and fishing gears in the study area


Fish samples collected from the study area

Appendix 4.6: Common Fin-Fisheries of the coastal waters of Nigeria.		
FAMILY	SCIENTIFIC NAME	COMMON NAME
BALISTIDAE	*Balistes carpriscus*	Trigger fish
	Balistes punctatus	Trigger fish
CARANGIDE	*Caranx crysos*	Jack fish
	Caranx hippos	Jack fish
	Caranx senegallus	Jack fish
	Selene dorsalis	Moon fish
CLUPEIDAE	*Ethmalosa fimbriata*	Bonga

	Llisha africana	West African shad
	Sardinella maderensis	Sardinella
CYNOGBLOSSIDAE	*Cynolossus canariens*	Tongue sole
DREPANIDAE	*Drepane africana*	Sprade fish
ELOPIDAE	*Elops lacetta*	Ten pounder
EPHIPPIDAE	*Chatodipterus gorensis*	Spade fish
HAEMULIDAE	*Pomadasys incises*	Grunter
	Pomadasys jubelini	Grunter
HEMIRAMPHIDAE	*Hemiramphus brasiliensis*	Half break
LOBOTIDAE	*Lobotes surinamensis*	Grouper
LUTJANIDAE	*Lutjanus agennes*	Snapper
	Lutjanus dentanus	Snapper
	Lutjanus goreensis	Snapper
MONODACTYLIDAE	*Psettus sebae*	Angel fish
MUGILIDAE	*Mugil cephalus*	Mullet
POLYNEMIDAE	*Galeoides decadactylus*	Threadfin
	Pentanemus quinquarius	Threadfin
PSETTODIDAE	*Psettodes belcheri*	Black sole
SCIANIDAE	*Pseudotolithus elongates*	Croaker
	Pseudotolithus senegalensis	Croaker
	Pseudotolithus typus	Croaker
SCOMBRIDAE	*Auxis tharzard*	Frigate Mackerel
	Euthynnus alletteratus	Frigate Mackerel
	Sarda sarda	Little tunny
	Scomber japonicas	Mackerel
	Scomberomorous tritor	Mackerel
SERRANIDAE	*Epinephelus aeneus*	Snapper
	Epinephelus georrensis	Snapper
SYNODONTIDAE	*Trachinocephalus nyops*	Large eye
TETRAODONTIDAE	*Lagocephalus laevigates*	Puffer fish
TRIGLIDAE	*Zenopsis conchifer*	Puffer
ZEIDAE	*Zeus faber*	Angel fish

Fish species that occur regularly in catches of Fishing Trawls operating within the Nigerian Coastal waters

Fish Taxa	Number of families	Genera	Number of species
Teleost	86	191	284
Rajiform	10	13	29
Squaliform	12	21	30

Regular component of catches from Fishing Trawls in Nigerian Coastal waters
Source: Isebor *et al*. (1999)

B. Species Composition and Distribution of Phytoplankton

Taxa	1	2	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19
Division – Bacillariophyta																		
Class-Bacillariophyceae																		
Order I – Centrales																		
Chaetoceros convolutus Castracane	+	+	+	+			+	+			+		+	+	+		+	+
Chaetoceros decipens Cleve					+			+			+	+	+	+		+		+
Cerataulina bergoni Lauder		+	+	+	+	+		+		+	+	+	+		+	+	+	
Coscinodiscus centralis Ehrenberg			+	+	+	+	+		+	+	+			+	+	+	+	
Coscinodiscus eccentrius Ehrenberg	+	+	+		+	+		+	+	+	+		+	+	+	+	+	+
Coscinodiscus gigas Ehrenberg	+		+	+	+	+	+		+	+		+	+	+		+	+	+
Coscinodiscus radiatus Ehrenberg	+	+		+	+	+	+	+		+	+	+		+	+	+		+
Hemidiscus cuneiformis Wallich	+	+	+	+				+	+	+	+	+	+	+	+	+		+
Hemidiscus sp.	+	+	+	+			+	+	+	+	+		+		+	+		+
Leptocylindricus danicus Cleve	+	+	+			+	+		+	+	+	+		+	+	+		+
Rhizosolenia alata Brightwell			+		+	+	+	+	+	+		+	+	+	+	+	+	+
Rhizosolenia styliformis Brightwell		+		+	+	+	+		+		+	+	+		+	+	+	
Rhizosolenia sp.	+	+	+		+				+	+	+	+		+		+	+	+
Skeletonema costatum (Greville) Cleve	+	+	+	+		+	+	+		+	+	+		+	+	+	+	+
Skeletonema costatum (Greville) Cleve	+	+		+	+		+		+	+	+	+	+	+		+	+	
Bacillaria paxillifer (O.F. Muller) Hendey			+	+	+	+		+	+	+		+	+		+	+		+
Thalasiothrix fraunfeldii Cleve & Grunow	+	+	+		+		+	+	+	+	+		+	+		+		+
Class – Dinophyceae																		
Ceratium macroceros (Ehr.) Cleve	+	+	+		+		+	+	+		+		+	+	+	+	+	
Ceratium tripos (O.F.M.) Nitzsch	+	+		+		+	+	+		+	+	+	+		+	+		+

C. Species Composition and Distribution of Marine Mammals

	1	2	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19
Division – Bacillariophyta																		
Class-Bacillariophyceae																		
Order I – Centrales																		
Chaetoceros convolutus Castracane	+	+	+	+			+	+			+		+	+	+		+	+
Chaetoceros decipens Cleve					+			+			+	+	+	+		+		+
Cerataulina bergoni Lauder		+	+	+	+	+		+		+	+	+	+		+	+	+	
Coscinodiscus centralis Ehrenberg			+	+	+	+	+		+	+	+			+	+	+	+	

Coscinodiscus eccentrius Ehrenberg	+	+	+		+	+		+	+	+	+		+	+	+	+	+	+
Coscinodiscus gigas Ehrenberg	+		+	+	+	+	+		+	+		+	+	+		+	+	+
Coscinodiscus radiatus Ehrenberg	+	+		+	+	+	+	+		+	+	+		+	+	+		+
Hemidiscus cuneiformis Wallich	+	+	+	+				+	+	+	+	+	+	+	+	+		+
Hemidiscus sp.	+	+	+	+			+	+	+	+	+		+		+	+		+
Leptocylindricus danicus Cleve	+	+	+			+	+		+	+	+	+		+	+	+		+
Rhizosolenia alata Brightwell			+		+	+	+	+	+	+		+	+	+	+	+	+	+
Rhizosolenia styliformis Brightwell		+		+	+	+	+		+		+	+	+		+	+	+	
Rhizosolenia sp.	+	+	+		+				+	+	+	+		+		+	+	+
Skeletonema costatum (Greville) Cleve	+	+	+	+		+	+	+		+	+	+		+	+	+	+	+
Skeletonema costatum (Greville) Cleve	+	+		+	+		+		+	+	+	+	+	+		+	+	
Bacillaria paxillifer (O.F. Muller) Hendey			+	+	+	+		+	+	+		+	+		+	+		+
Thalasiothrix fraunfeldii Cleve & Grunow	+	+	+		+		+	+	+	+	+		+	+		+		+
Thalasionema longissima Cleve & Grunow		+	+		+	+	+		+	+	+		+		+	+	+	+
thalassionema nitzschioides Cleve & Grunow	+	+	+	+	+	+		+	+	+		+	+	+	+		+	+
Division – Dinophyta																		
Class – Dinophyceae																		
Ceratium macroceros (Ehr.) Cleve	+	+	+		+		+	+	+		+		+	+	+	+	+	
Ceratium tripos (O.F.M.) Nitzsch	+	+		+		+	+	+		+	+	+	+		+	+		+
Overall Taxa Richness	14	16	16	13	14	13	14	14	15	16	17	14	16	15	16	19	13	16

Source: Natural Eco Capital Fieldwork April, 2024

Appendix 4.6: Summary of Physico-chemical characteristics of Sediment from the study locations

Parameter		Min	Max	Mean
pH		7.1	8.3	7.6
Electrical conductivity		1438.4	51230.0	30443.8
Chloride	mg/kg	1155.0	55441.0	25712.2
Sulphate	mg/kg	2622.9	13740.0	7298.2
Phosphate	mg/kg	100.0	924.5	271.0
Nitrate	mg/kg	0.1	9.0	1.4
Sodium	mg/kg	347.8	14123.0	10110.5
Potassium	mg/kg	221.6	8905.0	3161.4
Calcium	mg/kg	73.1	10902.0	1828.0
Magnesium	mg/kg	652.9	20903.0	3261.3
Sand	%	0.1	10.7	3.6
Mud	%	89.3	99.9	96.4

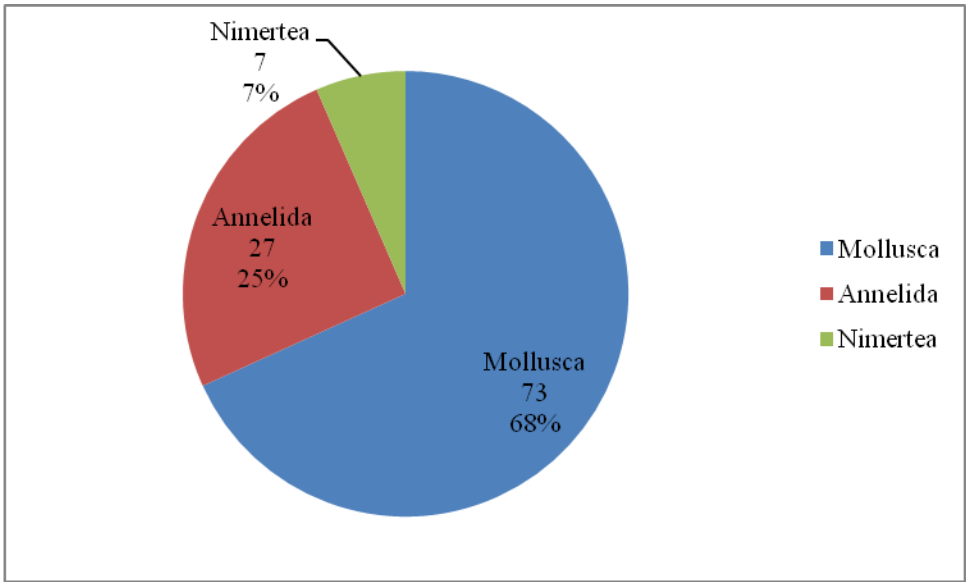
B. **Summary of Concentrations of heavy of metals in Sediment of study area**

Parameter	Unit of Measurement	Min	Max	Mean
Iron	(mg/kg)	619.1	20,351.0	11,343.7
Manganese	(mg/kg)	12.5	156.6	84.1
Copper	(mg/kg)	0.6	10.5	5.6
Nickel	(mg/kg)	0.5	15.9	8.9
Barium	(mg/kg)	0.3	7.4	3.5
Lead	(mg/kg)	0.7	12.6	8.5
Cadmium	(mg/kg)	0.1	1.9	0.7
Chromium	(mg/kg)	0.3	4.9	2.2
Zinc	(mg/kg)	1.2	42.4	20.2
Vanadium	(mg/kg)	ND		
Mercury	(mg/kg)	ND		
Arsenic	(mg/kg)	ND		

Appendix 4.6: Summary of Physico-chemical characteristics of Sediment from the study locations

ND: Not Detected

C. Summary of concentrations of hydrocarbons in Sediment from the study area				
Parameter	**Unit of Measurement**	**Min**	**Max**	**Mean**
Oil & Grease	(mg/kg)	13.7	146.3	69.0
TPH	(mg/kg)	1.3	9.5	4.4
BTEX	(mg/kg)	0.0	0.1	0.1
TOC	(%)	4.1	16.8	12.1
PAH	(mg/kg)	0.1	1.5	0.5



Percentage contributions of different taxa to species richness

Appendix 4.6: Summary of Physico-chemical characteristics of Sediment from the study locations

D. Average Microbial counts (cfu/g) of sediment samples

STATION	Bacteria		Fungi	
	TOTAL HETEROTROPHIC BACTERIA (HB) cfu x 10^6/g)	HYDROCARBON UTILISING BACTERIA (HUB) (cfu x 10^6/g)	TOTAL HETEROTROPHIC FUNGI (HF) (cfu x 10^6/g)	HYDROCARBON UTILISING FUNGI (HUF) (cfu x 10^6/g)
1	1144.20	693.10	1345.02	560.03
2	1125.04	585.70	1178.20	760.02
3	1231.03	456.01	1214.30	650.02
4	1342.02	432.11	1643.0	790.01
5	1542.01	654.22	1254.0	653.11
6	1453.0	765.12	1875.11	783.02
7	1132.03	665.01	1671.11	765.12
8	1342.11	568.1	1231.10	564.01
9	981.01	344.0	1321.01	432.04
10	1123.42	345.0	1221.30	456.02
11	1164.20	673.10	1365.02	460.03
12	1125.04	585.70	1278.20	770.02
13	1251.03	453.01	1314.30	660.02
14	1332.02	436.11	1343.0	780.01
15	1542.01	653.22	1454.0	673.11
16	1463.0	764.12	1575.11	793.02
17	1122.03	669.01	1671.11	785.12
18	1242.11	567.1	1331.10	574.01
19	981.01	345.0	1221.01	452.04

Appendix 4.7: Checklist of the encountered species during the study

Reptiles

S/No	Botanical name	Family	Habit	Occurrence
1	*Acalypha crenata*	Euphorbiaceae	Forb	5
2	*Acrostichum aureum*	Adiantaceae	Forb	7
3	*Ageratum conyzoides*	Asteraceae	Forb	10
4	*Alchornea cordifolia*	Euphorbiaceae	Shrub	16
5	*Alocacia cf. macrorrhiza*	Araceae	Shrub	8
6	*Alstonia boonei*	Apocynaceae	Tree	12
7	*Alternanthera sessilis*	Amaranthaceae	Forb	9
8	*Anthocleista vogelii*	Loganiaceae	Tree	16
9	*Artocarpus altilis*	Moraceae	Tree	8
10	*Aspilia africana*	Asteraceae	Forb	11
11	*Asplenium sp.*	Aspleniaceae	Forb	8
12	*Asystasia gangetica*	Acanthaceae	Forb	7
13	*Bambusa vulgaris*	Poaceae	Shrub	10
14	*Bidens pilosa*	Asteraceae	Forb	10
15	*Bolbitis auriculata*	Lomariosidaceae	Forb	9
16	*Borreria scabra*	Rubiaceae	Forb	9
17	*Brachiaria deflexa*	Poaceae	Grass	11
18	*Bridelia micrantha*	Euphorbiaceae	Tree	6
19	*Brilliantaisia sp.*	Acanthaceae	Forb	9
20	*Celosia argentea*	Amaranthaceae	Forb	8
21	*Centrosema pubescens*	Papilionoideae	Climber	14
22	*Ceratophyllum demersum*	Ceratophyllaceae	Forb	1
23	*Ceratopteris cornuta*	Adiantaceae	Forb	1
24	*Chromolaena odorata*	Asteraceae	Forb	11
25	*Cochorus olitorius*	Tiliaceae	Forb	4
26	*Cochorus tridens*	Tiliaceae	Forb	4
27	*Cocos nucifera*	Arecaceae	Tree	4
28	*Combretum sp.*	Combretaceae	Climber	8
29	*Commelina diffusa*	Commelinaceae	Climber	8
30	*Costus afer*	Zingiberaceae	Shrub	8
31	*Cyclosorus sp.*	Thelypteridaceae	Forb	9

Appendix 4.7: Checklist of the encountered species during the study

32	*Cyperus arculatus*	Cyperaceae	Forb	6
33	*Cyperus esculentus*	Cyperaceae	Forb	10
34	*Cyperus involucratus*	Cyperaceae	Forb	6
35	*Cyrtosperma senegalense*	Araceae	Forb	9
36	*Dieffenbachia seguine*	Araceae	Shrub	6
37	*Dioclea reflexa*	Papilionoideae	Climber	6
38	*Dissotis rotundifolia*	Melastomataceae	Forb	11
39	*Drepanocarpus lunatus*	Papilionoideae	Shrub	9
40	*Dryopteris marginalis*	Aspidiaceae	Forb	14
41	*Eichhornea crassipes*	Pontederiaceae	Forb	12
42	*Elaeis guineensis*	Arecaceae	Tree	15
43	*Emilia coccinea*	Asteraceae	Forb	9
44	*Ethulia conyzoides*	Asteraceae	Forb	8
45	*Euphorbia hyssopifolia*	Euphorbiaceae	Forb	11
46	*Ficus exasperata*	Moraceae	Tree	3
47	*Ficus leprieurii*	Moraceae	Shrub	4
48	*Ficus pumila*	Moraceae	Tree	6
49	*Ficus sur*	Moraceae	Tree	6
50	*Ficus trichopoda*	Moraceae	Tree	10
51	*Fleurya aestuans*	Urticaceae	Forb	10
52	*Gmelina arborea*	Verbenaceae	Tree	4
53	*Hallea stipulosa*	Rubiaceae	Tree	12
54	*Heteropteris Leona*	Malpighiaceae	Shrub	6
55	*Hewittia sublobata*	Convolvulaceae	Climber	6
56	*Hura crepitans*	Euphorbiaceae	Tree	6
57	*Ipomoea aquatica*	Convolvulaceae	Climber	11
58	*Ipomoea asarifolia*	Convolvulaceae	Climber	9
59	*Ipomoea involucrata*	Convolvulaceae	Climber	9
60	*Lantana camara*	Verbenaceae	Forb	8
61	*Leea guineensis*	Leeaceae	Climber	3
62	*Lepistemon owariense*	Convolvulaceae	Climber	7
63	*Lonchocarpus cyanescens*	Papilionoideae	Shrub	6
64	*Lonchocarpus sericeus*	Papilionoideae	Shrub	4
65	*Ludwigia abyssinica*	Onagraceae	Forb	8
66	*Ludwigia erecta*	Onagraceae	Forb	9

Appendix 4.7: Checklist of the encountered species during the study

67	*Luffa cylindrica*	Cucurbitaceae	Climber	7
68	*Lygodium microphyllum*	Schizaeceae	Forb	12
69	*Lygodium smithianum*	Schizaeceae	Forb	8
70	*Maesobotrya barteri*	Euphorbiaceae	Tree	3
71	*Mangifera indica*	Anacardiaceae	Tree	7
72	*Marantochloa purpurea*	Marantaceae	Shrub	11
73	*Mariscus alternifolius*	Cyperaceae	Forb	8
74	*Mezoneuron benthamianum*	Caesalpinioideae	Shrub	3
75	*Mikania cordata*	Asteraceae	Climber	7
76	*Momordica charantia*	Cucurbitaceae	Climber	11
77	*Musa paradisiaca*	Musaceae	Shrub	8
78	*Musa sapientum*	Musaceae	Shrub	11
79	*Musanga cecropioides*	Moraceae	Tree	8
80	*Mussaenda polita*	Rubiaceae	Shrub	9
81	*Nauclea sp.*	Rubiaceae	Tree	8
82	*Nephrolepis bisserata*	Davalliaceae	Forb	10
83	*Nymphaea lotus*	Nymphaeaceae	Forb	7
84	*Palisota hirsuta*	Commelinaceae	Shrub	7
85	*Panicum maximum*	Poaceae	Grass	10
86	*Paspalum vaginatum*	Poaceae	Grass	9
87	*Passiflora foetida*	Passifloraceae	Climber	8
88	*Pennisetum purpureum*	Poaceae	Grass	4
89	*Pentodon pentandrus*	Rubiaceae	Forb	8
90	*Peperomia pellucida*	Piperaceae	Forb	6
91	*Peureria sp.*	Papilionoideae	Climber	7
92	*Phoenix reclinata*	Arecaceae	Tree	7
93	*Phyllanthus muellerianus*	Euphorbiaceae	Shrub	7
94	*Phyllanthus reticulatus*	Euphorbiaceae	Shrub	10
95	*Pistia stratioites*	Araceae	Forb	8
96	*Platostoma africanum*	Lamiaceae	Forb	7
97	*Polygonum lanigerum*	Polygonaceae	Shrub	8
98	*Pseudospondianthus preussii*	Euphorbiaceae	Tree	6
99	*Psychotria sp.*	Rubiaceae	Shrub	8

Appendix 4.7: Checklist of the encountered species during the study

100	*Psydrax mannii*	Rubiaceae	Tree	5
101	*Quisqualis indica*	Combretaceae	Climber	7
102	*Raphia hookeri*	Arecaceae	Tree	16
103	*Raphia vinifera*	Arecaceae	Tree	7
104	*Rauvolfia vomitoria*	Apocynaceae	Tree	8
105	*Rhizophora racemosa*	Rhizophoraceae	Tree	5
106	*Sacciolepis africana*	Poaceae	Grass	10
107	*Scoparia dulcis*	Scrophulariaceae	Forb	8
108	*Senna occidentalis*	Caesalpinioideae	Shrub	8
109	*Senna siamea*	Caesalpiniaceae	Tree	3
110	*Sida corymbosa*	Malvaceae	Forb	7
111	*Smilax anceps*	Smilacaceae	Climber	6
112	*Solanum erianthum*	Solanaceae	Shrub	3
113	*Solanum lycopersicum*	Solanaceae	Climber	2
114	*Solenostemon monostachyus*	Lamiaceae	Forb	8
115	*Struchium sparganophora*	Asteraceae	Forb	8
116	*Synedrella nodiflora*	Asteraceae	Forb	7
117	*Terminalia catappa*	Combretaceae	Tree	7
118	*Tithonia diversifolia*	Asteraceae	Forb	4
119	*Tragia benthami*	Euphorbiaceae	Forb	8
120	*Tristema hirtum*	Melastomataceae	Forb	8
121	*Triumffeta cordifolia*	Tiliaceae	Forb	6
122	*Typha latifolia*	Typhaceae	Forb	6
123	*Urena lobata*	Malvaceae	Shrub	12
124	*Vernonia cinerea*	Asteraceae	Forb	8
125	*Zea mays*	Poaceae	Grass	3
	Total			**978**

Taxa	Species name	Common name
Pholidon	*Manis tricuspis*	Tree Pangolin
Rodentia	*Expixerus epii*	African Palm Squirrel
	Thryonomys swinderrianus	Grasscutter
	Antherurus africanus	Bush-Tailed Porcupine
Carnivora	*Pathera capensis*	Leopard
	Aonyx capensis	Otter

Appendix 4.7: Checklist of the encountered species during the study

	Genetta poensis	Forest Genet
Tubulidentata	*Trichenchus senegalensis*	Manatee
Artiodactyla	*Choeropis liberiensis*	Pigmy Hippopotamus
	Tragelephus spekei	Sitatunga
	Hippopotemus amphibius	Hippotemus
	Potamocherus porcus	Red River Hog
	Syncerus caffer	Buffalo
	Tragelephus scriptus	Bushback
	Cephalophus maxwelli	Maxwell duiker
	Cercopithecus sylvicultor	Yellow-backed duiker
	Cercopithecus moniticola	Blue-duiker
Reptalia	*Crocodylus niloticus*	Nile Crocodile
	Orteolaemis tetraspis	Short nose Crocodile
Primates	*Pan troglodytes*	Chimpanzee
	Cercopithecus erythrogaster	Red Bellied Quenons
	Cercopithecus mona	Mona Monkey
	Colobus verus	Olive Colombus
	Cercopithecus nictitans	Putty Nose Monkey
	Cercopithecus nictitanus	White Throated Monkey
Proboscidea	*Loxodonta africana*	Elephant

Appendix 4.8: Country's Comparative Socio-Economic Indicators

Year		Nigeria	Africa	Developing Countries	Developed Countries
Basic Demographic and Labour Indicators					
Area (in '000 km²)	2017	924	30,067	94,716	35,018
Total Population (millions)	2017	191.8	1,244.8	6,252.1	1,190.0
Urban Population (% of total)	2017	49.9	40.5	49.2	81.4
Population Density (per km²)	2017	210.6	42.4	66.0	34.0
Population Living Below $1.90 a Day (% of Population)	2016	48.6	...	s1.3	...
Population Growth Rate – Total (%)	2017	2.6	2.5	1.3	0.6
Population Growth Rate – Urban (%)	2017	4.5	3.5	2.4	0.9
Population < 15 years (%)	2017	43.8	40.8	27.9	16.6
Population 15-24 years (%)	2017	19.1	19.2	16.7	11.9
Population >= 65 years (%)	2017	2.7	3.5	6.8	17.4
GNI per Capita (US $)	2016	2 450	1 836	4 442	41 208
Labor Force Participation *- Total (%)	2017	56.6	65.8	62.3	60.3
Labor Force Participation **- Female (%)	2017	48.5	55.3	47.8	52.5
Sex Ratio (per 100 female)	2017	103.9	100.2	107.5	105.3
Human Develop. Index (Rank among 187 countries)	2015	152	...	…	…
Dependency Ratio (%)	2017	87.2	79.6	54.6	52.0
Female Population 15-49 years (% of total population)	2017	22.8	24.0	25.6	22.6
Life Expectancy at Birth – Total (years)	2017	53.6	61.9	70.2	80.7
Life Expectancy at Birth – Female (years)	2017	54.0	63.3	72.3	83.5
Crude Birth Rate (per 1,000)	2017	38.1	33.9	20.6	10.9
Crude Death Rate (per 1,000)	2017	12.3	9.0	7.5	8.6
Infant Mortality Rate (per 1,000)	2016	66.9	49.3	33.1	4.5
Child Mortality Rate (per 1,000)	2016	104.3	72.6	44.3	5.3
Total Fertility Rate (per woman)	2017	5.5	4.4	2.6	1.7
Maternal Mortality Rate (per 100,000)	2015	814.0	444.1	237.0	10.0
Women Using Contraception (%)	2017	20.5	37.6	62.1	...
Health and Nutrition Indicators					
Physicians (per 100,000 people)	2005-15	37.6	41.6	121.6	293.5
Nurses and Midwives (per 100,000 people)	2005-15	148.9	120.9	211.3	873.4

Year		**Nigeria**	**Africa**	**Developing Countries**	**Developed Countries**
Births attended by Trained Health Personnel (%)	2010-16	35.2	55.9	76.6	98.9
Access to Safe Water (% of Population)	2015	68.5	71.6	89.4	99.5
Access to Sanitation (% of Population)	2015	29.0	39.4	61.5	99.4
Percent. of Adults (aged 15-49 years) Living with HIV/AIDS	2016	2.9	3.6	1.1	...
Incidence of Tuberculosis (per 100,000)	2016	219.0	221.7	163.0	12.0
Child Immunization Against Tuberculosis (%)	2016	64.0	82.1	84.9	95.8
Child Immunization Against Measles (%)	2016	51.0	74.4	84.0	93.7
Underweight Children (% of children under 5 years)	2010-15	...	18.1	15.3	0.9
Prevalence of Stunting	2010-15	32.9	33.3	25.0	2.5
Prevalence of Undernourishment (% of population)	2015	7.9	17.5	12.3	2.7
Public Expenditure on Health (as % of GDP)	2014	0.9	2.6	3.0	7.7
Education Indicators					
Gross Enrolment Ratio (%)					
Primary School – Total	2010-16	93.7	101.7	103.8	102.6
Primary School – Female	2010-16	92.8	98.8	102.2	101.8
Secondary School – Total	2010-16	55.7	51.8	...	106.6
Secondary School – Female	2010-16	53.5	49.7	...	106.4
Primary School Female Teaching Staff (% of total)	2010-16	48.2	46.0	51.3	81.0
Adult literacy Rate – Total (%)	2010-16	...	68.6	...	...
Adult literacy Rate – Male (%)	2010-16	...	76.0	...	...
Adult literacy Rate – Female (%)	2010-16	...	61.7	...	...
Percentage of GDP Spent on Education	2010-16	...	4.9	4.1	5.2
Environmental Indicators					
Land Use Arable Land (as % of total land area)	2015	37.3	8.0	11.3	10.1
Agricultural Land (as % of land area)	2015	77.7	37.4	38.1	35.1

Year		Nigeria	Africa	Developing Countries	Developed Countries
Forest (as % of land area)	2015	7.7	21.0	31.4	28.8
Per Capita CO_2 Emissions (metric tons)	2014	0.5	1.1	3.5	11.0

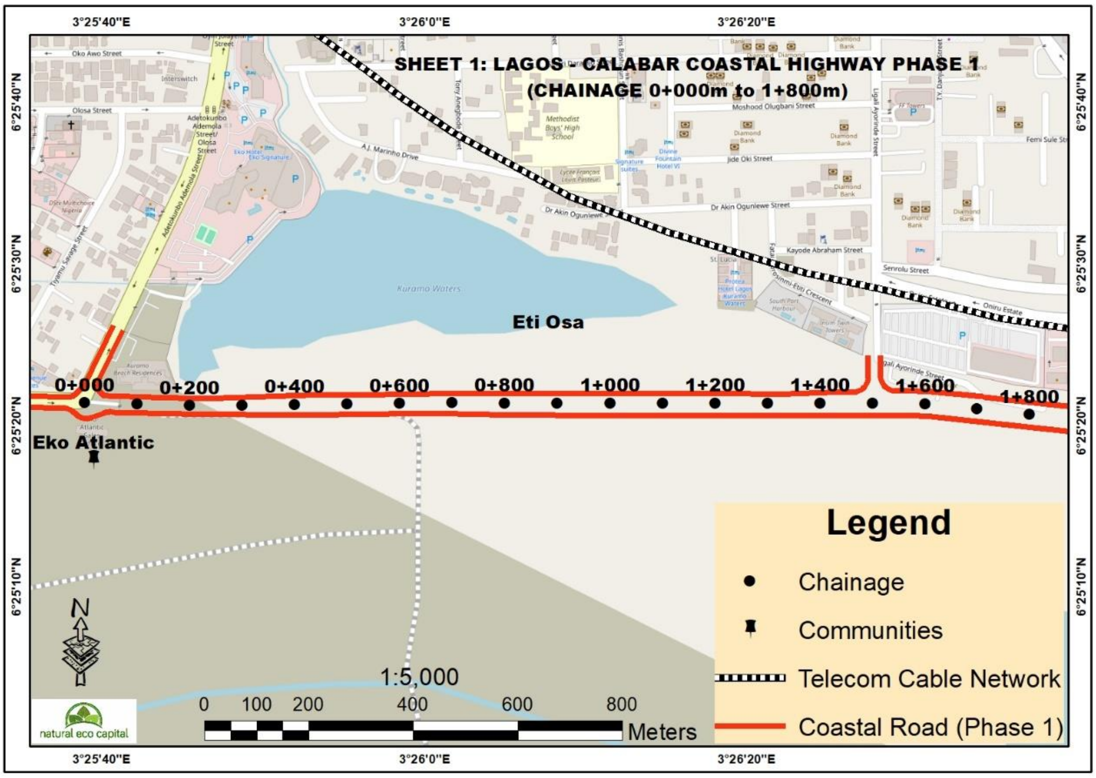
Notes: n.a.: Not Applicable; …: Data Not Available; * Labor force participation rate, total (% of total population ages 15+ years)
** Labor force participation rate, female (% of female population ages 15+ years)
Sources: *AfDB Statistics Department Databases; World Bank: World Development Indicators; UNAIDS; UNSD; WHO, UNICEF, UNDP; Country Reports*

Special Festivals in Lekki Tourism Zone

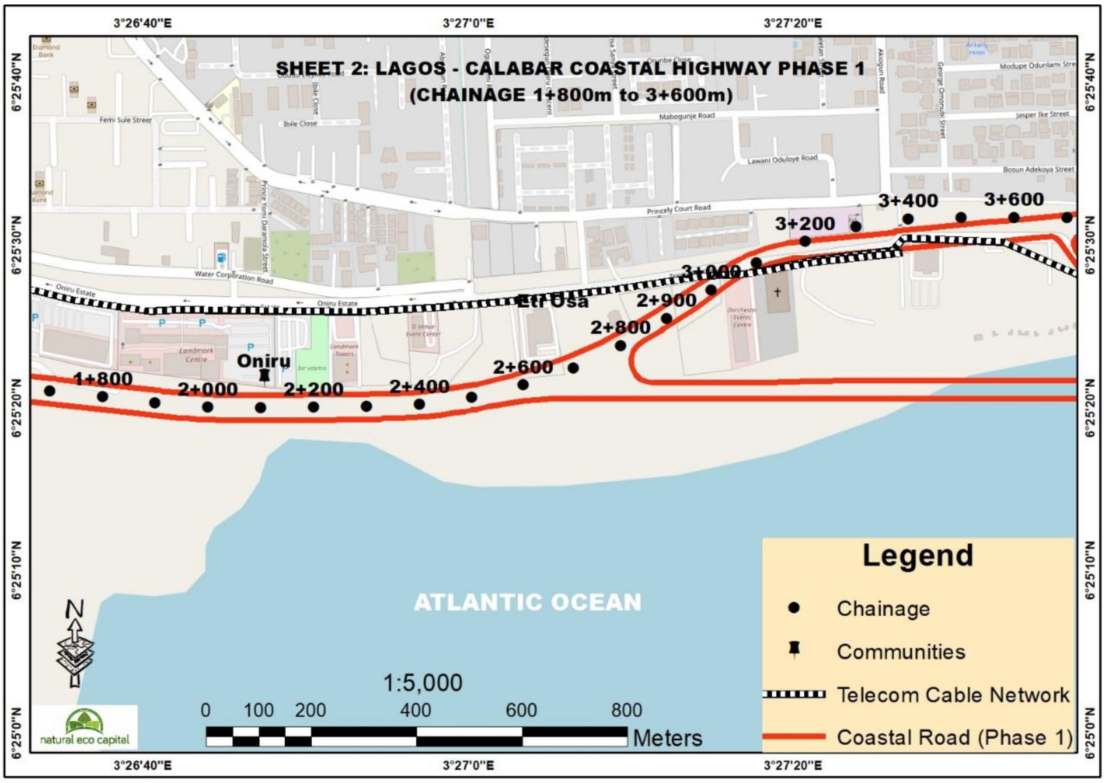
S/N	Festival	Community	Period	Duration	Restriction	Sponsor	History	Publicity	Believe	Challenge
1	Jigbo	Akodo, Idishere	March every year	3	Gender and Non-indigene	Local Govt.	From Ile- Ife	Town crier, radio, television	Healing	Believe
2	Ogodo	Idishere	Once a year	3	Gender and Non-indigene	Family abroad	To pay homage to their gods	Town crier	None	Believe
3	Kilajolu	Idishere	March yearly	1	Gender and Non-indigene	None	Fore fathers	Town crier	Remember their ancestors	Believe
4	Kilajor	Idishere	March yearly	1	Gender and Non-indigene	None	Fore fathers	Town crier	Remember their ancestors	Believe
5	Katanipo	Akodo, Iwale, Magbon-Alade, Orofun,	March yearly	3	Gender and Non-indigene	Community and LG	To worship water goddess	Radio	To make water goddess be happy with them	Believe and built- up areas
6	Ololo	Ogulu, Iwale, Orimula, Mushayo, Ikulo, Imagbon	March yearly	3	Gender and Non-indigene	Family and friends	Gods of water	Town crier, social media	To app eals water goddess	Believe, finance and civilization
7	Ado-Olomo	Iwale	March yearly	1	Gender and Non-indigene	Community members	From Ile- Ife	Town crier	Gods wor ship for children	Finance
8	Katanpo	Akodo	Once a year	3	Gender and Non-indigene	Community members	Ancestors	Town crier	For peace	Built-up areas
9	Eepa	Ikole	March Yearly	3	Gender and Non-indigene	Interested Persons	From Ile-Ife	Town crier	For joy and provision	Finance and Civilization
10	Okoro	Ikole, Ogolo , Idishere	March yearly	1	Gender and Non-indigene	Community members	From ancestors	Town crier and radio	For satisfactory	Believe and civilization
11	Oyinbo-gi	Ikole,	March Yearly	1	Gender and Non-Indigene	Boys	None	Radio	For service	Believe

Metilelu (2021)

Appendix4.9: Telecom and other utilities services along the Proposed corridor

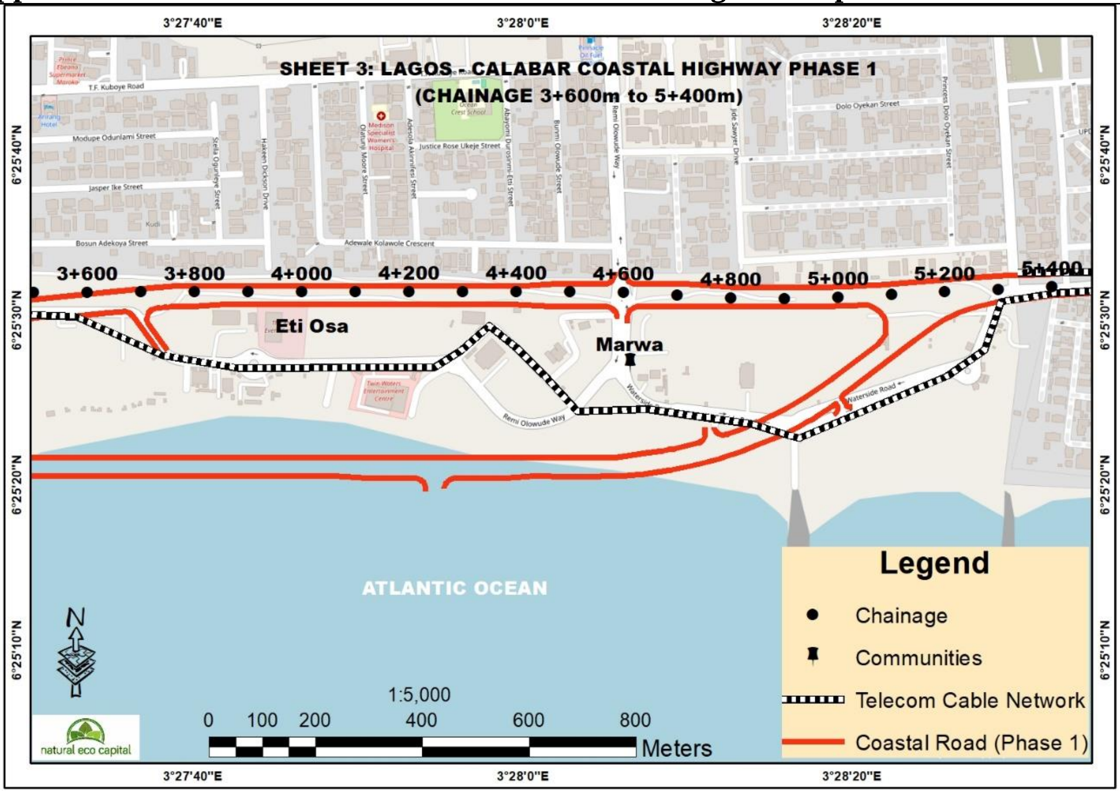


Sheet 1



Sheet 2

Appendix4.9: Telecom and other utilities services along the Proposed corridor



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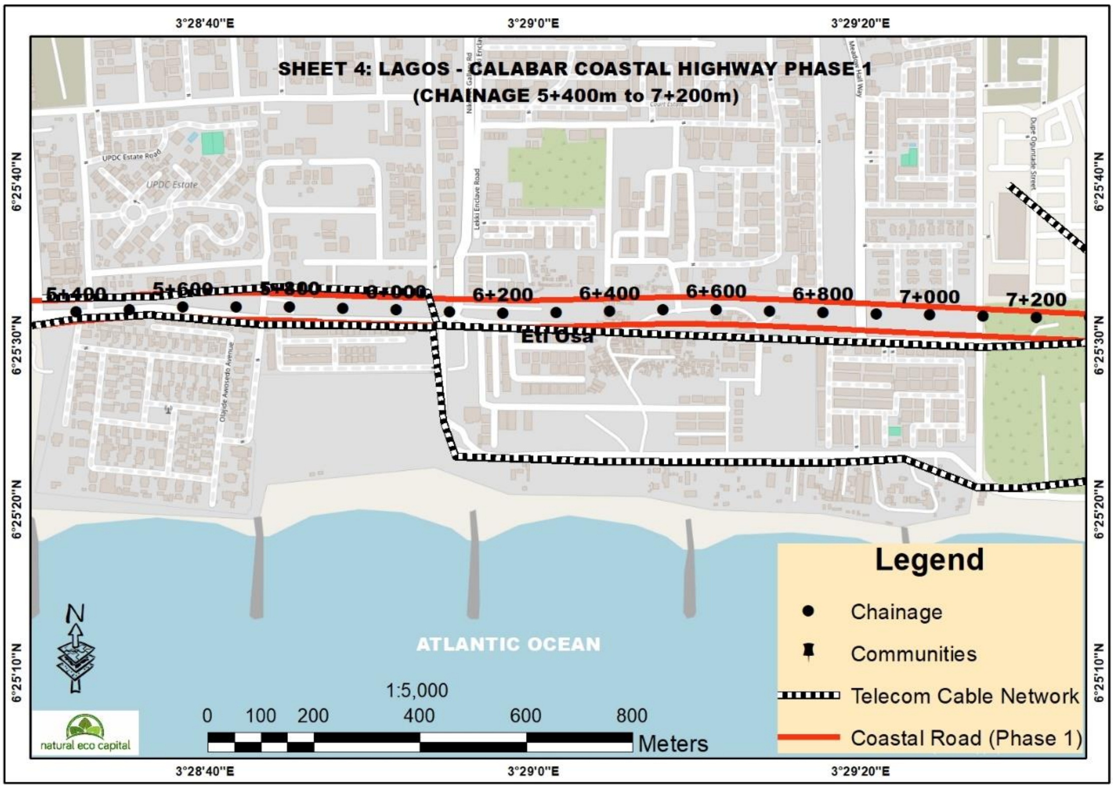
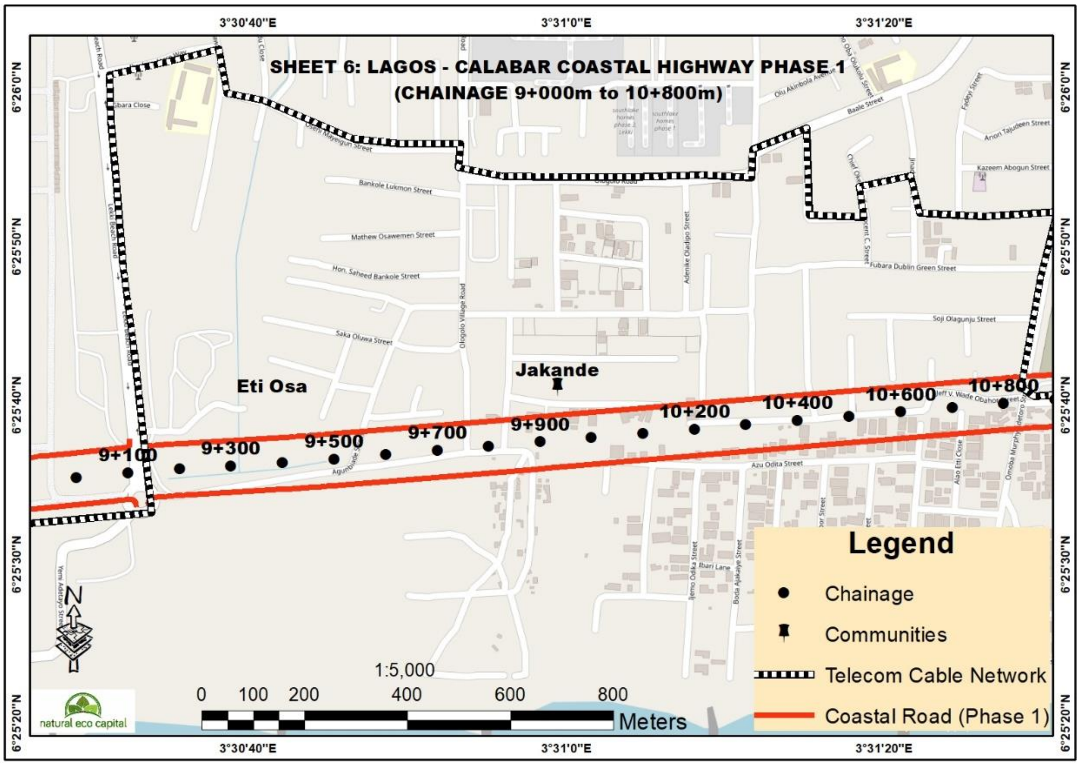


Sheet 4

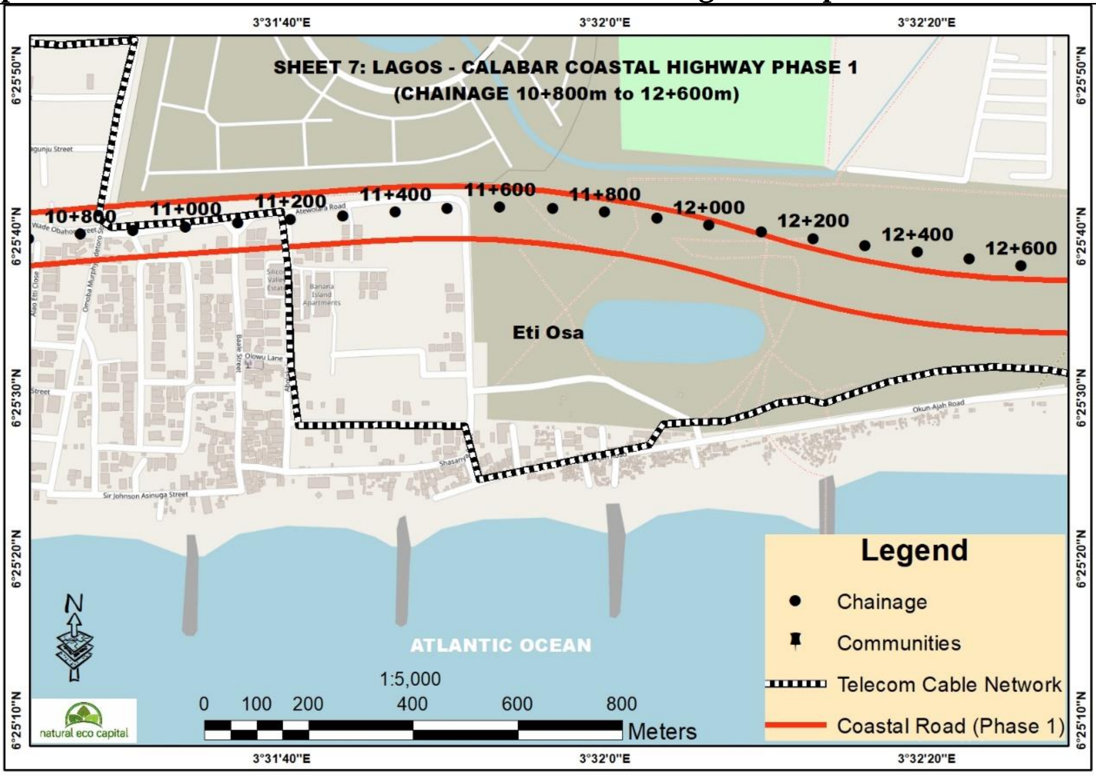
Appendix4.9: Telecom and other utilities services along the Proposed corridor

Sheet 5



Sheet 6

Appendix4.9: Telecom and other utilities services along the Proposed corridor



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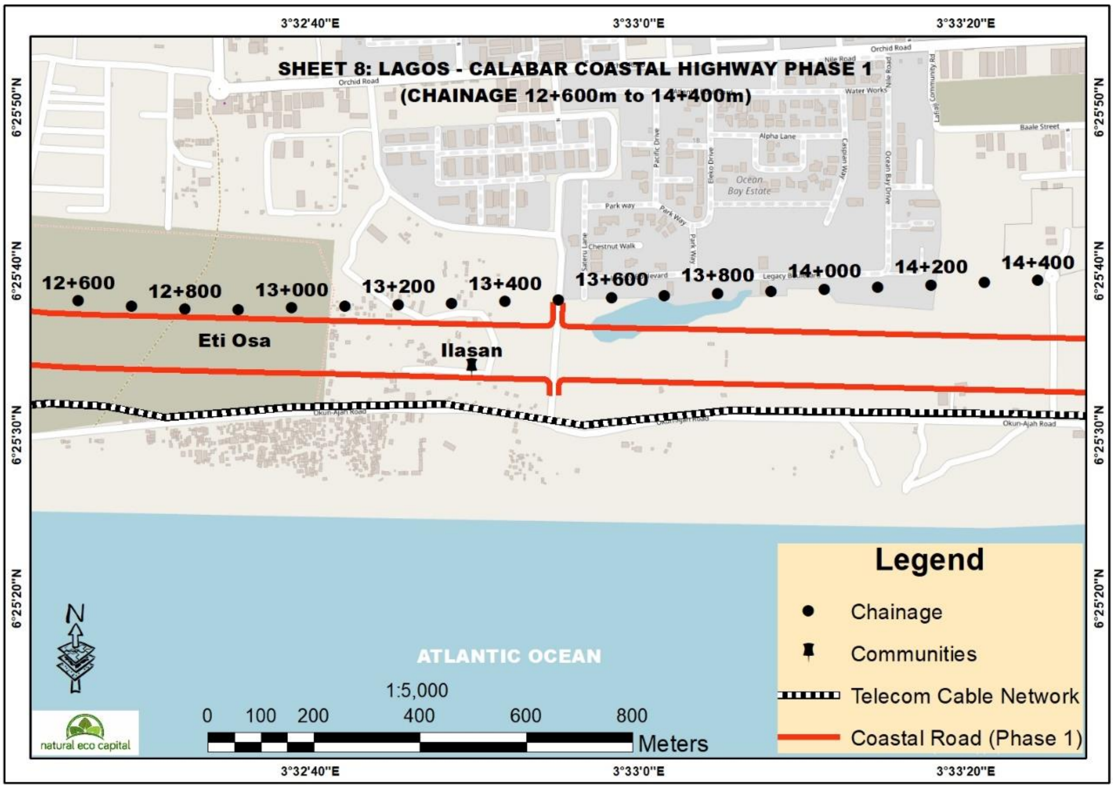
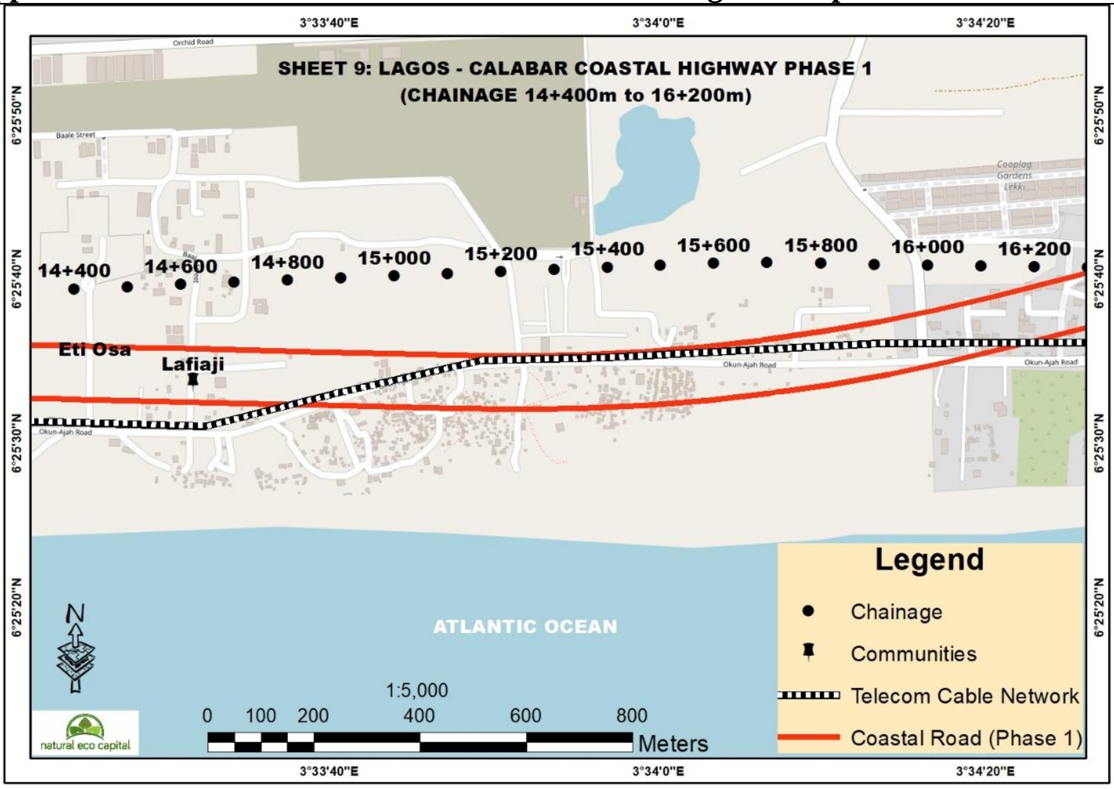


Sheet 8

Appendix4.9: Telecom and other utilities services along the Proposed corridor



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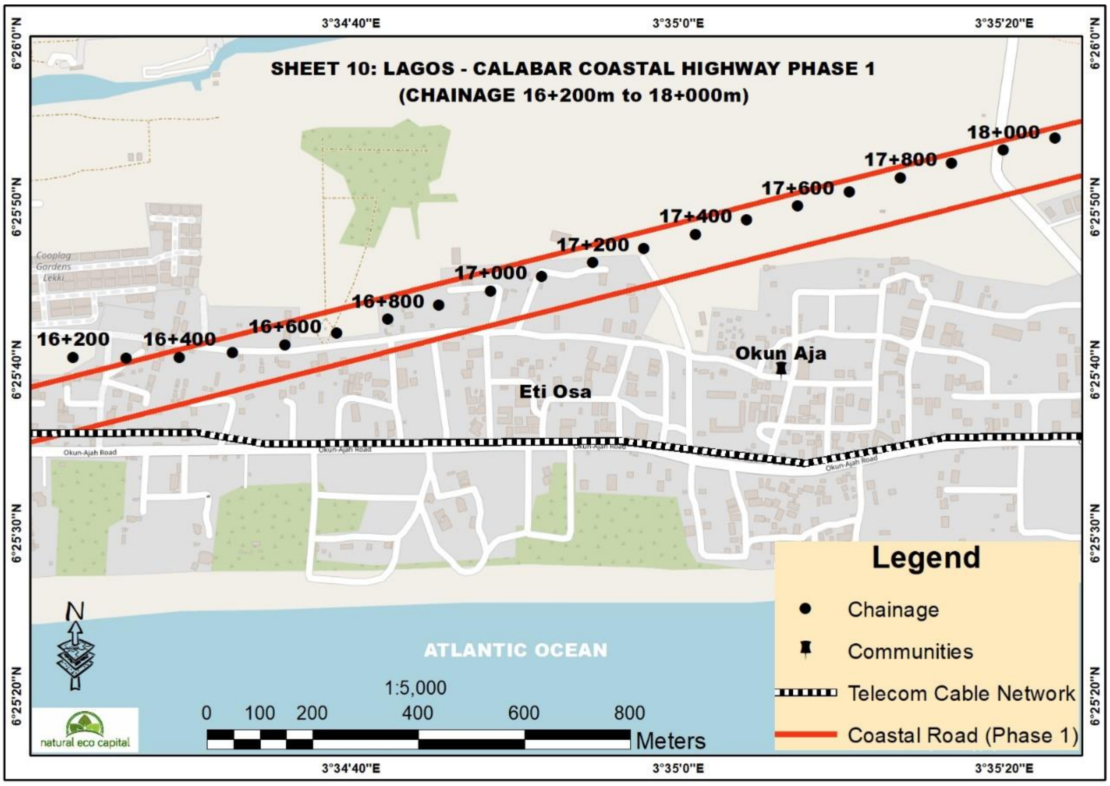
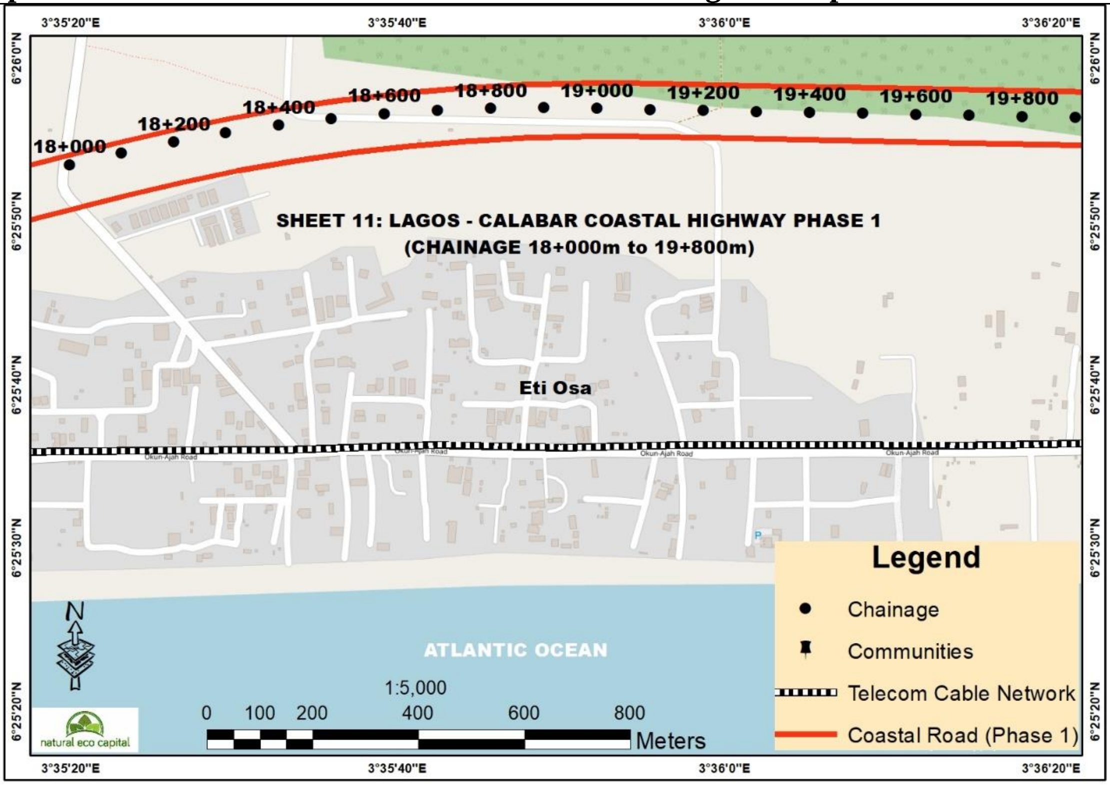
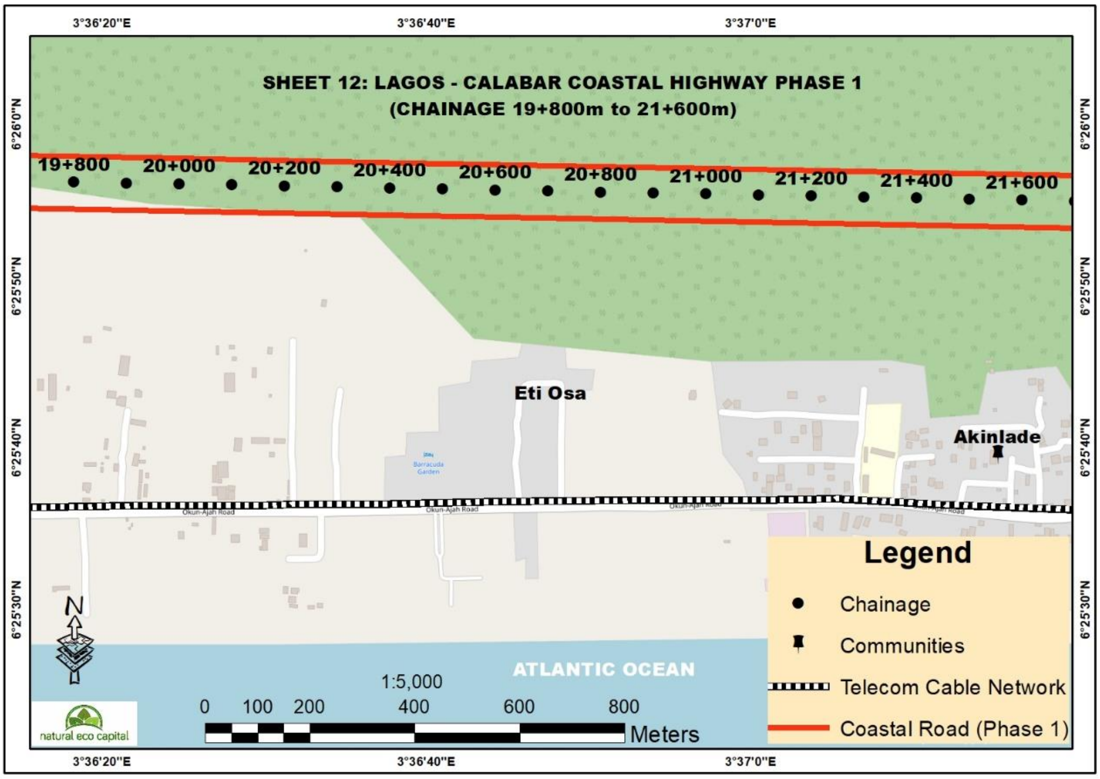


Sheet 10

Appendix4.9: Telecom and other utilities services along the Proposed corridor

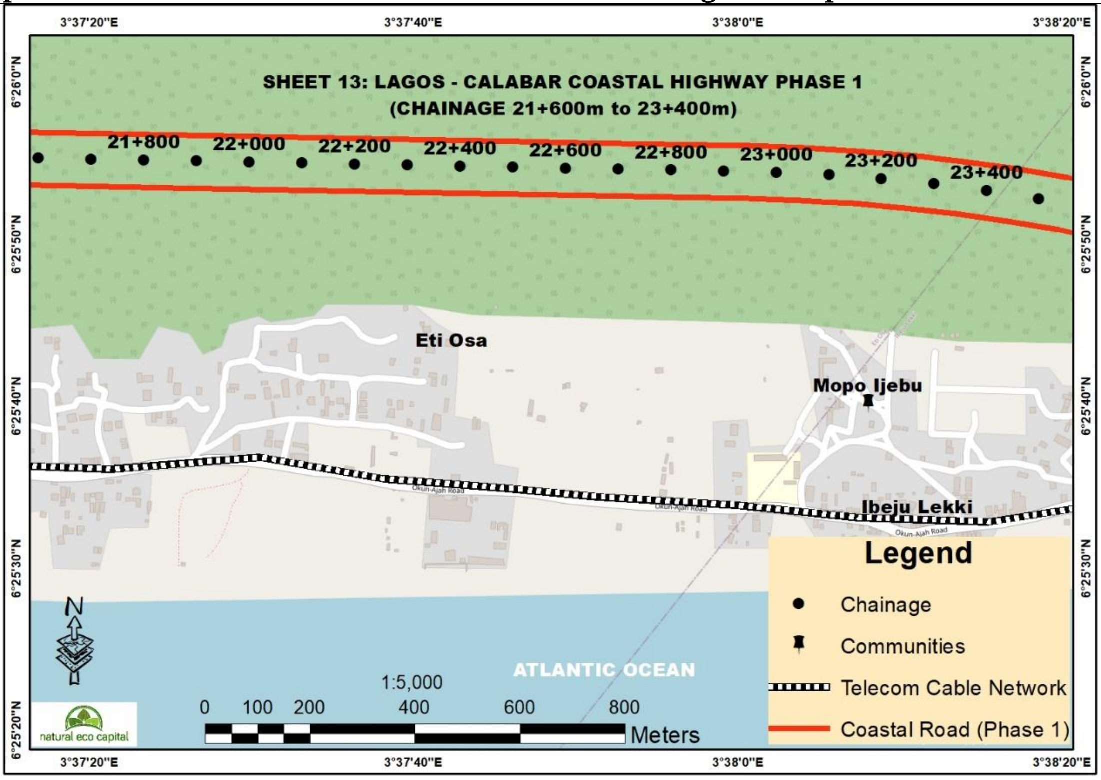


Sheet 11



Sheet 12

Appendix4.9: Telecom and other utilities services along the Proposed corridor



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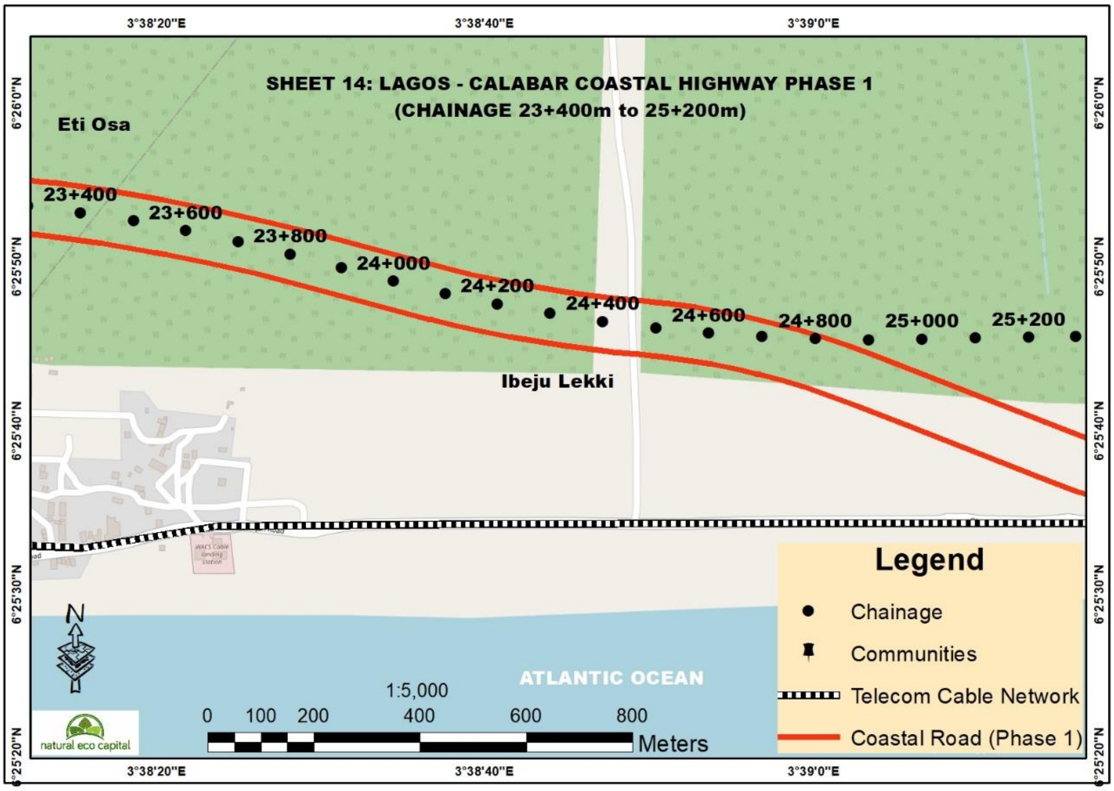
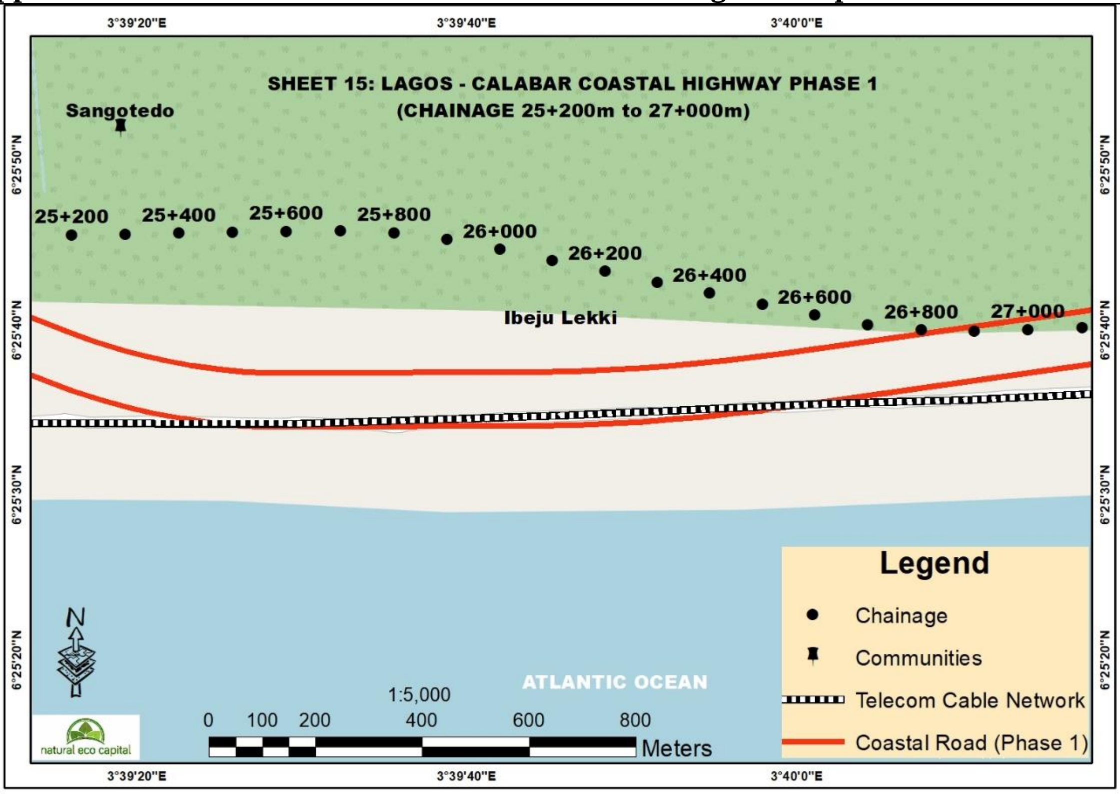
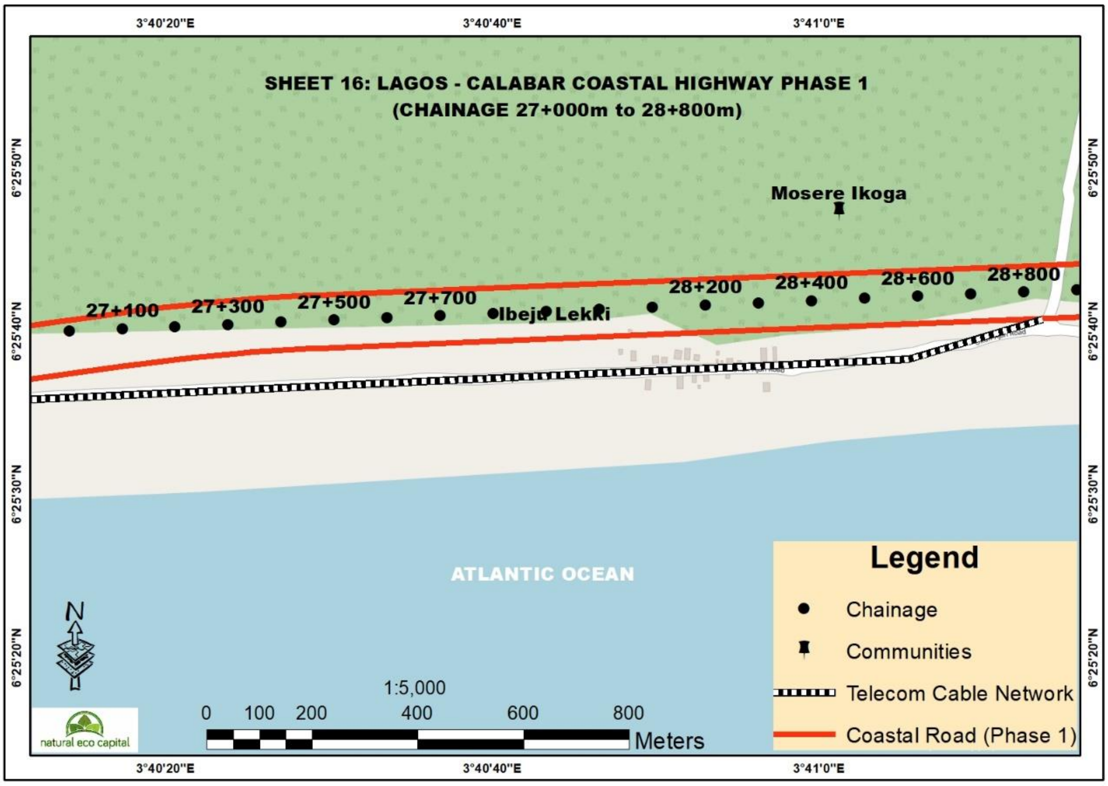


Sheet 14

Appendix4.9: Telecom and other utilities services along the Proposed corridor



Sheet 15



Sheet 16

Appendix 4.10: Stakeholders Engagement and Consultation

1. Stakeholder Engagement Approach and Outcomes

In order to obtain the views representative of a broad spectrum of the stakeholder including those in disadvantaged positions, a multi-pronged approach is followed by reaching out to every segment of the identified stakeholders announcing the project and the opportunity to participate both verbally and in writing, electronically and in print media. In other words, the opportunity to comment and to raise issues for evaluation was announced to the broadest range of stakeholders.

Especially for the communities, "ladder of engagement", which describes basic forms of public consultation at the bottom, rising to full public participation at the top was adopted and these include:

- Informing - telling participants about some decision which has already been taken (for example explaining the reasons for, or benefits of, something contentious or criticised).
- Consulting - seeking participants' ideas or views as an input to some decision which the council/government will take.
- Deciding together - sharing the decision with the community; giving the community some real power; and
- Supporting community decisions - allowing the community to make the decision with the council/government at most providing advice or comment.

At the early stage, capacity of all stakeholders was enhanced with the manner and level of background information conveyed to them which were presented in no technical language and generally made sufficiently clear. Empowering the stakeholders through this manner of information transfer enabled them to participate meaningfully and to the best of their ability as much as reasonably possible.

Furthermore, general meetings were coupled with an "open house" component where small groups of people were briefed in the language that was considered right to reach their minds and hearts for meaningful contributions.

2. The Stakeholders Consulted

Stakeholders, for the purpose of this project were defined as all those people and institutions that have an interest in the successful planning and execution of the project. This includes those positively and negatively affected by the project.

The wide range of stakeholders identified ranged from members of the local communities with limited levels of education and specific cultural values to others with relatively high levels of education, skills and understanding.

Specifically, the key stakeholders identified and consulted in the area included leaders in the communities, individual people who own asset that will be directly or indirectly affected and business owners. Appendix 1 contains the schedule of the public meetings held across the corridor. Appendix 2 shows a list of some of stakeholders’ meetings held with cross sections pictures of some of the stakeholders.

3. Focus of Engagement:

During the meeting, stakeholders were reminded of the delicate balance between development and environmental preservation. It was emphasised that the proposed road traverses ecologically sensitive areas and mixed human developments. The project's commitment to environmental stewardship is reinforced through the Environmental and Social Impact

Assessment (ESIA) process. Stakeholders support is key to understanding their support, fears and concern and how to manage any arising impacts.

4. **Summary of Issues from Stakeholders**

Most stakeholders saw all meetings as very good step toward bringing people together.

Key Stakeholder Concerns:

a. **Enumeration, Compensation, And Property Realignment.**

The stakeholders' feedback centred on enumeration, compensation, and property realignment. Here are the key comments raised:

- **Realigning to Avoid Affected Assets:** Stakeholders expressed the need for careful realignment to minimise the impact on affected properties.
- **Temporary Suspension of Asset Marking:** Some stakeholders reported hospitalisations due to the marking of ancestral properties (specifically in the Okun Aja area).
- **Actual Width of Acquisition Zone:** Concerns about the discrepancy between the initially communicated meter width before Jakande Estate and the observed reality were raised.
- **Request for Additional Time to Relocate:** Stakeholders requested more time to relocate from affected properties.
- **Properties on the Right-Hand Side Outbound:** The fate of properties on the right-hand side of the corridor remains a valid concern.

b. **Environment and Social**

- **Biodiversity Concerns:** Experts emphasize that compensation to stakeholders should not overshadow the project's impact on the environment, biodiversity, and ecosystem within the corridor. Waiting for the ESIA report which usually take some time is not an option; immediate action is necessary. The project may displace animals like pythons and crocodiles. Contractors must be trained to recognize and rescue these organisms.
- **Cultural Heritage**: Deities that the community worships should not be wiped out but appeased to avoid accidents after highway construction. Heritage should not be overlooked. Will the Government give them another piece of land instead of the one they have already taken?
- **Compensation of other nearby communities and not just the host communities:** The effects of environmental pollution affect both close and far communities, and thus, impacted communities should be compensated accordingly.
- **Impact on the means of livelihood:** Fishing is the major primary means of livelihood in these communities. Fishermen use the water for fishing.
- **Dust/Emission issues**: emissions into the air and noise from truck movements and vibrations due to the ongoing construction are affecting the community people, especially around Eleko.
- **Flood issues**: The height of the road is higher than the level of the community nearby, making it vulnerable to erosion/flooding during the rainy season.
- **Safety issue in relation to transport:** Truck drivers should be warned to stop over speeding to avoid causing accidents, and the contractor should attend to community members with respect whenever a complaint is reported to them.
- **An alternative road** should be made for truck movements as the road is damaged and must be fixed to avoid accidents.

5. **Some Recommendations by stakeholders**

- The project should showcase environmental consciousness.

- Implications for the biodiversity action plan should be cost-effective.
- We request alignment details to assess impacts **around conservation areas.**
- Given rising ocean transgressions, integrated coastal protection is crucial.

Appendix 4.10: Stakeholders Engagement Plan

S/NO	Group of Stakeholders	Objective	Engagement Methods	Date	Venue
1	Affected Individuals	Address individual concerns and grievances related to the project.	• Individual consultations: One-on-one discussions to understand their specific issues. • Grievance mechanisms: Establish processes for reporting and resolving complaints.	Ongoing as part of the enumeration	Along the alignment
2	Local Communities	Engage with the broader community to ensure transparency and gather feedback.	• Town hall meetings: Large gatherings where project updates are shared, and questions are answered. • Community workshops: Interactive sessions to discuss project details and address community needs. • Door-to-door visits: Personalized communication with residents.	Ongoing and further dates to be arranged once alignment is clear	Eko Hotels (done Twice)
3	Communities Along Chainage 1-24 Km	Understanding the needs and concerns of each community segment.	• Adapt based on local context and preferences.	May 15, 2024	FMW, TBS
4	Communities Along 24-47.5Km	Understanding the needs and concerns of each community segment.	• Adapt based on local context and preferences.	May 17, 2024	FMW, TBS
5	Government Agencies	Ensure alignment, regulatory compliance, and joint planning.	• Formal consultations: Structured meetings with government representatives. • Regular updates: Keep agencies informed about project progress. • Joint planning: Collaborate on	Ongoing/routine	

Appendix 4.10: Stakeholders Engagement Plan					
S/NO	**Group of Stakeholders**	**Objective**	**Engagement Methods**	**Date**	**Venue**
			project milestones and approvals.		
5	CSOs	Involve CSOs in environmental aspects and community well-being.	• Workshops: Discuss environmental impact assessments, mitigation, and monitoring. • Focus groups: Gather CSO input on specific topics. • Collaboration: Partner with CSOs for community development.	May 17, 2024	FMW, TBS
6	Media	Disseminate accurate project information and manage public perception.	• Press releases: Share project updates and milestones. • Interviews: Provide insights to journalists. • Project updates: Regular communication with media outlets.	Ongoing	TV Stations and News and News from other media and
	General Public	Engage with the broader public to create awareness, manage expectations, and address concerns	• Public Awareness Campaigns: Use billboards, radio, and social media to inform the public about the project's benefits, timelines, and potential disruptions. • Community Meetings: Organize town hall sessions where residents can voice their opinions and ask questions. • Feedback Channels: Set up hotlines, email addresses, or online forms for public inquiries and feedback. • Educational Workshops: Conduct workshops on road safety, environmental	Ongoing as part of general consultation	TV Stations and News from other media and face to face

Appendix 4.10: Stakeholders Engagement Plan

S/NO	Group of Stakeholders	Objective	Engagement Methods	Date	Venue
			impact, and project updates.		
	International Stakeholders	Engage with stakeholders beyond national borders who have an interest in the project	• Diplomatic Channels: Collaborate with relevant embassies and consulates to keep international stakeholders informed. • International Conferences and Forums: Participate in global infrastructure events to share project progress and seek partnerships. • Project Updates on International Platforms: Use international media outlets, industry journals, and online platforms to disseminate information. • Bilateral Agreements: If applicable, negotiate agreements with neighbouring countries to ensure smooth cross-border transportation.	Ongoing as part of general consultation	News from media

Appendix 4.10
SCOPING REPORT Coordinated by the Federal Ministry of Environment
Stakeholders at the Scoping Workshop

The key stakeholders that participated in the Workshop included representatives from the followings: Federal Ministry of Environment- Representatives of the Minister and the Federal Controller of the Ministry in Lagos State; Lagos State Ministry of Environment and Water Resources, Federal Ministry of Works officials, Hitch, NGO's, NCF, Public and private sectors, LGA Reps, the Academics, the Host Communities members, NEC team etc. The Attendance lists are included in Appendix 1.

Achievements and key discussion points

Table below provides a matrix of participants' comments/observations and the responses compiled at the workshop.

Appendix4.10 : Stakeholders' Comments

Stakeholders' Questions/Comments/Observations	**Consultants' Responses/**
Mr. Richard expresses his displeasure as a citizen in diaspora who has invested in stores in Landmark and Oniru, where he had spent over 50 million naira on the temporary structure and provided source of livelihood for over 28 staff. He asked why he was not considered for compensation after marking his store in the right of way for the project. He further asked why consultation was not made before the marking for demolition of the people's structure.	Dr. Eugene (CEO, of Natural Eco-capital) reassured all participants that the various suggestions and technologies required will be imbibed and every contributor will be adequately acknowledged. He went further to state that stock-taking of climate action will be adequately looked into considering his experience in capital coalition and climate action plan for the country. He then advised every contributor to ensure proper title on their assets. He went further to share the grievance redress platform for online and various tools, pieces of information or any contributions that can be provided by experts i.e. neclagcalcoastalroad2024@gmail.com Engr. Dare (FMOW) reassured that land acquired and materials will be valued, and the compensation committee will see to them. He then stated that the members of the
Mr. Mamore (Conservationist) commended the project and drew attention to the impact of the project on Lekki conservation where the 100 meters will begin from at Jakande Housing Estate. He further stated that biodiversity impact is a concern considering animal sensitivity to noise and encroachment. He emphasized that animals wander and crossroads at will and that can be an issue of concern.	
Engr. Gbolahan Awonusi.raised concerns on the timeline of the project. He wanted clarifications on the total time for the project of the first section. Secondly, he asked if the railway track been designed and is it going to be handled by HiTECH? Has the impact of the railway tracks been put into consideration for the ESIA & RAP? He then mentioned that auxiliary activities along with social impact should be captured properly.	

<table>
<tr><td></td><td rowspan="7">committee are mostly here in Lagos and the secretary to the committee was introduced domiciled in the Ministry of Physical Planning and Urban development, Lagos. He then went further to state on the issue of road accidents that Hitech will deploy more safety officers to curb the effect of the activities. He further requested that brilliant engineers and craftsmen are needed for employment by Hitech, and consideration is given to the indigenous community. He then admonished Hitch to look at Baale Repo area consideration for realignment of the right of way.

Furthermore, all the issues identified will be given further attention in the course of the preparation of the ESIA.

Best practice project as well as the principle of circular economy to be shown and adequate mitigation & management measures would be given attention also.

Finally implore all stakeholders involved to review the report when displayed by the ministry and also participation of the experts in knowledge sharing, tools and technologies are welcomed to ensure the project captures all needed without excluding vital areas.

Throughout the project, consultations will be made with relevant stakeholders to ensure the right things are done and all concerns can be made known through the provided email above.</td></tr>
<tr><td>A community member asked if coastal erosion for this project has been duly considered. He went further to ask if the waterways of the mangrove areas were adequately considered as well.</td></tr>
<tr><td>Conservationists highlighted several issues of concern for proper consideration including.
a. Online platform for sharing of concerns.
b. Carbon footprint calculation through recognized tools
c. Road resilience to ocean encroachment
d. On RAP, he asked if land will be acquired with the materials (Sand fill) that are affected by the right of way of the project.
e. Will building type along the corridor of the highway change?
f. How can complaints get to the compensation committee?
g. When is the section 2 of the project commencing?</td></tr>
<tr><td>Engr. Chisom (Office of Drainage Service – Lagos State Ministry of Environment and Water Resources) asked if the plan of the drainage features can be made available to the office of the Drainage Services to see the alignment of the project to Lagos State Master Plan for the areas in the corridor of the project.</td></tr>
<tr><td>Mrs. Olufisayo (Legal Practitioners) vehemently stated the violation of section 21 of the EIA act which demands that EIA or ESIA should have been concluded before the commencement of construction or demolition. She then went further to ask if there could be redesigning of the route of the right of way to avoid heavy compensation by avoiding some structures by taking a closer look at the inhabited areas to join existing roads.</td></tr>
<tr><td>Mr. Moses Ogunleye (consultant) was rhetorically verbose on section 2 of the project and asked if the ESIA covered all the projects or just section 1 or phase 1. He further asked why the right of way in Boditi extended to 1.5km from the shoreline. He then advised that the corridor development plan be properly considered.</td></tr>
<tr><td>Otunba Sola Enitan (legal practitioners coalition for land rights) reiterated that consideration should be towards.
a. Hazardous Materials Transportation
b. Ancestral livelihood and transition
c. Issues around primary demography
d. Cultural destabilization and restoration
e. Road support through post-impact assessment</td></tr>
</table>

f. Monitoring, Reporting, Transparency, and availability of information	
Engr. Olowa (Chairman Ibeju-Lekki LCDA) raised concerns on the road alignment at Mopo-Ijebu and Eleko village. He further asked for adequate consideration of indigenous community identity that could be lost in this project. He highlighted that on completion of the project, low-income housing should be considered for the people because the cost of real estate will be unaffordable for the indigenous community. He went further to describe the ongoing construction poses a great road accident risk to the populace. He then advised the contractor (HiTECH) to consult the LG to align the project with Lagos State Master Plan which is available at the Ibeju-Lekki LGA. He concluded by appealing to Engr. Dare (FMOW) on Iwe erepo area for consideration.	

Focused Group Meetings with Communities Along Different Chainages Date: MAY 16, 2024

1. Communities Along 1-24Km

<table>
<tr><th>S/NO</th><th>Group of Stakeholders</th><th>Objective</th><th>Engagement Methods</th><th colspan="2">Observations/Expectation/needs and Response by FMW</th><th>Remarks</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Communities Along 1-24Km</td><td rowspan="3">Understanding the needs and concerns of each community segment. Engage with the broader public to create awareness, manage expectations, and address concerns</td><td rowspan="3">Focused Group Discussion</td><td>Issues raised</td><td>How they were addressed</td><td rowspan="3">The stakeholders' feedback primarily centered around enumeration, compensation, and property realignment. Here are the key comments raised:</td></tr>
<tr><td>The representatives of Okunaja Community stated that their concerns arose from the alignment's impact on their community. They said they were comfortable with the alignment done in March this year, though it had some adverse effects. They were unhappy with the latest alignment, which threatened to wipe out their community with the potential loss of about 700 houses, their roots, monuments, and ancestral homes. They demanded that the alignment be revisited as they were uncomfortable with the current state.
A representative of the Lafiaji Community also raised the issue of the real coastal line, stating that by law, the area for which the Federal Government has claims should be as it was in the past. He suggested that to ensure the people are not adversely affected, a better alignment should be worked out to reduce the impact on the communities.

Markings are ongoing now and making people apprehensive, and we kindly request that this be supported until the HM comes next week, as assured.</td><td>In her response, the Federal Controller of Works said the Okunaja issue has been considered and that the Federal Minister of Works has shown interest in resolving it. As the matter continued, she appealed to the Okunaja Community to exercise patience. The Minister is scheduled to visit on Wednesday next, and we will bring it to his attention and consideration. She also agreed that further marking of structures should be suspended until the Minister intervenes. Additional details will be supplied later.</td></tr>
<tr><td>Another contributor who claimed to be a legal representative of some of the people in the communities, including Landmark, stated that the area the Federal Government was entitled to has to be interpreted not with the present shoreline but as it was in 1967.</td><td>The project has taken into cognisance all relevant laws</td></tr>
</table>

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs and Response by FMW		Remarks
				Some others wondered why some properties outside the alignment were also marked and noticed served their owners. Another drew attention to the difference in the size of the impacted area between what was marked and the figure on the notice given.	The Federal Government plans to have a world-class tourism center along the coastal areas, which will attract investments and boost business activities. That, she said, is the reason that some areas right of the alignment have been marked for acquisition. The space marked for acquisition may have been added to what was indicated in the notice.	
				More time should be given to us to pack out.	The Government is a listening one and would address all concerns.	
				What will happen to all properties on the right-hand side outbound of the corridor?	The final design will reveal what happens. However, it is critical to understand that integrated coastal management is needed to ensure the shoreline is saved from coastal erosion, which appears imminent.	






Stakeholders engagement with Communities Along 1-24Km

2. Communities Along 24-47.5Km Date: MAY 17, 2024

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
2	Communities Along 24-47.5Km	Understanding the needs and concerns of each community segment. Engage with the broader public to create awareness, manage expectations, and address concerns	Focused group Discussion	c. **Cultural Heritage**: Deities that the community worships should not be wiped out but appeased to avoid accidents after highway construction. Heritage should not be overlooked. Will the Government give them another piece of land instead of the one they have already taken? d. **Compensation of other nearby communities and not just the host communities:** The effects of environmental pollution affect both close and far communities, and thus, impacted communities should be compensated accordingly. e. **This meeting**: This meeting is a very good step toward bringing people together. f. **Impact on the means of livelihood:** Fishing is the major primary means of livelihood in these communities. Fishermen use the water for fishing. g. **Use the old alignment:** The original survey, done over ten years ago, is not followed today, resulting in excessive damage to the community,	The Government will help them understand their cultural heritage, and a management plan will support the issues. The Federal Government and the ESIA also recognise the importance of cultural heritage, and it should be looked into. It would be good if it could be avoided; otherwise, it could be relocated with government support. Old alignment impacts are high, and the new alignment has the least impact. The Government will not do anything intentionally to harm or suffer its people. With development, there will be both positive and negative impacts. The old alignment is not sufficient to accommodate the proposed scope of the Project in terms of wideness and to avoid traffic issues and the destruction of more structures. RAP will also	It was generally agreed that the old alignment impacts are high, and the new alignment has the least impact. •

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
				houses, and places of worship. We want the old alignment to be followed and used. The Awereko community was badly affected, but this can be avoided if the old alignment is used. Returning to the old alignment will resolve all other implications and issues. h. **Dust/Emission issues**: emissions into the air and noise from truck movements and vibrations due to the ongoing construction are affecting the community people, especially around Eleko. i. **Flood issues**: The height of the road is higher than the level of the community nearby, making it vulnerable to erosion/flooding during the rainy season. j. **Safety issue in relation to transport:** Truck drivers should be warned to stop overspeeding to avoid causing accidents, and the contractor should attend to community members with respect whenever a complaint is reported to them. This will be addressed in the Transport Management Plan	address the displacement issue. The Government will always go for the impacts of the less effect. Consultation starts somewhere and continues; if you were not part of the earlier consultations, it does not mean that others were not there. Make your contributions with new ideas that will be in the management plan. Federal government-appointed valuers will take note of the properties and value them, and the valuation will be used for compensation. They will appeal to the community to allow them to do their work so they can get appropriate compensation. The ESIA consultant will work with the community to develop a heritage management plan. •	

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
				k. **An alternative road** should be made for truck movements as the road is damaged and must be fixed to avoid accidents. **SUGGESTIONS MADE BY STAKEHOLDERS** 1. Why can't the Government spend the money and go do **underground transport and avoid or reduce the high negative impacts**? The communities have been in existence for over 647 years (iwerekun). Why do you want us to move? We cannot move. I am pleading for the Government to please look into it and also look at what is available in other countries, like using tunnels. One of the kabios(Kabiyesi) agreed to take up the contract and support this kind of Project. **l. Use of barriers to stop the water surge:** Do a barrier that will stop the water from encroaching. If not done, it will also affect the Project. Make a barrier; you cannot resettle a king to another place to be under another king. • The valuers working along these chainages should hold off on their work to avoid agitation from community members, especially those enumerating structures within 250 meters of the shoreline.		

Communities Along 24-47.5KM

Field Meetings with Host Community Members- Chainage 0-47.4km

3. Field Meetings with Host Community Members- Chainage 0-47.4km

Stakeholders Reactions & Concerns
Showed displeasure about the proposed project affecting ancestral land and heritage; their most paramount concern and need is for the government to go back to the original alignment proposed for the project
They want the government to build them schools, health care centre and model market.
one of their deities is on the new alignment of the project. They said it was very important. that rituals are performed before work can commence on the land. If not, there will be grave consequences and the project may not progress. They will like the government to also build them model market health care centre and more senior secondary school.
Their major worries and concern are that the project is going to affect a lot of their cultural heritage, the water bodies, fishes, and other livestock which is a major source of their livelihood will be gone. And their major occupation is fishing. They will like government to build barriers between the water and the community because of erosion. They also want government to build schools, hospitals, marketplaces as they don't have any of these. They also want government to provide with lands where they can resettle the affected people and they cemeteries.
The community members were not happy and receptive because they want government to go back to the former alignment.
The change of alignment which now has affected those that were not affected before; resulting to grievances and agitations.
Worried about the impact of the project on their business. They said that while they understand the need for development, they're concerned about the negative consequences for them. Specifically, they're worried about losing their means of livelihood, the investments they've made in their business, unpaid loans, and the jobs of the staff they employed. They also asked if there's any way the project could be changed to reduce the impact on their businesses.
Upset about the fact that his entire property would be demolished as part of the project, and he was concerned about the loss of all of the expensive equipment inside
Government should consider replacement for project Affected households, also development of the area for more government
There nothing they can do if the government wants the land, but they should please not leave them stranded, they have young ones growing up in the community so their dreams are not cut short and should provide them with necessary social amenities.

Field Meetings with Host Community Members- Chainage 0-47.4km


GPS Map Camera
Eti-Osa,Lagos,Nigeria
Olosa Street, Eti-Osa, Lagos, Nigeria
Lat 6.433244, Long 3.750288
05/06/2024 12:10 PM GMT+01:00
Note : Captured by GPS Map Camera


GPS Map Camera
Ibeju/Lekki,Lagos,Nigeria
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Note : Captured by GPS Map Camera


GPS Map Camera
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GPS Map Camera
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GPS Map Camera
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GPS Map Camera
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GPS Map Camera
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Note : Captured by GPS Map Camera

Field Meetings with Host Community Members- Chainage 0-47.4km

Appendix 5: Project Affected Persons, Project affected host communities, Local Communities, general public.

2	General Public including project host communities, Local Communities professionals, media, etc	Disseminate accurate project information and manage public perception. • Present the proposed project to the stakeholders. • State the project's objective with emphasis on the benefits. • Inform the stakeholders of the readiness of the government to execute the project. • That the funding of the project was not a challenge as the partners have a guaranteed source of funding • Demonstrates transparency and accountability. • Solicit the cooperation of the stakeholders who should also see themselves as partners. Prove that the government's readiness to comply with all relevant regulations with the appointment of the ESIA consultant	Town hall meetings: Large gatherings where project updates were shared, and questions answered. • Community workshops: Interactive sessions to discuss project details and address community needs.	Eko Hotel, Vi., Lagos	Thursday, April 11, 2024	**Why is old alignment not being followed in Okunaja Community?** The EIA Act of 1992 stipulates that an Environmental Impact Assessment (EIA) must be approved by the Federal Ministry of Environment before the commencement of any project unless an exemption has been granted. Is there any approval? The project ...????	The **Lagos-Calabar Coastal Highway project** is a significant development for Nigeria. It spans approximately **700 kilometers** along the coastline, aiming to enhance travel and trade. The project prioritizes fairness, infrastructure, and proper documentation. The construction will control the menace of ocean surge threatening many communities. **Spurs and Connectivity to the highway**: • Sokoto-Badagry spur, which was conceived during President Shagari's administration. • This spur will connect the ongoing Lagos-Badagry route being developed by both the federal government and state government. • Additionally, the coastal road will link to the Enugu-Abakaliki-Ogoja-Cameroon African Trans-Saharan route. **Distance and Travel Time**: • The Sokoto-Badagry route spans 1,000 kilometers. • From the spur of the trans-Saharan trade route down to Apo in Abuja, it covers 461 kilometers. • Travel time will significantly improve: Sokoto to Lagos in about 10 hours, and southeast to Abuja in a maximum of 5 hours. **Economic Impact**: • The roads will be constructed with concrete pavements, attracting foreign investment. • This investment will strengthen and stabilize the Nigerian naira.

							• The corridor will also offer land for tourism, estate development, and industries. **Landmark's Involvement**: • None of Landmark's infrastructure is impacted by the coastal development. • Landmark, despite subletting the area along its shoreline to some individuals, never had ownership of the shoreline. • The shoreline, according to a Supreme Court judgment, belongs to the federal government within 250 meters from the shore. • Landmark requested to provide documentation proving ownership of the shoreline. • No inhumanity meted to Landmark and that the matter should be put to rest. **Compassionate Approach**: • The current administration aims to ensure that individuals illegally residing on the coastline (despite lacking proper infrastructure and documentation) will be compensated. • the compassionate approach of the Renewed Hope Agenda administration, which even pays for those staying illegally on the coastline. • In Okun Aja community the new alignment makes it properly coastal in addition to saving more houses that would have been destroyed if the old alignment is followed. It also will support in dealing with the coastal erosion which is very pronounced in the area. • Compensation will be paid today to some of the affected persons to demonstrate government's commitment.

							EIA • EIA for the project is proceeding with adherence to the necessary procedures. There is provision for both **preliminary and final approvals** in the process. **Everything is in order as due process is being** followed

Project Affected Persons, Project affected host communities, Local Communities, general public.

National Assembly Members, joint National Assembly Committee on Works

National Assembly Members led bu Chairman, joint National Assembly Committee on Works, Sen. Barinada Mpigi and Chairman House Committee on Works, Rep. Akin Alabi.								
S/NO	Group of Stakeholders	Objective	Engagement Methods	Date	Venue	Observations/Expectation/needs	Response by FMW	Reamark
1	National Assembly Members led bu Chairman, joint National Assembly Committee on Works, Sen. Barinada Mpigi and Chairman House Committee on Works, Rep. Akin Alabi.	Familiarise members of the National Assembly with the proposed project as part of ensuring legislative oversight. Informed about project progress. Seek collaboration.	Onsite seeing and tour of the alignment	•		• "This is the kind of project, a legacy project that will put a smile on people's faces and we are all committed to achieving it," Members are happy with this project. • This is a project everyone should be committed to, both the Executive and the Legislature and it must be delivered. And actively work together to support in securing adequate funding for the road. • "We have seen it over and over again in this country, where you have great intention when you want to begin a project, but along the line, you will run into trouble. • We assure the Ministry of Works of adequate budgetary provision for the completion of the Highway. • House of representatives would	• The proposed coastal highway spanning approximately **750 kilometers** is set to connect several states along Nigeria's shoreline. Starting from **Lagos**, it will extend all the way to **Cross River**, with an additional spur reaching the **north-central** part of the country. The project is being handled by **Hitech Construction Africa Ltd.** the commitment to development and the project's potential longevity, stating that roads constructed under the renewed hope of the president would last for a century. Additionally, the acquisition of lands along the highway corridors is seen as a valuable resource that could contribute to funding the project. • highway which has a contract sum of N1.067 trillion.	"We assure you that we are fully committed to do this project as per the directives of the Federal Government through the ministry of works to do it within 36 months

National Assembly Members led bu Chairman, joint National Assembly Committee on Works, Sen. Barinada Mpigi and Chairman House Committee on Works, Rep. Akin Alabi.								
S/NO	Group of Stakeholders	Objective	Engagement Methods	Date	Venue	Observations/Expectation/needs	Response by FMW	Reamark
						work with the Senate President, Speaker of the House of Representatives and the two committees on appropriation for adequate funding of the road. • However, every fund released must be accounted for. • Is the EIA done? • When next we come remember to provide us with Personal Protective Equipment (PPE)	• EIA is part of the design ofthe project. • We shall provide the PPE when next a visist is made.	

Public Consultation – Ongoing

National Assembly Members, joint National Assembly Committee on Works

Media Date: Apr 11, 2024 Venue:Arise Television Morning Show Channels TV's Morning Brief on Thursday

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW
1	Channels TV's Morning Brief on Thursday **with** the Minister of Works, **David Umahi**	Disseminate accurate project information and manage public perception.	• Share project updates and milestones. • Provide insights to journalists.	Need to understand. **Scope and Timeline**: **Project Phases**: **Subsequent Segments**: **Future Phases**:	The Lagos-Calabar Coastal Highway promises significant transformation and economic development for the region! • The Lagos-Calabar Coastal Highway spans approximately 700 kilometers along Nigeria's coastline. • The project aims to enhance travel and trade in the coastal corridor. • The initial phase covers a 47.47-kilometer section starting from Victoria Island in Lagos. • It features five lanes on each side of the dual carriageway, including a train track in the middle. • The highway passes through Lekki deep seaport, connecting several states: Ogun, Ondo, Delta, Bayelsa, Cross River, and Akwa-Ibom. • Completion of this phase could boost Lagos State's economy by 50% due to its connection to the Lekki Deep Seaport and economic corridor. • The second section extends approximately 55 kilometers from the Lekki Deep Seaport to the boundary between Ogun and Ondo states. • It has received approval from the Bureau of Public Enterprises (BPE) and awaits approval at the next Federal Executive Council (FEC) meeting. • The entire project is expected to take a total of eight years to complete.

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW
					• The third segment will begin in Calabar, Cross River State, stretching to Akwa Ibom State. • This part is scheduled to start in July, pending design finalization and approvals from the BPE and FEC. • Additional segments will be constructed independently, including one from Port Harcourt in Rivers State to Bayelsa State, and another from Delta State heading towards Ondo State.
2	**Arise Television with** the Minister of Works, **David Umahi**	Disseminate accurate project information and manage public perception	Exclusive interview	Need to understand. **Scope and Timeline**: **Project Phases**: **Subsequent Segments**: **Future Phases** What is the budget for the road? Why would **Landmark Beach Resort** property face demolition due to the ambitious to the project	• The Lagos-Calabar Coastal Highway promises significant transformation and economic development for the region! • The Lagos-Calabar Coastal Highway spans approximately 700 kilometers along Nigeria's coastline. • The project aims to enhance travel and trade in the coastal corridor. • The initial phase covers a 47.47-kilometer section starting from Victoria Island in Lagos. • It features five lanes on each side of the dual carriageway, including a train track in the middle. • The highway passes through Lekki deep seaport, connecting several states: Ogun, Ondo, Delta, Bayelsa, Cross River, and Akwa-Ibom. • The ingenuity of the coastal road came from President Tinubu when he was governor. He procured the right of way on the Lagos corridor and gazetted it. If you want to come out of inflation you have to prioritize investments in

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW
					infrastructure, this project will address elements of return on investments. • The cost of the road is fairly cheap considering the concrete based nature which is different from asphalt and also cost of similar projects. • Reassured the public that the **Landmark Beach Resort** property would **not** face demolition due to the project. •

Media

Sustainability Professionals/ CSOs with Conservations Sanctuaries

Date: 17/05/2024 Venue: Federal Ministry of Works, Glass House Conference Room, TBS, Lagos

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
1	CSOs with Conservations Sanctuaries in the project area which included Nigeria Conservation Foundation (Lekki Conservation Centre) and others – meeting with the ESIA Lead, Dr. Eugene Itua and Teams	Involve CSOs in environmental aspects and community well-being.	• Focus group discussion.	**Biodiversity Concerns:** Experts emphasize that compensation to stakeholders should not overshadow the project's impact on the environment, biodiversity, and ecosystem within the corridor. The contractor's team needs training to recognize and be eco-conscious of organisms in the project area. **Urgency and Emergency Declaration:** Waiting for the ESIA report is not an option; immediate action is necessary. An emergency declaration to the minister would enhance climate consciousness and international appeal. **Animal Displacement and Training:** The project may displace animals like pythons and crocodiles. Contractors must be trained to recognize and rescue these organisms. **Pangolins and New Findings:** Pangolins, near extinction, were known to inhabit the Epe to Ijebu-ode axis. Recent findings suggest pangolins may also exist in the Lagos-Calabar coastal highway corridor. **Identification and Mapping:** Sensitivity and geo-referencing of animal habitats should guide preservation efforts. **Recommendations:** The project should showcase environmental consciousness. Implications for the biodiversity action plan should be cost-effective. We request alignment details to assess impacts **around conservation areas.**	• It's commendable that biodiversity experts are raising concerns about the impact of the development corridor on the environment and species within the project corridor. • Dr. Itua addressed the team, imploring that this should not be looked at from a political angle. The key issue is that we need an inventory of the animals we have within the coastal highway corridor and a table that highlights the receptor sensitivity of these organisms. For instance, on the IUCN list, where do these organisms fall? Are they threatened or endangered? • A biodiversity management plan will be developed just like we have other management plans like a shoreline management plan and a traffic management plan. • Some suggested measures by the biodiversity team can also be kept in place, as recently the ESIA team	

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
				Integrated Coastal Protection: Given rising ocean transgressions, integrated coastal protection is crucial.	got approval for its monthly newsletter on environmental management. • Dr. Itua stressed that this project should be used as an opportunity to define best practices for the country. • We need the support of the owners of the santcuaries to identify the animals, whose physical habitat we do not know. • Then we can recommend what should be done and present a budget for it to be carried out with officers on the field. • Together, let's work toward preserving and protecting our country's biodiversity!	

Sustainability Professionals/ CSOs with Conservations Sanctuaries

Utility/Service providers May 14, 2024 Venue: Federal Ministry of Works, Tafawa Balewa Square, Lagos

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
1	Utility/Service providers along the Lagos Calabar Coastal Highway, Section 1 Mtn, Mainone, Digital Reality, Broadbased Communicatons, Wiocc, Oadc, Huawei, Natcom, Lasimra,Mdcl,Dolphin Telecom, Lagos State Minstry Of Energy And Mineral Resources, Fiberone, Wtgs, Tcn, Globacom, Ekedplc	Present the proposed project alignment to the stakeholders. Provide the project's objective. The project demonstrates transparency and accountability with the overall vision of the project. and the opinions of the stakeholders on the environmental and social impacts of the proposed project. Diverse perspectives, local knowledge, and expertise are anticipated to	• Focus Group Discussion	Want stakeholders' involvement from the project design stage: Why are we being engaged now that the project has commenced and not sure if their opinion will still count. Relocation of cables laid underground cost about one billion dollars. Another concern raised was the TCN overhead cable project, which will also be impacted by the proposed project. The reason for that was given as the cables needs to be above ground due to the nature of it that does not require heat and the absence of technology also plays a major role. Question if the affected service providers will be duly compensated was also raised during the meeting.	• **Symbolism and Commitment**: The road represents connectivity, economic growth, and improved livelihoods. It embodies our collective commitment to a better future. • **ESIA and RAP**: The Federal Government has commissioned the Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) for the project. These assessments ensure that everyone's voice is heard and prevent disenfranchisement. Compliance with national laws and international expectations is a priority. • **Utility and Service Providers**: Utility and service providers play a pivotal role in the project's success. Their expertise, contributions, and insights are integral to addressing integration challenges and ensuring overall project success. For a more successful and sustainable project, she mentioned the following as some of the reasons for inviting the service providers. **Stakeholder Involvement**: To achieve project objectives, stakeholders' opinions, fears, concerns, and contributions are essential. Sustainability and responsible construction practices depend on collaboration with stakeholders. • **Appeal to Stakeholders**: Stakeholders are encouraged to respond to the questionnaire and share insights with others. Comprehensive stakeholder opinions will guide sustainable project delivery for present and future generations.	It was agreed all bring their survey plans/coordinates of their utility locations. creation of a WhatsApp platform and filling of the questionaries shared to members

S/NO	Group of Stakeholders	Objective	Engagement Methods	Observations/Expectation/needs	Response by FMW	Remarks
		help identify potential impacts, risks, and opportunities related to the project. The project will also assist in informing the development of suitable mitigation measures and a robust Environmental and Social Management Plan (ESMP).				

Federal and State MDAs

Eko Hotel, Vi., Lagos	December 18, 2023

S/NO	Group of Stakeholders	Objective	Engagement Methods	Stakeholders Comments Observations/Expectation	Information/Response provided by FMW
1	Federal and State MDAs, with members of HITECH and Natural Eco Capital	Ensure alignment, regulatory compliance, and joint planning. Inauguration of the Committee that will ensure a smooth process involving stakeholders' engagement and educating key stakeholders to ensure compliance with local and international regulations.	• Formal consultations: Structured meetings with government representatives. • Regular updates: Keep agencies informed about project progress. • Joint planning: Collaborate on project milestones and approvals.	**Marking of Alignment** Some others wondered why some properties that were outside the alignment were also marked and noticed served their owners. Another drew attention to the difference in the size of the impacted area between what was marked and the figure on the notice given. Lagos State Physical Planning The Ministry is aware of the ROW for the proposed project. The major issue has to do with encroachment by individuals and organisations. Appropriate measures must be taken to take possession of such portions involved. As far as the Ministry was concerned, the plans for those areas have been gazetted by the Lagos State Government. The ESIA Committee must ensure the participation of all those listed as stakeholders. They must ensure they are given opportunity to contribute	The Federal Controller of Works, Lagos Engineer Korede Kesha and the Chairman, Engr. Wasaya, Director Highways (B&D) **The Proposed Project** The Federal Government has proposed the construction of a Coastal highway starting from Lagos and ending around Calabar in Cross River State, a distance of about 700 kilometers. It passes through 9 states - Lagos, Ogun, Ondo, Delta, Bayelsa, Rivers, Akwa Ibom and Cross River States. Though it does not directly pass through Edo State, the close proximity and activities proposed around Gee-gee waters caused the listing of Edo State. - It is parallel to the on going East - West Road which is about 40 km from the shore. The proposed highway will be 20 km from the shore, there by having a 20 km buffer between the two roads on the average. - The project will be executed in different phases. The phase 1 is of 106 km starting from Lagos. - As proposed it will have a ROW of 100m. The median will be used for railway. There also be access roads on both sides which will first be constructed before the main carriage ways.

S/NO	Group of Stakeholders	Objective	Engagement Methods	Stakeholders Comments Observations/Expectation	Information/Response provided by FMW
				their quota. The TOR and the project designs will be made available. **ESIA** **The following are needed.** 1. The TOR for the ESIA Development. 2. Work Plan - Registration of the project with FMEnv. 3. Creation of WhatsApp Group for ease of contact and information sharing 4. ESIA Consultants need document to help in the development of a TOR which will be needed to register the project with FMEnv. 5. ESIA Consultants also need the Route Map that have been developed so far. 6. Copies of the relevant documents relating to the project.	**ESIA & RAP for the proposed Lagos – Calabar Coastal Highway** It was in recognition of the vital and strategic role of the Environmental and Social Impact Assessment that the Committee has to be set up. The ESIA Committee will work in concert with relevant stakeholders to advise on how the adverse effects of the Project on lives and livelihood of project affected persons could be mitigated. It was inevitable that some people will be impacted to the extent that they may have to be relocated due to the loss of their homes and source of livelihood. Dr. Eugene Itua, CEO, Natural Eco Capital stated that: - 1. The project is a gigantic one which will impact several communities and assets. 2. The project merits the use of ESIA as major element for resolving issues as well as highlighting the benefits of the project. 3. It a category 1 project which requires two season sampling and stakeholders' consultation with impacted people and communities along the corridor. 4. The ESIA assist to obtain what is called "Social Licence" which guarantees the cooperation and buy in of the major stakeholders. 5. There are those who will involuntarily be displaced and that will lead to the development of a Resettlement Action Plan (RAP)

S/NO	Group of Stakeholders	Objective	Engagement Methods	Stakeholders Comments Observations/Expectation	Information/Response provided by FMW
					which incorporates Resettlement and livelihood restoration plan for those impacted. 6. Activities - ESIA consultants to be part of the next over flight involving the next phase. The Federal Government was prepared to also ensure that those significantly affected are also settled and compensated. Road project of high magnitude have always impacted on people; however, the gains are enormous as the flow of traffic, reduction of travel times, high connectivity and economic growth experienced on the long run justify such project. The proposed Lagos Calabar Coastal Highway will also open up the South of the country, connect communities along the route, open up rural areas, reduce the travel time, spur economic growth and promote social activities.
1	Federal and State MDAs, with members of HITECH and Natural Eco Capital	Review alignment and joint planning.	• Structured meetings with government representatives. • Keep agencies informed about project progress. • Joint planning/Collaborate on project milestones and approvals.		

Project Field activities