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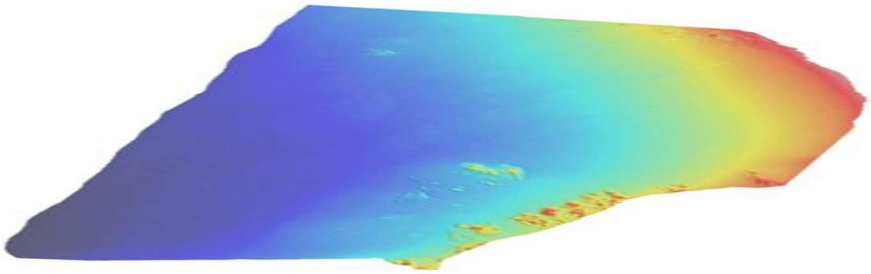

Environmental, Social and Health Impact Assessment (ESHIA) Study for the Development of an Industrial Fish Harbor Complex at Black Johnson, Western Sierra Leone.

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		Environmental Impact Assessment Matrix Added
		Environmental and Social Management plan (ESMP) added
		Environmental Monitoring Plan (EMP) Added
		Community Development Plans (CDAPs) added
		Resettlement Action Plans (RAPs) Added
		Grievance Redress Mechanisms (GRMs) Added
		Environmental Impact Statement (EIS) added

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Acronym

AG	Attorney General
BBB	Build Back Better
CA	Competent Authority
CDAP	Community Development Action Plan
CMIP5	Coupled Model Intercomparison Project Phase 5
EIS	Environmental Impact Statement
ESHIA	Environmental, Social and Health Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
FBOs	Fish Business Operators
FGD	Focus Group Discussion
FCC	Freetown City Council
FSM	Fecal Sludge Management
GDP	Gross Domestic Product
GVWC	Guma Valley Water Company
HDW	Hand Dug Well
IPCC	Intergovernmental Panel on Climate Change
IEE	Initial Environmental Evaluation
MAF	Ministry of Agriculture and Forestry
MFMR	Ministry of Fisheries and Marine Resources
MLG	Ministry of Local Government
MLHCP	Ministry of Lands Housing and Country Planning
MoE	Ministry of Environment
MoWM	Ministry of Works and Maintenance
MDAs	Ministries, Departments, and
NPAA	National Protected Area Authority
ONS	Office of National Security
NPAA	National Protected Area Authority
RAP	Resettlement Action Plan
RCP	Representative Concentration Pathway
RPF	Resettlement Policy Framework
SLEPA	Sierra Leone Environmental Protection Agency
SLIE	Sierra Leone Institute of Engineers
SLP	Sierra Leone
SLR	Sea Level Rise
SPS	Sanitary Phytosanitary
VLM	Vertical Land Movement
WASH	Water supply, Sanitation and Hygiene
PSMSL	Permanent Service for Mean Sea Level
SLR	Sea level rise
VLM	Vertical land movement
CMIP5	Couples Model Intercomparison Project Phase 5

Glossary of Terms

Technical Term	Meaning
Accretion	The process by which coastal sediment returns to the visible portion of a beach or foreshore after a submersion event. A sustainable beach or foreshore often goes through a cycle of submersion during rough weather and later accretion when weather is calm.
Active Beach	The area of the littoral system that is usually subject to transport by wind, waves, and currents on a seasonal or daily basis
Algal Bloom	The sudden increase in the quantity of marine algae (seaweed), caused by high levels of nutrients such as phosphates, nitrates, in the nearshore areas of a coast
Aquifer	This is a permeable geological formation through which groundwater can flow and from which groundwater can be readily extracted.
Alien Species	This is also referred to as exotic species, which does not occur naturally in an environment. They are either intentionally or accidentally transported through human activity.
Alongshore	These are areas located parallel to and near the shoreline (also referred to as longshore
Anoxic	This occurs when an environment contains little or no dissolved oxygen and hence little or no benthic marine life. Anoxic conditions occur in deep water locations with limited physical circulation
Aquaculture	The cultivation of aquatic organisms, including freshwater ponds, fish cages in the open waters and the culture of marine organisms referred to as mariculture.
Aquifer	A permeable geological formation on a piece of land, through which groundwater can flow and from which groundwater can be readily extracted. Aquifers occurring upland without saltwater intrusion or extrusion is called freshwater aquifer. Those in intertidal zones containing saltwater
Armoring	Placement of fixed engineering structures, including rock or concrete on or along the shoreline to reduce coastal erosion. Armoring structures include seawalls, revetments, bulkheads, and rip rap (loose boulders). Coastal armoring is useful for disappearing beaches occurring due to sea-level rise
Backshore	The generally dry portion of the beach between the berm crest and the vegetation line that is submerged only during very high sea levels and eroded only during moderate to strong wave events.
Ballast water	
Bathymetric Chart	A topographic map of the bed of the ocean, with depths indicated by contours (isobaths) drawn at regular intervals. Also, known as seafloor mosaic
Bathymetry	The measurement of water depths in oceans, seas, and lakes and the information derived from underwater soundings for profile of land under water
Ballast water	This refers to Water carried by a vessel to improve its stability
Beach	An accumulation of loose sediment (usually sand or gravel) along the coast. This includes accumulations created by sand bars and sand dunes
Foreshore	This refers to the areas of any tidal river, seabed, creek or channel lying between the average high tide mark and the average low tide mark. It is the part of a shore between the water and occupied or cultivated land. The Foreshore Act of Sierra Leone provides that all areas of the foreshore located at 150ft from highest high water (HHW) mark onshore belongs to Government. The erection of wharves or other structures by private people on the foreshore requires lease agreement with Government and can be used for infrastructure development for Public goods.

Disclaimer

This report has been developed to provide information in relation to the environmental, social and health impact assessment (ESHIA) studies for the construction of a fish harbour at Black Johnson. This includes identification of the general requirements for impact mitigation. Our Consulting Firm, Black Eagle Sierra Leone Limited, hereby expressly disclaims all liability for any loss, damage, injury, or other consequences that may arise from any reliance on this report. The use or representation of any software tools, engineering systems or products used to produce this report is not to be taken to imply approval or endorsement for their sales at the disadvantage of other similar systems or patented products owned by Companies for harbour designs and construction.

Executive Summary of Environmental Impact Statement

The proposed construction of an industrial fish harbor facility at Black Johnson, along the Western Area Peninsular of Sierra Leone will facilitate enhanced sustainable resource exploitation from robust MCS and value addition compliance to increase national revenue generation from quality fish catches, modern licensing scheme of quota management, port related fees, import and export taxes. It will create job opportunities among youths and women, with possibilities to explore in deep sea fishing, increasing fish production and improving hygiene and sanitation compliance in fish handling, processing, and analytical testing, to meet local and export demands. Contribution of the fishery sector to the food security of Sierra Leoneans will be enhanced. The fish harbour will provide shore protection and erosion control to protect coastal villages against flooding and coastal erosion. The operations of the fishing port will attract private sector investment and create more job opportunities among the youths and women. This will enhance the socio-economic status of the Black Johnsons and adjacent communities. The project site meets minimum requirements of not been heavily inhabited and not associated with any large fossil fuel power station and cement manufacturing or oil refinery factory, compared to candidate sites in Kissy Cline Bay, Kingtom, Susan's Bay of Murray Town and Tombo. The project is in line with Sierra Leone's medium term national development plan (MTNDP) for ensuring sustainable growth in fish catches and its phytosanitary and sanitary controls to export fish to EU and other international markets.

The process for compulsory acquisition of land for the harbor project followed the due process of the law. It included satisfactory stakeholders' consultation and issue identification. The engagement process included the development of project management committees comprising of the Public Relations (PR) Committee; Compensation Committee (CC) and Environmental, Social and Health Impact Assessment (ESHIA) Committee. The PR Committee which was led by the Ministry of Information and Communication facilitated community and nation-wide sensitization on the harbor project with the key deliverable of a documentary on the fish harbor and its ancillary investment opportunities. This documentary showcased Sierra Leone for investment opportunities during the 2020 Dubai EXPO. The CC comprised of Ministries of Fisheries, Lands, Environment, Justice, and Landowning Families which oversaw the due process of land acquisition. The proposed land has been surveyed, endorsed by Parliament and approved by the President through issuance of a warrant for possession. The land now belongs to the MFMR. Compensation of landowning families is ongoing with additional considerations for alternative parcels of land to be allocated to every verified member of land-owning families as part of the resettlement action plan (RAP) . The engineering design for the main seafront of the harbour should encompass the deeper parts of the Black Johnson Lagoon and the Whale Bay.

The Yantai Resort at Big Water situated at the foreshore of the Whale Bay and Black Johnson Lagoon should be reclaimed for seafront development and breakwater construction. This area is already under severe coastal erosion, situated at low elevation coastal zone (LECZ), less than 5m above sea level. Leaving this facility near the seafront of the harbor will create inclination and slowdown sediment transport due to siltation buildup. As part of the location of this facility violates the foreshore act, a resettlement package for the owner of the facility should be negotiated urgently by the MFMR. A portion of the land of Yantai Resort is already within the acquired 252-acre concession land for the Harbor. Therefore, the only option for the owner of Yantai Resort is to reach a negotiated settlement with MFMR based on consideration. Any legal challenge on their part will fall through. The Ecolodge Resort by reclaiming the lagoon and the and banks deposited by the Bay. The considerations for lagoon aquaculture as part of the industrial fish harbor will require identification of additional culture sites in remaining Lagoon adjacent to the proposed site and the proper selection of culture species. We propose an Integrated Marine Park and Mariculture Station with a well-constructed aquariums (at least two) where social animals including orcas

(Killer Whales), bottlenose dolphins and manatees can be trained in captivity to provide social functions. Dolphins are lovely animals and very intelligent and playful and charismatic. Cetaceans and can be trained in captivity to provide entertainment for people. Aquariums are lucrative business in China with well-developed expertise which could be transferred into Sierra Leone. Aquarium simulates and creates a living environment and conditions of aquatic life similar to natural. The marine animals in captivity will be taken care of by professionals, making them breed and grow up. This advantage is considered to be a unique potential for income generation for communities and additional revenue generation for Government.

The marine park at the Fish Harbor will gradually become an experimental and demonstration place for the breeding of aquatic organisms and for exhibition. It is good for science education, resource protection and scientific research. Students at Secondary Schools and Universities will obtain practical training on conservation and animal welfare management from the Marine Park. Apart from the daily exhibition, the aquariums of the SLMP will perform functions of endangered aquatic animal protection hub and regulate aquarium expansion in Sierra Leone in the future. Killer Whales (Orchinus orca), Common Bottlenose Dolphins (Tursiops truncatus), West African Manatees are found in the waters of Gulf of Guinea, with common bottlenose Dolphins, Manatees, Hump Back Whales are common in Sierra Leone Waters. The humpback Whales (Megaptera novaeangliae) is particularly known to breach in shallow coastal waters of Sierra Leone and get stranded on beaches when they breach.

We note that salinity is the most important environmental variable in the lagoon that will affect aquaculture development. Existing salinity of the lagoon is around 35ppt. Coastal erosion, eutrophication and pollution are additional limiting factors for a lagoon aquaculture development that will need to be addressed. Fish cages, oyster spat culture on mangrove rafts and artificial substrate and shrimp farming are possible mariculture opportunities. Black Johnson village and surrounding villages sit on a major Peninsular traffic, plied by light and heavy-duty vehicles. The vehicular traffic produces noise levels greater than 75 dB on a daily basis, which the community have adapted to for over five decades. The estimated noise level of 65-75 dB from construction phase of the project is therefore adaptable and would not cause untold impact on the health and wellbeing of the people. However, we recommend the use of heavy machinery during the day, to minimize the combined effects of noise from machinery and nearby vehicular traffic.

1.0. Introduction

1.1. Background

The potential of fisheries production in Sierra Leone and the resulting trade benefits have been impaired by limited infrastructure with most of the fish produced in both the small scale and industrial sectors sold at ex-vessel prices. Fish is mostly sold unprocessed at landing sites or processing is limited to wrapping, sun drying and smoking. The absence of appropriate processing technology is forcing fish business operators (FBOs), including industrial fishing Company Agents to immediately dispose of fish products by direct sales. In the small-scale fishing communities, owners and Agents of fish processing units outsource fish capture to small-scale fisheries operators by providing productive inputs (such as, liquid cash, fuel, gear etc.) with the understanding that the catch is sold to them. Women fish processors who dominate the fish handling and processing segment of the fish value chain operate under conditions of limited or lack of post-harvest infrastructure.

Although the industrial fishing boats have freezer holds and blast freezing facilities where fish is graded, sorted, frozen and packaged (mainly wrapped in cartons), the absence of a fish harbor undermines the required timeliness of discharging and market distribution of catch. The lack of appropriate handling, processing, and packaging materials induces knee-jerk selling of catches on the beaches along the Freetown Peninsular. The high valued catches are repacked in third countries in Africa and indirectly exported to lucrative markets such as the EU with the accompanying loss of revenue to the originating country. Wastages and spoilage from the lack of post-harvest infrastructure is significant with adverse impact such as on food fish insecurity. For example, small scale marine artisanal fisheries sector operators end up burying large quantities of small pelagic (that they cannot preserve owing to lack of post-harvest facilities) in the sand on beaches which otherwise could have been utilized.

Moreover, we have witnessed the proliferation of the so-called '*Fish Trade Agents'* due to lack of post-harvest infrastructure thereby introducing another segment in the value chain with the concomitant food fish insecurity and rise in price. Sanitary and Phytosanitary (SPS) challenges emanating from the lack of post-harvest facilities is an important hindrance to accessing lucrative international market. Sierra Leone failed to meet minimum standards required to be listed among countries allowed to export fish to EU markets during the 2009 EU Mission conducted by the European Commission (EC) Health and Consumers Directorate General (DG-SANCO, 2009). Among the recommendations proffered by the 2009 EU Mission is the provision of official controls by the Competent Authority (CA) for any fishing vessel and establishment to meet equivalent guarantees with controls prescribed by the EU (See Article 12 (a) of Regulation (EC) No 854/2004. Such conditions will be very difficult to achieve without a fish harbour complex that allows berthing of fishing vessels for effective port inspections and other official controls. Most of the larger fishing vessels licensed to fish in Sierra Leone waters (e.g., Tuna vessels) do not currently call at the Port of Freetown to discharge or transship their catches due to the lack of a fish harbour to allow their berthing. The absence of industrial fishing vessel maintenance facilities with appropriate syncrolift docking platform, is a disincentive for fisheries investment. Additionally, a colossal revenue loss is incurred from lost port fees, port handling income, license fees, fuel sales, loss of taxation income and from downstream economic multiplier effects supported by a fishing harbour. It is against this backdrop that the Government of Sierra Leone through the Ministry of Fisheries and Marine Resources (project executing agency) has contracted Black Eagle Sierra Leone Limited to carry out an Environmental Social and Health Impact Assessment (ESHIA) including the Resettlement Policy Framework (RPF) for an industrial fishing habour complex to be constructed on a 252-acre land at the Black Johnson village, and on sea areas of the Whale Bay extending up to 10 acres along the Freetown Peninsular. The proposed fish harbour construction will be funded under a grant of US$ 55 million donated by the government of the People's Republic of China, under the African Road Belt Initiative (ARBI). The fish harbour complex will allow improved licensing system based on total allowable catches. This will permit the establishment of a quota management regime, where licensing will be based on quantity of fish caught by vessels instead of the existing situation of levying license fees based on size of fishing vessel (gross registered tonnage).

Moreover, a robust MCS system mounted *in situ* at the harbour, will significantly contribute to sustainable resource exploitation.

The ESHIA report outlines in detail, safeguard instruments to ensure that all project activities meet the requirements of the relevant national legislation and international conventions to which Sierra Leone is a signatory, as well as national and international environmental and social safeguard policies. Relevant stakeholders have been consulted including but not limited to; Ministry of Fisheries and Marine Resources (MFMR), Environmental Protection Agency of Sierra Leone (EPA-SL), Ministry of the Environment (MoE), Ministry of Lands, Housing and Country Planning (MLHCP), Ministry of Local Government, Ministry of Agriculture and Forestry, Councilors, Local Authorities of project site and surrounding villages, Landowners and other relevant stakeholders.

1.2. The Objectives of the ESHIA Studies

The goal of the ESHIA studies is to assist the MFMR to effectively manage the environmental and social impacts from the construction and sustainable operations of a fish habour complex at Black Johnson along the Freetown Peninsular. Black Eagle - Sierra Leone Limited, has carried out the following activities in order to provide the required assistance:

1. Assess environmental, social and health impacts caused by constructing and operating a fish harbour complex at Black Johnson as well as any traceable effect on the quality of citizen's lives including land and biodiversity degradation with the object of designing environmental, social and health impact mitigation measures

2. Develop **Environmental, and Social Management Plan** (ESMP) to be used for the environmental, social and health screening and assessment of fish harbour complex construction and operations.

3. **Develop Construction Management Plan (CMP)** to include mitigation plans for environmental, social and health impacts associated with the construction of the fish harbour at Black Johnson. The CMP will identify the minimum mitigation requirements for:

    a. Public safety,
    b. Site plan and security,
    c. Earth works, excavation, land reclamation, retention/piling and associated works,
    d. Construction periods, operation hours and communication strategy for site personnel,
    e. Community information and complaints management plan
    f. Noise , vibration, air dust management, Traffic, site access and parking managementg) Noise , vibration air and dust management, Traffic, site access and parking management,
    g. Waste management
    h. Water discharge, wash downs, water conservation, dewatering, stormwater and sediment control
    i. Asbestos removal
    j. Plans for biodiversity restoration
    k. lndemnification
    l. Other issues identified by the Black Johnson Community

4. Develop a **Resettlement Policy Framework** (RPF) that will provide guidance in the event that land needs to be acquired and people need to be resettled and options for implementing a **Resettlement Action Plans** (RAPs);

5. Embark on intensive and extensive community consultation to develop a comprehensive

Community Development Action Plan (CDAP) for the consideration of the developer/s

2.0. Methodology

The ESHIA study approach and methodology follows The Equator Principles (EP) as amended in 2019 which provides baseline and risk/financial management framework to identify, assess and manage environmental and social risks associated with the construction of a fish harbour at Black Johnson. The approach includes the following 10 specific principles:

Principle 1: Review Screening, Scoping and Categorization
Principle 2: Environmental and Social Assessment
Principle 3: Applicable Environmental and Social Standards
Principle 4: Environmental and Social Management Plan
Principle 5: Stakeholders Engagement
Principle 6: Grievance Mechanism/Community development/ Resettlement Actions
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: Reporting and Transparency

The stakeholder's engagement (Equator Principle 5) was mainstreamed in equator principle 1 (project scoping and categorization) and Principle 5 (Grievance) in the ESHIA process for the fish harbor project at Black Johnson. This was required due to seeming misconceptions and myth among some stakeholders concerning the project objectives. For example (Project Site Black Johnson was mistaken for Western Area Peninsular Forest Reserve). Mainstreaming stakeholder's engagement informed the environmental and social impact assessment (Equator Principle 2) and the preparation of environmental and social management plan (ESMP).

2.1. Project Screening, Scoping and Categorization

Our project categorization approach was based on the first equator principle that comprised of screening and scoping as codified by the Environmental Protection Agency Act of Sierra Leone of 2008 as amended in 2010 as well as International Standards for environmental social and health impact studies. The harbour project has been categorized as **category A**, as the harbour construction is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader and the sites or facilities subject to physical works. Our Environmental assessment (EA) therefore examined the project's potential negative and positive environmental impacts and compared them with feasible alternatives (including the " ***Do nothing or without project*" *situation***. Our studies has recommended measures required to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Our impact classification and evaluation of significance of impacts considered the issues of prediction, evaluation of significance, identification of mitigation measures and assessment of residual impacts. For this purpose, the types of impacts have been determined based on reversibility, extent, duration, and frequency to inform the determination of whether the impact is **negligible, minor, moderate or major**. **Negligible impacts** are not persistent with no obvious changes to the natural benchmark. **Minor impact** means that the impacts are limited and can be identified by usual means of monitoring and there can be no adverse effect on the functioning of the ecosystem and communities. **For moderate impacts**, we considered noticeable impacts that

can result into changes to the ecosystem but does not transform the quality of the ecosystem and without loss of their natural functioning. **Major impacts** result to temporary or permanent transformation of the ecosystem with loss of their functioning and there is transformation of community lifestyle and quality.

The first part of the ESHIA was based on an Initial Environmental Evaluation (IEE) - involving scoping visits and stakeholder engagement meetings to identify key stakeholders, develop stakeholder's engagement plan and identify project risks. It comprised of the screening and registration of the harbour project with EPA-SL and the identification of legal basis for the land acquisition. The ESHIA application, including Screening Form and proposed project area coordinates have been submitted to the Environmental Protection Agency Sierra Leone (EPA-SL) by our client, the MFMR as notification for the proposed project. This served as input to facilitate the ground truthing exercise conducted by the EPA-SL and to complete the registration requirement of the project with EPA-SL. The ground truthing exercise informed the preparation of scoping report that evaluated the nature of conflicting interests and/or risks associated with proposed harbour project at Black Johnson.

2.1.1. Inception of the ESHIA Studies

This section specifies the approach employed by Black Eagle Sierra Leone Limited from the overall understand of the ESHIA project. Additionally, the process of developing the inception report is outlined before describing key issues that are relevant to the ESHIA project implementation. The outcome of discussions with MFMR, and the relevant stakeholders andbeneficiaries of the fish habour complex are also reported. In Section 3 the field study is described detailing the strategic activities, outcomes of the activities, and the relevant organizations contacted during the inception period are specified. Summaries of outcomes of the activities are presented as detailed descriptions of the outcomes will be provided in the final report of the ESHIA report. A detailed description of the ESHIA project plan is presented in Section 4 outlining preliminary findings. Activities to be undertaken during the development of specified project deliverables are separately presented. For most components of the Environmental, Social and Health Impact Assessment processes, specified numbers of days are provided. This enables the verification of the activities and the timeframe for implementation during the implementation process. Preliminary findings on strategic activities are reported in Section 5.

2.1.2. Preparatory Activities

Detailed discussions were carried out amongst the Black Eagle - Sierra Leone Limited team to identify key issues, relevant data/information to be collected and relevant stakeholders'/contact persons to be interviewed in Sierra Leone during the environmental, social and health impact assessment processes. These include; stakeholder consultation, baseline data analysis, training, EIA impact analysis and methodology, environmental impact identification, and social impact identification as detailed below.

2.1.2.1. Stakeholder Consultation

The stakeholders for this project include Individuals, Communities, Government agencies, Private organizations, Non-Governmental Organizations or others having a legitimate interest in both the EIA process and outcomes of the projects. The objective of stakeholder consultation include:

- to inform the stakeholders about the fish habour complex project and its likely effects; to ensure that all the impacts, issues, concerns, alternatives and mitigation which interested parties believe should be considered in the EIA are addressed.
- The stakeholder's engagement framework comprised mainly of stakeholder's meetings, focus group discussions and key informant interviews and the development of stakeholder's consent form that will entail:

- Completion of a scoping form and inclusion of consent for stakeholders, including vulnerable persons. The stakeholder engagement plan was prepared as a working document and circulated amongst the study teams. It will be updated during the project cycle (design, construction operational and decommissioning)
- Inception meeting and community engagement for the identification of risks associated with key stakeholders of Black Johnson Community, including effects on their socioeconomic livelihoods
- Providing the legal basis for land acquisition at Black Johnson for the fish harbour
- Recommendation of mitigation measures in line with World Bank's mitigation Hierarchy Pyramid for environmental and social framework

The detailed scoping report forms part of this ESHIA studies inception report which includes information from desk review and review of previous ESHIA studies for harbour construction site verification exercises. It identifies significant environmental aspects that require further analysis and the identification of vulnerabilities of the community and areas for community development action plan as input into the resettlement action plan (RAP) and environmental and social management plan

2.1.2.2. Training Needs for Project Team

Discussions were held on training needs of project team and Technical Staff of Client Institution on the scope, focus and methods of field study and data collection. Client Staff training on the job was agreed for local content and capacity development of national institutions. Both MFMR Staff and IMBO staff were incorporated on ESHIA assessment routines to build and retain technical capacity.

2.1.2.3. Baseline Data Collection and Analysis

The following considerations will be important in collecting and analyzing baseline data:

- Project design/characteristics in terms of potential environmental constraints such as: project size, the production of waste, pollution and nuisances, etc. Baseline information in the geotechnical report of the Engineering Feasibility Studies by the Chinese Consulting Engineers will form part of the baseline information that will be reviewed.

- Environmental sensitivity of geographical areas likely to be affected by the project. Baseline information provided in the geotechnical report will be analyzed and the design and construction judgement based on the following prevailing parameters:

- Protected areas
- Nature reserves and parks
- Potential biodiversity hotspots: areas with rare or protected species or habitats, areas which are abundant in flora and/or fauna, pristine areas

- Potential significant effects from:
- the magnitude and complexity of the impact,
- the probability of the impact,
- the duration, frequency and reversibility of the impact.

- Determined level of assessment: Project is category A, which require a full EIA. Detailed analysis would will be required aimed at gathering information in adequate detail so as to discuss concretely how risks could be addressed and minimized (and possibly eliminated) in the project design. Attention will be paid to appropriate monitoring requirements during project implementation. The scope of analytical work may vary from a detailed study of a

specific project component to routine checks to ensure that the project design conforms to governing principles.

2.1.2.3.1. EIA Impact Analysis Methodology

The main aim of the baseline data collection process was to provide adequate information such that sensitive environmental areas can be avoided. In particular, areas that are unique and/or particularly vulnerable to disturbance will be identified. The characterization of project areas is an essential component of the EIA process and is required in order to determine the likely impacts and to document baseline conditions for monitoring purposes. The level of effort apportioned to baseline data collection is proportional with the scale and nature of the project. Baseline data will be obtained to meet national requirements for a Category A project such as this fish harbour construction. The entire Black Johnson area will be assessed in a comprehensive desk top study, and secondly by walkover survey for each location of known or perceived sensitive areas. Given the project's potential significant environmental impact, ecological survey of the entire route is necessary.

2.1.2.3.2. Impact assessment and geotechnical evaluation

The impact assessment took the lead from prior geotechnical studies conducted as compared to international standards and using existing baseline studies from engineering feasibility and previous site selection information and real time situation. These are benchmarks for determining, assessing and managing social and environmental risk. This is conforming the ESHIA for the fish harbour construction

2.1.2.3.2.1. Environmental Impact

The ESHIA process identifies the potential impacts associated with the construction and operation of the fish habour complex, and assigns a significance rating to each impact after the application of any mitigation measures. The significance criteria comprise High, Moderate and Low categories (corresponding to the traffic light equivalent of red, amber and green) taking the following factors into account amongst others:

- The sensitivity of receptor (e.g. common species/habitats vs protected species/habitats)
- Geographical extent of impact
- Water and air quality
- Duration (short, medium, long term or permanent)
- Recoverability (natural recovery/intervention required/non recoverable)
- Protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas
- Geotechnical and bathymetry suitability
- Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems)
- Use and management of dangerous substances
- Major hazards assessment and management
- Impact of habitat/ecosystem alteration
- Cumulative impacts of existing projects, the proposed project, and anticipated future projects
- Pollution prevention and waste minimization,
- Pollution controls (liquid effluents and air emissions) and solid and chemical waste management
- Noise impact assessment
- Motor traffic impact assessment
- Impact assessment on panoramic view

2.1.2.3.2.2. Social Impact

The Assessment considered the issues of feasible socially preferable alternative requirements under host country laws and regulations, applicable international treaties and agreements such as:

- Protection of human rights and community health, safety and security (including risks, impacts and management of project's use of security personnel)
- Protection of cultural property and heritage
- Labour issues (including the four core labour standards), and occupational safety
- Fire prevention and life safety
- Socio-economic impacts of land acquisition and involuntary resettlement
- Impacts on affected communities, and disadvantaged or vulnerable groups
- Impacts on indigenous peoples, and their unique cultural systems and values
- Consultation and participation of affected parties in the design, review and implementation of the project
- Efficient production, delivery and use of energy
- Food security and nutrition
- Employment
- Local livelihoods
- Women and gender relations

2.1.2.4. Key Issues for the ESHIA Report

The inception period of the ESHIA project lasted for four weeks. The period started on 15th June 2022 and ended on 15th July 2022. Key activities within this period are characterized by data and information collection regarding the key issues for the ESHIA studies identified above. A number of issues extracted from the above checklist are presented in Table1 . This includes the status of issues investigated with relevant stakeholders during the inception period.. Data and information collection around the issues listed in Table 5 were done through discussions, and interviews conducted with key persons at SLEPA, NPAA, Ministry of Agriculture and Forestry, Law Officers Department, The Attorney General's Office, Ministry of the Environment, Ministry of Land, Housing and Country Planning, Ministry of Fisheries and Marine Resources, Ministry of Local Government, the Sierra Leone Police, Land Owners, Community Leaders and Members, SLIE, Ministry of Works and Maintenance. :

Table 1: Key Issues for Discussions and Interviews with Stakeholders During the Inception Period

Key Issues	**Man –Days**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**12**	**14**
Initial meeting and Analysis of Baseline conditions, Literature review, Meeting other working groups				**X**								
Comprehensive Assessment of ESHIA levels in the study (Impact, Responses, Alternatives, and Mitigation Measures) based on technical proposal	**X**											
Discussions over stakeholder information and consultation plan, including training, work procedure and materials		**X**										
Discussions over Field work (instruments, interviews questionnaires, logistics, training), Focussed research and hotspots" identification and analysis		**X**										
Discussion over the format, and content of the ESHIA Report including the Environmental and Social Impact Management Plans (ESMP=EMP+SMP)			**X**	**X**								

Discussions over Public review of final draft of the ESHIA report and Consultative meetings					X	X						
Discussions over finalizing ESHIA report Preparation, Finalise ESMP and all annexes (RPF, RAP's, Grievance forms stakeholder meeting notes etc.)						X						
Discussions over Final ESHIA report Presentation						X						
Final Inception Report (Preparation and delivery)							X	X	X	X	X	X

2.1.3. Project Inception Meeting

The field visits for the scoping was preceded by an inception meeting with key stakeholders at the conference room of MFMR. The purpose of the inception meeting was to identify and engage key stakeholders to solicit their involvement in the ESHIA process and include their views in the project categorization, identify possible impacting areas including socioeconomic, environmental and cultural issues of interest to the Black Johnson community. The stakeholder perception during the meeting served as input into the community development action plan and resettlement action plan. The meeting also provided information on the status of the harbour project to improve stakeholders understanding and encourage their involvement in the ESHIA process. The key stakeholders that attended the inception meeting comprised of landowning families of Black Johnson Community, Local community leaders, representatives of the Ministry of the Environment (MoE), The Environment Protection Agency of Sierra Leone (EPA-SL), The Survey's

Department of Ministry of Land and Country Planning (MLCP), the Ministry of Tourism and the Ministry of Fisheries and Marine Resources, and Black Eagle-Sierra Leone Ltd. A cross section of participants during the inception meeting is presented in Figure 1.

Figure 1. Cross Section of Participants during ESHIA Inception Meeting

The stakeholder's meetings consisted of an inception meeting which was held at the MFMR conference room on 15th June 2022. This was followed by a compensation committee meeting with landowners and a larger community engagement meeting at the Black Johnson community Centre, for wider engagement to elicit local stakeholders view for the elements of the community development action plan. The detailed scoping report will form part of the ESHIA studies inception report and will include information from desk review and review of previous ESHIA studies for harbour construction site verification exercises. It will identify significant environmental aspects that require further analysis and the identification of vulnerabilities of the community and areas for community development action plan as input into the resettlement action plan (RAP) and environmental and social management plan.

2.1.4. Initial Environmental Evaluation (IEE)

This comprised of a scoping study that included project screening and registration, stakeholder's identification, and engagement. It also comprised of ground truthing visits by EPA-SL to verify project site coordinates and to evaluate conflicting interests. This was used as key benchmarks in the ESHIA process against which the EIA license granting institution (EPA-SL) will evaluate the

project viability to warrant EIA license.

2.1.5. Project Screening and Registration

The ESHIA application, including Screening Form and proposed project area coordinates were submitted to the Environmental Protection Agency Sierra Leone (EPA-SL) by the MFMR as notification for the proposed project. This served as input to facilitate the Ground Truthing exercise conducted by the EPA-SL and to complete the registration requirement of the project with EPA-SL. The project has been classified by EPA-SL as a major infrastructure project that will impact on the landscape of the Black Johnson Community. This requires an environmental and social impact assessment (ESHIA) study to identify mitigation measures for associated impacts and recommend resettlement action plan that will ensure that the lives of the people are not worst off as a result of the project.

2.1.6. Scoping Studies and Preparation of Scoping Report

The Fish harbour project at Black Johnson requires an environmental impact assessment license which involves a scoping of the various aspects of the project, to ensure that the project is well designed to minimize negative environmental impacts. The Scoping studies will identify areas for environmental safeguards and incorporate measures to minimize and mitigate environmental, social and health impacts assciated with the project at an early stage . The scoping exercise included consultation with relevant stakeholders including the Environmental regulating agency (EPA-SL), tourism sectors and monument agencies. This was done inorder th capture consents and useful safegards required for the implementation of the project. The scoping studies involved the definition of the project framework and the development of stakeholder's engagement plan (SEP) and policies and its implementation through the harbour project cycle (pre-design, construction, operations, and decommissioning). It comprised of the screening and registration of the harbour project with EPA-SL and the identification of legal basis for the land acquisition. The scoping also included stakeholders' meetings for the identification of key areas for community development action plan (CDAP), which will inform the development of resettlement action plan (RAP) for the Black Johnson community.

2.1.7. Community Engagement Meetings and Interviews

Two large stakeholders' meetings were held at the Black Johnson Community. First was a groundbreaking meeting at the Black Johnson village square, held with key stakeholders including community leaders. Second was a larger community meeting held at the Black Johnson Community Center. This larger meeting was to elicit held views of stakeholders on key community development action plan. This meeting was based on Focus Group Discussions (FGDs) with groups of community members to respond to key questions on community development prescribed by an FGD questionnaire (Appendix 1). This was followed by key informant interview (KII) meetings held with key stakeholders that can influence decision making at associated project communities. These communities include York Village, John Obey, Big Water and Whale River Areas During the meetings, a Community Health Officer assessed the baseline wellbeing of the vulnerable people of Black Johnson community, including women by obtaining their Blood Pressure prior to commencement of the project construction. This was considered for risk evaluation of human health associated with the project. The cross section of participants at the FGD and KII meetings is presented in Figure 2.

Figure 2. Focus Group and Key Informant Meetings for CDAP

2.1.8. Initial Ground Truthing Exercise by EPA-SL

The first ground truthing exercise was carried out by the Environment Protection Agency of Sierra Leone (EPA-SL) and comprised of site visits held on 30th June 2022 and 20th July 2022. The initial findings during the first site visit were discussed during a stakeholder meeting at the conference room of the MFMR. The major issues raised by EPA-SL were concerned with the verification of perimeter boundaries of the project concession area. In the absence of the Surveyor, it was difficult to ascertain the precise areas for verification. Another concern was the Bollard (pillar) of bridge, a relic used during slave trade, to transit slaves through the Whale Bay to Bunce Island for onward trip across the Atlantic Ocean to North America (Figure 3). There were also issues of Yankai Resort partly situated in the concession area and owners claimed not to be aware. The issue of sea turtle nesting sites at Black Johnson was also raised by EPA-SL, based mainly on opinions from various lay people who do not seem to fully understand the environmental issues. There is an unlawful claim of landownership affecting two resort owners, Mr. Dumbuya for Yankai Resort and Tito's Eco-Village Lodge. Three unfinished houses of Yankai lodge are located in the project site, but within the Foreshore, less than 150ft from the Black Johnson beach, flanking the Whale Bay seafront and Black Johnson Lagoon. This structure is illegal by law and do not require compensation. Tito's Eco-lodge is even worst as it is situated at areas less than 50ft of the foreshore

Figure 3. Project Site Observed during Ground Truthing

The MFMR and stakeholder Team including the State Counsel representing the MFMR and Ministry of Environment, Tourism and Relic Commission and ESHIA consultants of Black Eagle, SL Ltd discussed the preliminary findings of the Ground Truthing at the Conference room of MFMR on 15th July 2022. Clarifications and general agreement facilitated a final ground truthing exercise held on 20th July 2022. Important clarifications during the stakeholders meeting included the following:

That the concession area for the fish harbour project at Black Johnson has been legally acquired by the Ministry of Fisheries and Marine Resources based on compulsory acquisition as provided by the Foreshore Act, Cap 149 and Section 21 of the Constitution of Sierra Leone. The coordinates of the land were demarcated thorough engagement with landowning families and verification process within the time window set by the MFMR that was extended for over six months. The State Counsel, Mr. Yusif Issac Sesay (Esq.) of law Officer's Department who is representing MFMR clarified that The President of Sierra Leone has signed the warrant transferring ownership of land to MFMR.

1) That the project site has not yet been demarcated with beacons and in the absence of a licensed Surveyor involved in the land ownership verification, it will be difficult to verify perimeter coordinated of the land
2) Compensation of landowning families is ongoing by the MFMR with additional considerations for allocation of alternative plots of land to family members
3) That the Yankai Resort and the Tito Eco-lodge are all located within the foreshore and do not legally qualify for compensation
4) That the slave relic at the project site comprises of remains of bollard of the transit Bridge used for transiting tens of thousands of African slaves through the Black Johnson Lagoon for shipment via the Whale Bay to the Bunce Island Slave Castle. It was clarified that the Slave door is present at York and was built by European Merchants in the 18th century, in addition to the Bunce Island Slave castle used for transport of Slaves across the Atlantic Ocean to North

America.

5) That sea turtles do not nest at the Black Johnson, except that as highly migratory species, sea turtles occur as bycatch in the artisanal fisheries of Sierra Leone, including in the Sierra Leone River Estuary. Those surveys involving MFMR and the sea turtle conservation program in Sierra Leone locates sea turtle nesting beaches at Turner's Peninsular, Shenge, Turtle Island, Western Area Urban and in the North

2.1.8.1. Final Ground Truthing Exercise

The final ground truthing exercise was guided by the Surveyor of Ministry of Lands, Housing and Country Planning (MLHCP), designate to the fish Harbour project in the person of Alhaji Mohamed Rabieu. The Ground Truthing process by EPA-SL relied on the guiding coordinates provided by Surveys Department of MLHCP to the MFMR. The exercise was facilitated by a Global Mobile Mapper coupled to a GPS which loaded the shape file of the coordinates of the project concession area of Black Johnson (Figure 4.).

The findings of the ground Truthing submitted to MFMR by EPA-SL included the following:

i) That the submitted coordinates of the proposed project site were accurate and consistent with the Ministry of Lands and Country Planning's survey data of the acquired land
ii) That there are few streams that flow through the concession areas and discharge into the Black Johnson Lagoon to the North West of the project site
iii) That the project site comprises of some houses under construction with few of them completed and occupied

Figure 4. Final Ground Truthing by EPA-SL, Guided by Licensed Surveyor

The report recommended that the displacement of people and loss of properties must be addressed by MFMR and that the ESHIA team should take cognizance of this and other social impacts associated with the fish harbour project. A sustained public engagement was recommended as a way of making the public fully aware of the benefits that will arise from the construction of fish harbour project at Black Johnson. It was strongly recommended that the environmental profile of the project site must be taken into account in recommending mitigation measures for environmental risks associated with the Project. It wasl also recommended that the ESHIA consultants consider the landscape and fish harbour construction design option during the scoping of the project. It was noted that this will provide immediate identification of mitigation measures required to minimize construction impact on socio-economics and wellbeing of the Black Johnson and surrounding communities. The Ground Truthing exercise conducted by Environment Protection Agency of Sierra Leone (EPA-SL) formed a major component of the scoping. This was used to verify any conflicting interests associated with the acquisition of land as related to the benefit of the project to the community and people of Sierra Leone.

2.1.9. Desk Review of Feasibility and ESHIA Studies

This was required at the design phase of the project and comprised a desk review of feasibility reports, previous ESHIA studies reports, newspaper articles and publications on harbour development for the last two years. It also included past information on the proposed Black Johnson site, including any satellite imagery that depicts biodiversity loss over time. The components of the fish harbour qualify as a fishery bonded industrial park (FBIP), containing multifunctional facilities. The project components were fully defined based on the results of the engineering feasibility studies on the project site, conducted in 2018 (Shandong Gangtong Engineering Consulting Co. Ltd, 2018). This was informed by site characterization during this ESHIA studies for a final site layout. This will help provide recommendations for a good design of the project to meet key objectives for the project, including identification of options for construction management plans (CMP). The project framework aims to provide for slipways and jetties for berthing of 15 vessels at a time for offloading of fish catches, fish processing and storage platforms, Vessel repair facility, bonded stores for fish handling and processing materials, maritime control areas. The project also proposes a mariculture demonstration park with a Competent Laboratory for Fish and Fishery products controls and provision of staff building and future development of social housing facility. The environmental management implications including Environmental and social management plan (ESMP), Grievance redress mechanisms (GRMs), community development action plans (CDAP) and resettlement action plans will define the project.

2.1.10. Stakeholders Inclusivity and Engagement Plan (SEP)

This included the identification of Stakeholders for their inclusion in the ESHIA process and development of stakeholder's engagement plan (SEP) based on national policies and in line with World Bank Safeguard Policies and other international instruments. The stakeholder's engagement plan has been prepared as a working document and circulated amongst the study teams and will be updated during the project phases (design, construction operational and decommissioning). Key stakeholders and stakeholder institutions were identified during the project inception meeting. These included project beneficiaries and landowners, regulatory agencies (EPA-SL, Ministry of Works), Community Leaders, Ministry of Lands and Country Planning, Ministry of Environment, Ministry of Tourism, Ministry of Justice, Civil Society Organizations (CSO's) including Artisanal Fishermen's Consortium and Industrial Fishing Company Association (SLIFCA)..

The stakeholder's engagement framework comprised mainly of stakeholder's meetings, focus group discussions (FGDs) and key informant interviews (KIIs) and the inclusion of stakeholder's consent framework. The SEP comprised of the following elements:

i) Stakeholders identification and definition of their timely roles in the ESHIA studies and project intervention
ii) Completion of a scoping and project screening form that includes stakeholders consent statement.
iii) Inception meeting and community engagement for the Identification of risks associated with key stakeholders of Black Johnson Community. This captured the effects of project activity on their livelihoods
iv) Providing the legal basis for land acquisition at Black Johnson for the fish harbour
v) Provide framework for achieving agreement and communicating EHIA study processes with stakeholders
vi) Presentation of elements of project inception and ground truthing and scoping report with stakeholders
vii) Identify means of collection of information and dissemination of project information
viii) Recommendation of Mitigation Measures in line with World Bank's Mitigation Hierarchy Pyramid for environmental and social framework

3.0. Data Collection and Ecosystem Modeling

The data collection and ecosystem modeling for the ESHIA studies for construction of fish harbour at Black Johnson will covered the following areas:

- Consultation of Stakeholders
- Topographical Survey and biophysical baseline data gathering
- Biodiversity, ecology and environmental risk assessment studies
- Bathymetric survey of whale Bay
- Socioeconomic and Health Baseline Data Gathering

3.1. Consultation of Stakeholders

Survey consultants carried out field study to identify the communities. The survey instruments used were questionnaires prepared prior to the survey, including key informant interview questionnaire and Focus group discussion questionnaire (See appendix 1 and 2.

3.2. Topographical Survey and Biophysical Data Gathering

The topographical survey and biophysical data gathering comprised of topographic characterization and mapping of the land and sea areas of the Black Johnson harbour site. It also comprised of desk review analysis of existing feasibility and ESHIA studies carried out in the area, biodiversity mapping to understand the biodiversity of the area, environmental risk assessment through collection of water and sediment samples for analysis and climate modeling for the Black Johnson and the Whale Bay areas. It also comprised of climate characterization and modeling, to understand the effects of climate change on proposed harbour construction and recommend mitigation measures the various project life cycle (from design Our topographic survey of the project site included mapping for site characterization at minimum scale of 1: 2000 and obtaining drone footages to depict the following features:

i. Roads and Access points withing the Black Johnson village area and utilities, buildings and vegetation terrains
ii. high-definition cross sections of existing structures
iii. Cross sectional areas of planned harbour platform, using baseline information of previous engineering drawings
iv. Geomorphology of the harbour area of Black Johnson village and features of the Whale Bay
v. Detailed description of required aggregate (rubble, sand or quarries) for the construction work, including their geotechnical suitability and preliminary quantity estimates for proposed structures for construction alternatives
vi. Possible layout for sewage outfalls and waste disposal areas
vii. Portable water supply areas, power supply and telecommunication points
viii. Fishing vessel and fishing gear manufacturing areas, small scale fishing boat offloading and gear maintenance points
ix. Office Area for the Marine Resources House and Competent Authority Laboratory for fish and fishery product testing
x. Possible port expansion and hotel hospitality areas

3.2.1. Characterization of Black Johnson Site for Proposed Harbour

This included desk review of existing studies, the use of drone to obtain footages of the Black Johnson land area for proposed harbour, biodiversity mapping of the site, environmental risk assessment and climate characterization and modeling.

3.2.1.1. Coordinates and Drone Footages of Project Site

The land coordinates for the 252-acre harbour project site were obtained from the Surveying Department of Ministry of Lands, Housing and Country Planning (MLHCP). The Ministry of Lands worked with the MFMR to set up a compensation committee comprising of land-owning families and the Security to verify land ownership and demarcate the 252-acre land area. Land acquisition which followed a due process affected land owning families and compensations package was agreed at Le 8 million for a plot of land equivalent to one town. In order to characterize the project site, a drone was deployed (Figure 5) to obtain footages around the concession areas which is not located in the Western Peninsular Forest that is protected under law, as previously misreported through social and print media.

Figure 5. Drone Deployment for Site Characterization

The coordinate of the land area which was based on reference bearings and GPS coordinates (Easting and Northing) were converted to Cartesian coordinate system, using The Universal Transverse Mercator (UTM) position of GQ01 with Joint Operation Graphics reference of NC28-16 and WGS 84 coordinate system. This coordinate system was provided to EPA-SL for the ground truthing exercise. Drone footages of the area were obtained using a drone to fly over the entire land area, including the Freetown Peninsula Protected Area Forest at the hills, back of Black Johnson. This was necessary in order to allay public fears that a Peninsular rainforest will be used for the harbour

Table 2. Fish Habour Boundary Coordinates

1	702958	915360.4	
2	702351.5	915273.7	
3	702005.1	915225.4	
4	701749.4	915139.1	
5	701708.8	914974.9	
6	701526.6	914271.3	
7	702389.5	914222.8	
8	702585.7	914925.2	
9	702820.8	914851.7	
10	702868.5	915011.3	
11	702942.6	915080.6	
12	702977.5	915140	
13	702995.3	915206.9	
14	702993.4	915261.6	
15	702958	915360.4	

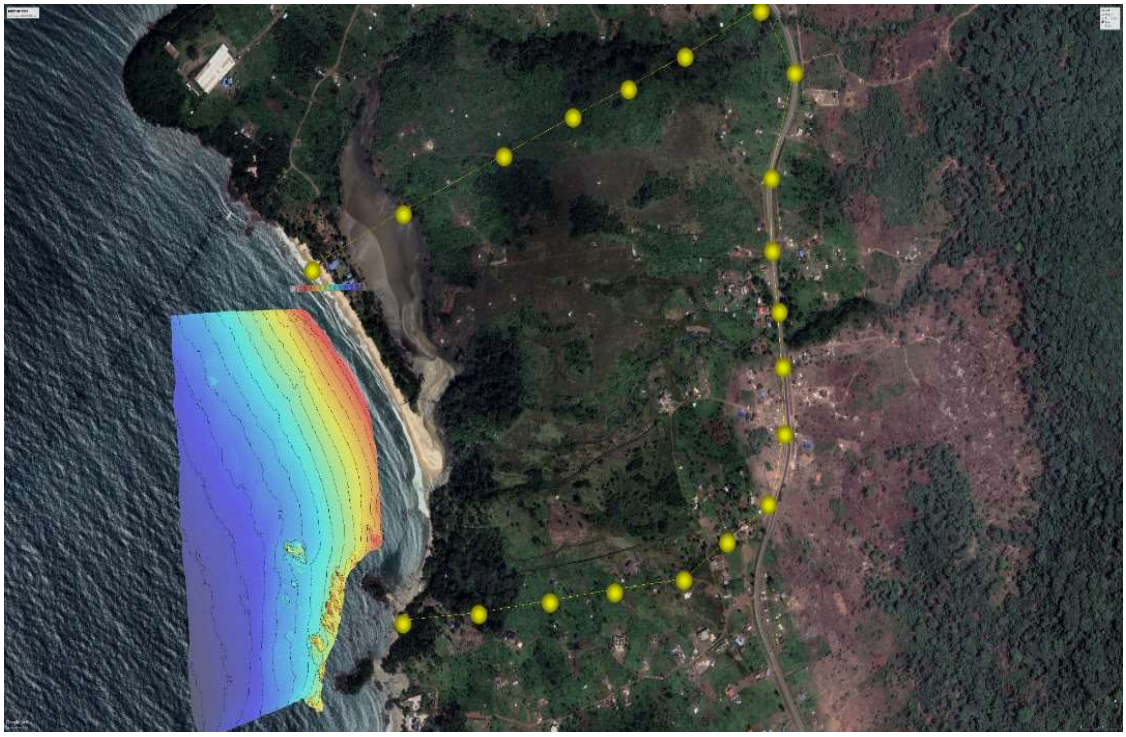


Figure 6. Traced Coordinates of Fish Harbour

3.3. Biodiversity, Ecology and Environmental Risk Assessment

3.3.1. Vegetation, Invertebrates and Fish

The Black Johnson ecological habitats were assessed through stratification method whereby the concession site was stratified into four zones from a specified reference point, and transects was being laid in each selected stratum (terrestrial -including farm bush); Wetland; Mangrove and Beach Zones). Ecological sampling for fish species landed by fishers and current status of mangrove vegetation was also reviewed. This technique ensured fair representation of the sampling sites. Both qualitative and quantitative approaches were explored for the survey since both provided different perspectives and complement each other. This aided the characterization of the proposed project site to achieve the best insights as described in Creswell (2013).

In principle, the ecological assessment of the status of vegetation, including mangroves and their flora and fauna (Fish, mammals, reptiles, birds, mangrove macro-benthos), with special emphasis on flagship species employed various methods of ecological sampling by experts on the project team. Transects lines guided by standard methods by many authors for similar research was used (Fano et al., 2003; Rochet and Trenkel, 2003; Diaz et al., 2004; Salas et al., 2006; Mistri et al., 2008; de Juan and Demestre, 2012; Rakocinski, 2012; Rodil et al., 2013; IMBO, 2011; 2015; Konoyima, 2020). Realtime plant identification onsite was made possible by the aid of the Google Lens App and local scientific knowledge of the community members that participated in the transect walk (Figure 7). Once the transect was walked and plants counted and identified, the same plant samples were collected in a bag and taken to the Biological Science Laboratory at Fourah Bay College for confirmatory identification by the aid of Botanist Technician.

Figure 7. Transect Walk and Observations for Biodiversity at Black Johnson

For epifauna, infauna and vegetation abundance sampling on intertidal zones, including the mangrove substrates, a 50m by 50m box transects, laid intermittently and all flora and fauna within each transect were counted and recorded. The diameter and height of the mangroves were also measured for use in further analysis of the value of mangroves at the proposed harbour site. Two distinct mangrove vegetation was discovered at either side of the Black Johnson Estuary. This includes catchment of White mangroves extending landward and the Rhizophora extending seaward towards the Whale Bay (Figure 8).

Figure 8. Mangroves, Avicennia (left) and Rhizophora (right) at Black Johnson River

The CO_2 offset by mangrove catchments at the Black Johnson River Estuary and Whale Bay areas was estimated as a proxy for the adaptive capacity of the Black Johnson community, against GHG emissions. Comparisons were made to overall CO_2 by mangroves of the Sierra Leone River Estuary. CO_2 is sequestered by mangroves at a rate two to four times greater than mature tropical forests and can store about three to five times more carbon per unit area compared to terrestrial forests (Fatoyinbo et. al.,2017). This makes mangroves as important ecosystems for reducing GHG emissions through sinks. We used the Climate Watch database query for GHG emissions and corresponding wetland, mangrove coverage and CO_2 offset for Sierra Leone. This was used as a baseline for comparison. We estimated the CO_2 offset by mangroves using ratio of relative atomic mass of CO_2 and carbon (3.67), using reference biomass of 840t of carbon per hectare of mangroves in the Whale Bay area and applying 25 years' life span of mature mangroves to obtain CO_2 sequestered in $MtCO_2e$ (Fatoyinbo, et. al.,2017).

3.3.2. Sediment and Benthos Sampling

Sampling of benthos for infauna within transects required scooping of sediments, sieved and

benthic organisms (infauna) recorded. Also, in each 50m x 50m transect lines, sediments were scooped to a depth of 25cm in waterlogged soils and water samples collected from such depth for sediment analysis at the Marine Biology Laboratory (Figure 8), Engineering Department of Fourah Bay College and the Sierra Leone National Water Quality Lab (Figure 9), for specific water quality indicator parameters including Heavy Metals, Nutrients, Escherichia coli and fecal coliforms. A portion of the top layer (1cm-2cm) of sediment was preserved in labelled plastic containers for physical, chemical and microbial analysis. Benthos samples collected were analyzed in the marine biology laboratory of Fourah Bay College (Figure 9), in order to determine the benthos community structure analysis as well as the species richness index of the project site.

Figure 9. Benthos and Plankton Analysis at IMBO Laboratory

Confirmatory laboratory tests for environmental monitoring, including water, ice and fish samples from establishments (Fishing Companies) in the Western Area will be carried out at accredited Laboratory in the sub-region. Environmental samples were collected from Black Johnson Estuary, ground water, river systems and the Whale Bay Area. Environmental samples were taken to the Sierra Leone National Water Quality Laboratory for physical, microbiological, and chemical test. Seawater and freshwater samples were tested for various parameters including Escherichia coli, total fecal and fecal coliforms and chemical analysis involving dissolved, nutrients and heavy metals including chromium, lead, arsenic, zinc were tested. The various equipment used for testing of samples is presented in Figure 10.

Figure 10. Analytical Testing of Water Samples at National Water Quality Lab

3.3.3. Marine Avifauna and Mammals

Local knowledge of the ecological assemblage of birds, mammals, mainly cetaceans and vegetation alongside 100 m intermittent ecological transect walk and literature review served as added advantage in obtaining useful information about the ecological integrity of the proposed project sites. We noted that Mangroves are critical ecological resources for climate regulation and coastal resilience. We employed geospatial mapping of the key mangrove sites on both sides of the Black Johnson River Estuary. Two distinct mangrove localities were surveyed, with White Mangrove (Avicenna) locality landward and Rhizophora seaward. The expanse of the vegetation was mapped using drone footages and appropriate Geographic Information System (GIS) tools by GIS specialists of the Black Eagle Consulting Team.

3.3.4. Water Quality Analysis

Water samples were collected at surface and 4m depth at the Black Johnson marine zone, preserved in ice and transported to the National Water Quality Laboratory Water laboratory, for analysis of key indicators of water quality, including physical indicators, microbiological indicators and chemical indicators of nutrient and heavy metals. Specific parameters for analysis included:

a. **Physica**l- Temperature, Salinity, Water Hardness (total calcium and magnesium ion concentration,

b. **Chemical**

i. Nutrient- Dissolved Oxygen Concentrations, Total suspended solids, pH, Phosphate, Sulphate, Nitrate-nitrogen.
ii. Heavy Metals- Iron(Fe), Lead (Pb), Cadmium (Cd), Arsenic (As), Zinc (Zn)
iii. Microbiological (Escherechia coli, Faecal and Non-faecal coliform**.**

3.3.4.1. Physical Analysis

Physical analysis for water samples was carried out using potable laboratory instrument at the national water quality laboratory, Ministry of Water Resources, Freetown. The turbidity measurement was carried out using the turbidity meter and dissolved oxygen meter was used to analyze dissolved oxygen (DO). For the analysis of total suspended solids (TSS), a 250ml of water sample was measured and blended for 2 minutes in a blender machine and phone meter used to obtain readings

3.3.4.2. Microbiological Analysis

The determination of fecal coliforms, E-coli and other bacteria in the water samples collected was carried out by membrane-filtration technique using the WAGTECH Portable Kit. One volume of each water sample of 50 ml was measured and filtered through Millipore filter pads with pore size of 0.45 µm in the pre-sterilized filtration unit assembly. The filter pads were capable of trapping any bacteria present in the water samples. The pads were then removed using forceps and placed on top of a filter membrane, soaked in membrane faecal coliform broth in pre-sterilized petri dishes. The petri dishes were later incubated for 18-24 hrs. at a temperature of 44^{o}C in the incubator of the WAGTECH portable kit after one-hour resuscitation period. Escherichia coli (E. coli) present was identified by the formation of blue colonies on the filter pads. The faecal coliforms formed pink colonies and non-faecal coliforms formed red colonies. The colonies were then counted and expressed per every 100ml water sample.

3.3.4.3. Chemical Analysis

Chemical analysis was carried out by photometric method, using the HACH DR /2010 Photometer 7100. The analysis procedure was in accordance with procedures outlined in the HACH water analysis handbook, 4th Edition (HACH., 2005.). “Water Analysis Handbook,” 4th Edition, 2005, pp. 31-200 See https://www.hach.com/WAH. Nitrate was determined using the cadmium reduction method at light wavelength of 400nm. A 10ml sample cell was filled with the water samples and another sample cell with de-ionized water. This was used as the blank sample. The contents of 1 Nitra Ver 1 nitrate reagent powder pillow was added to the cell with the water sample. After a period of 6 minutes reaction time, the sample cell with de-ionized water was used for zeroing the instrument before the prepped sample was measured in

mg/l N- N.

Water Hardness was analyzed using a MINIKIT AF424 test.:
200ml = (No. of tablet × 10) -5 100ml
= (No. of tablet × 20) – 10 50ml = (No.
of tablet × 40) – 20

Lead was analyzed using the lead test kit. To every 5ml of water sample was added 3 drops of lead 1 and swirl, dipping one strip in sample and waiting for 5 min.

Arsenic test using watch visual arsenic detection kit as follows:

Graduated flask, Tri-filter arsenic trap bung, Black filter slide, Red filter slide, Filter paper (labelled black), filter paper labelled Red, Flask, Powder Sachet A1, Tablets A2 and forceps. Sample preparation included taking one flask and filling it to the 50 ml line with water sample. Next, A1 powder sachet was taken and poured into the flask, loaded bung device was taken and check filter slides fully pushed into the bung. Next, a Tablet of A2 was taken from the container and carefully dropped into the flask. The bung device was pushed down firmly into the flask and waited for 20 minutes for reaction to take place. The black filter slide was taken from the bung device and readings by color codes conducted.

3.3.4.4. Salinity Analysis

For salinity analysis, water samples were collected from Black Johnson, at selected points within

the proposed Industrial Fish Harbour construction site, in June 2022. The water sampling points consisted of: i) Fresh water from upstream and downstream of Black Johnson's stream water, marked as station 1 and station 2, ii) Underground water and surface water from the intertidal zone (estuary), marked as station 3 and station 4 respectively, and station 5 was sea water. The samples were taken to the Marine Biology laboratory at the Institute of Marine Biology and Oceanography for analysis. Additional water samples were also collected during the bathymetric survey routine

3.4. Bathymetric Survey to Map Sea Floor Profile of Whale Bay

3.4.1. Reconnaissance Visits and Survey Planning

The site location (Figure 10) and preliminary survey coordinates (Table 1) were obtained through a four days reconnaissance visits to the seafront of the Whale Bay areas to understand the general layout and topography. We used guiding coordinates provided by the Client (**MFMR**), as coordinates discerned by the Government's Surveying Department, to define the Survey Area. The coordinate system used is based on the WGS 84 Datum, the guiding coordinate for the landward area of the project site (**Latitude 8.26132^{o}N, Longitude 13.167029^{o} W)** was used to acquire preliminary coordinates for survey planning (Table 3.).

Table 3: Preliminary Coordinates for the Bathymetric Survey in Whale Bay

LATITUDE			LONGITUDE		
Degrees	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**
8	16	14.03	-13	10	4.23
8	16	14.01	-13	10	7.00
8	16	13.96	-13	10	13.48
8	16	13.93	-13	10	21.12
8	16	14.19	-13	10	28.16
8	16	14.07	-13	10	41.30
8	16	9.19	-13	10	9.66
8	16	9.04	-13	10	9.69
8	16	8.93	-13	10	26.64
8	16	9.04	-13	10	41.22
8	15	56.19	-13	10	16.15
8	15	56.22	-13	10	25.85
8	15	55.99	-13	10	41.02
8	15	49.94	-13	10	23.97
8	15	49.95	-13	10	34.04
8	15	49.94	-13	10	40.60
8	15	43.2	-13	10	24.78
8	15	30.38	-13	10	31.54
8	15	30.31	-13	10	41.70
8	15	30.25	-13	10	43.16
8	15	17.28	-13	10	7.68
8	15	17.28	-13	10	33.6
8	15	17.29	-13	10	42.20

During the reconnaissance visits, we obtained information from the Black Johnson community concerning the history of the project site, including prevailing water levels and flooding events during the rainy season. After the visits, the decision was made, together with the client to extend the survey site to 250m further out to sea, from the original requested area of 500m. The 10m contour was also captured by Black Eagle SL Ltd., to provide the client with an indication of deeper waters and its distance from the shoreline, as required for fishing vessels of larger drafts. Accordingly, we acquired coordinates for the bathymetric survey area in the Whale Bay, Stretching to approximately 700 meters long, above the 500m client mandate. South of the Black Johnson Beach into the Whale Bay, extending into the deeper waters of the Sierra Leone River Estuary which empties into the Atlantic Ocean. Surveys were extended into deeper waters to capture depth profiles between 1m to 10m contours as part of the survey mandate (Figure 11). The 10m depth extent was required, so as to understand

the isobaths for deep water terrains that can permit port navigation and berthing for larger fishing vessels equivalent to the Panamax vessels. The survey will assist the Ministry of Fisheries and Marine Reasources in deciding on an optimal location for a new fishing harbour in the area.

Figure 11. Bathymetric Survey Location

3.4.1.1. Survey Personnel and Equipment

The survey was carried out by expert hydrographers and port engineers and Skippers of Black Eagle SL. Ltd., including the following: Mr. Stefan Kruger - Party Chief/Skipper,
Mr Schalk Willem Prinsloo - Professional Hydrographic Surveyor. In order to meet the local content requirements of Sierra Leone, Staff of the Client Institution of the MFMR and our collaborating institution of IMBO were trained on the survey routines involving the latest bathymetric technology of multibeam and Side Scan Sonar. The survey equipment comprised of advanced navigation, multibeam and side scan sonar and conductivity systems, including the following:

- 1 x Trimble R4S GNSS Receivers
- SBG Ekinox INS system used for navigation with smart balance and accuracy
- Edgetech 6205 Multibeam and Side Scan Sonar
- Valeport Swift SVP, a CTD device fitted with **Valeport's** digital time of flight **sound velocity sensor (range of 1,375-1,900 m/s and resolution of 0.001m/s**), temperature compensated piezo-resistive pressure transducer and a temperature sensor (range of -5°C - +35°C)
- Data acquisition and processing done with BeamworX. Other software used include, Trimble Business Centre, Qinertia, Sonarwiz, and Microstation.
- Plankton and seawater sampling at various points during survey routine

The bathymetric survey, conductivity and plankton equipment used is presented in Figure 12.

Figure 12. Bathymetric Survey, Conductivity and Plankton Equipment

3.4.1.2. Installation and Calibration of Survey Equipment

Installation of sensors, measurement of offsets and setup of the BeamworX project files were done on board the vessel of opportunity 'Sea Safari' (Figure 13) which is a 33 ft catamaran vessel Supplied by the consultants Black Eagle SL Ltd. The vessel was powered by two Suzuki outboard engines of 300hp each.

Figure 13. Bathymetric Survey Vessel, 'Sea Safari' Catamaran

3.4.1.2.1. Sensor Offsets

The following offsets were measured and used in the BeamworX project and SBG INSi realtime, via a computer conectivity (See offsets in Table 4).

Table 4. Bathymetric Survey Equipment Offsets

Sensor Devices	STBD	FRD	Up
Waterline (COG)	0.000	0.000	0.000
SGB IMU	1.395	0.805	1.292
Edgetech 6205	1.525	1.017	0.403
SBG GPS 1	1.595	2.049	2.383
SBG GPS 2	1.595	0.051	2.383

The installation and calibration of survey instruments was based on the simple tri-bit binary descriptor (STBD) that utilizes a simple sampling pattern (SSP) and a tri-value binarization strategy (TBS). Here, sample points were divided into two groups according to the distance from their pattern centre and smoothed out. The descriptor was then adaptive to the matched images produced, based on a selection strategy that detected keypoints to pair with low correlated pairs of sampling points. This was done for the edgetech 6205 bathymetry and side scan sonar system and the SBG Ekinox System and GPS devices. This ensured continous recordings with precision and robustness in all weather conditions, including highly turbulent environments in the Whale Bay.

3.4.1.2.2. Datum Information and Control

The datum level, coordinate system and control include the following:
Datum : World Geodetic System 1984 (WGS 84)
Ellipsoid : World Geodetic System 1984 (WGS 84)
Projection : Universal Transverse Mercator (UTM): Zone 28 North
Geoid Model : EGM 2008
Central Meridian : 15°00' 00" W
Vertical Datum : Chart Datum (CD) = Mean Sea Level (2022-06-21) – 1.68m

For survey control, a base station was setup over an unknown point and GNSS data logged for later post processing. Due to the unavailability of control points in the area no control point could be occupied to compare the coordinates to our survey. There is however great confidence in the Post Processed Base Point (PPP) that was computed using the static survey observations as mentioned above, with an accuracy better than 0.005m, 0.011m and 0.024m for the latitude, longitude and ellipsoidal height respectivly being generated at the 95% confidence level. The post processed kinematic (PPK) survey points were computed using the base station coordinates as well as the motion during the survey to create a trajectory that could be applied to the data set to ensure the best, and most acccurate results. Since there was no control points that could have been used in the area to shift the height of our survey, a decision was made to use the Eye4Software Hydromagic- EGM2008 geoid model as the vertical datum for the survey which can be reduced to Chart Datum afterwards.

In order to ensure that this model is an accurate representation of the Mean Sea Level (MSL) for the area, a R4s Trimble receiver was mounted onboard the vessel for a full tide cycle to help model the tidal data for that time period. The sounding depths for the survey also had to be reduced to the Chart Datum as per standard practice. There was some difficulty to establish the offset to chart due to a lack of information in the country of Sierra Leone. The following workflow was followed to best establish the chart datum offset for the area. A R4s receiver was placed in a secure location on one of the vessels moored to the quayside (Figure 14). This was left to log positional data every second for almost 24 hours (from the 21st of June to the 22nd 2022). The heights for this time period was reduced to the EGM2008 geoid that is closely similar to the Mean Sea Level (MSL) in that area.

Figure 14. R4s Base Station Set Up Near Cape Light House

Location specific tidal data was not available due to absence of tidal gauge. We reviewed tidal data from various sources including online data bases such as tide times (tide-forecast.com, TideTime.org, UK Hydrographic Office Admiralty Tidal Prediction Service). Due to the lack of time series of tide gauge data in Sierra Leone, three different resources were used to establish a predicted tide for that specific time period, to compare it to the surveyed tide described above. See Figure 15 below that outlines the difference between the predicted tide for the area that is referenced to chart datum against the surveyed tide that is referenced to the geoid EGM2008 that closely resembles the MSL of the area.

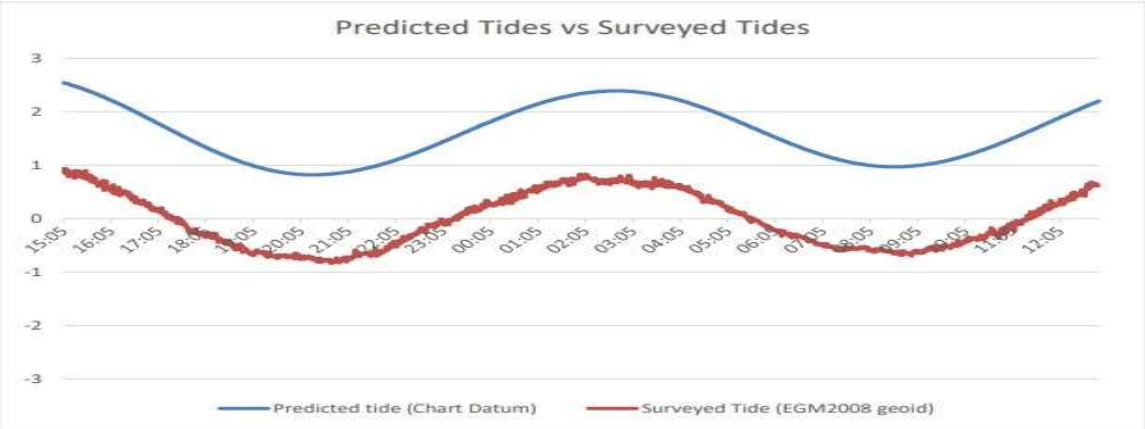


Figure 15. Offset of Predicted and Surveyed Tides

It is clear that there is an obvious offset between the two datasets. This has been calculated as 1.62 metres using the data that has been collected. Figure 16 shows the surveyed tides compared to the predicted tides when the former has been reduced to ChartDatum. It seems to fit surprisingly well when keeping in mind that it is only a prediction, and that the closest tide gauges seems to be in Dakar and Abidjan.

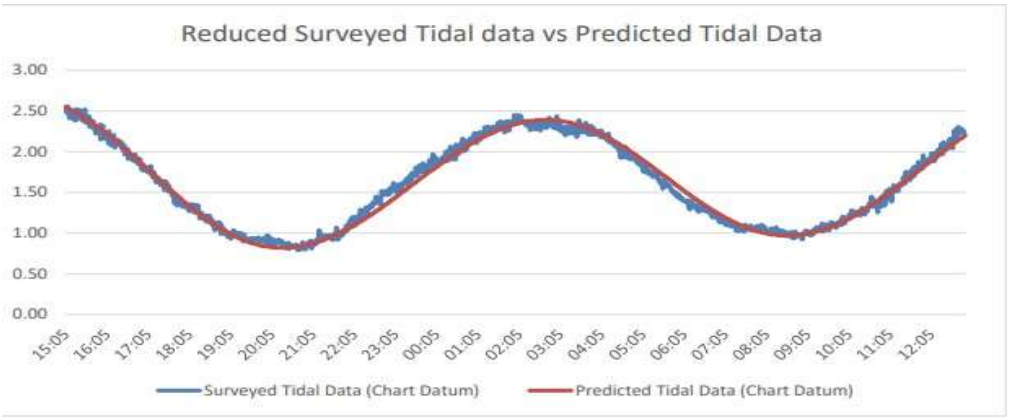


Figure. 16. Surveyed Tidal Datum Reduced to Chart Datum

The only concern with the above is that the offset to chart datum is based on an approximation of the tides in the area that can fluctuate with the seasons. This introduced the fact that there needs to be some alternative check on this offset of 1.62m between MSL and Chart Datum (Findlay I.W.O., 1978). In addition, a previous feasibility studies for the construction of a coastal across Sierra Leone River Estuary estimated a mean sea level of 1.9m with lowest astronomical tide of 0.2m (OPII/NaReMaC, 2019). We also note that sea levels are expected to rise by 0.6m and 1.3m by 2100, in more than 7 decades. The offset between MSL which we observed with the R4s receiver overnight and Chart Datum used to reduce our dataset corresponds to the Lowest Astronomical Tide of 1.70m as calculated by I.W.O Findlay in 1978. This is about 0.08m different to what has been calculated by Black Eagle SL Ltd., which is within tolerance. The decision was made that more research has to be done to verify the value for the Chart Datum offset. Three historic Admiralty Charts published by the United Kingdom Hydrographic Office (UKHO), the last of which was published in 1967, was retrieved and investigated. All three of these charts indicated that for over 50 years the Chart Datum offset from MSL was 5.5 feet or 1.68 metres (UKHO, 1967).

Realizing that very few hydrographic surveys has been done in the specific area since 1967 and that the current charts reflect the data from these historic charts, the conclusion was drawn that the Chart Datum offset would not have changed radically and would still be around 1.68m from the MSL. This once again fits very well with the previous calculated offset of 1.62m and even better with the 1.70m in the UKHO studies. The decision was thus made to accept the value of 5.5 feet or 1.68m as presented on the Admiralty Charts as to conform to the standard set by the UKHO and followed by most modern navigational aids.

3.4.2. Bathymetric Survey Routine and Training

The survey team comprised of Black Eagle Hydrographers with wealth of experience in bathymetric surveys and conversant with the terrains in Africa, including the Sierra Leone River Estuary, where the Whale Bay is located. The survey cruise leader was Stefan Kruger, the Project Director of Black Eagle, Sierra Leone Limited. Members of this team were involved in a previous bathymetric survey for construction of Lungi Bridge (Figure 17).

Figure 17. Survey Team for Whale Bay Bathymetric Mapping, June 2022

In order to meet the local content policy of Sierra Leone and strengthen institutions, a training and capacity building on the new multi-beam technology was provided for one staff from the client institution (the Ministry of Fisheries and Marine Resources) and a Technician from the Institute of Marine Biology and Oceanography (IMBO). They were trained on the calibration and installation of survey equipment including alignment exercise for suitability of survey system and data logging. The Technician was already also part of the Black Eagle Team to collect water and plankton samples for environmental analysis. The local content personal were also trained on the use of the latest CTD technology, the Vale Port Swift SVP device and its real-time data processing (Figure 18).

Figure 18. Training of MFMR Staff and Locals on New Bathymetric Technology

The bathymetric. survey team casted off from the Shipyard of Black Eagle at the Cape Light House in Aberdeen at 7am in the morning and commenced acoustic registrations at 9am in the morning. About one-hour period was used for equipment installation and calibration. The survey captured the high-water tidal stream, using the online tide times and the Sierra Leone Marine Chart. During the survey, only few small-scale fishermen were spotted on a fishing trip in the Whale Bay (Figure. 19.), which may be an indication of limited fishing activity in the Bay.

Figure 19. Artisanal Fishing Boat Spotted in Whale Bay During Survey

3.4.2.1. Multibeam Survey and patch test Calibration

The survey was conducted at no more than 4 Knots. The survey lines were run along the edges of the previous swath to allow for a minimum of 80% overlap. A single sound velocity profile (SVP) was performed in the deepest survey area, where a thermocline was detected at +- 6m deep and confirmed by performing another SVP. Continuous SVP data was acquired at the head band, to monitor surface temperature changes. A patch test calibration procedure was carried out to ensure that the multibeam system was within the correct specified alignment. The preliminary findings of the bathymetric survey is presented in Section 5 of this report.

3.5. Climate Modelling and Meteorology

Existing Information from weather station records on rainfall, temperature, humidity, wind direction and wind speed data and additional information was collected from secondary sources such as the UK's Met Office, Sierra Leone Met Department, Climate Watch and the World Bank Climate Portal. We note that an Engineering Feasibility by Shangdon Engineering Consulting Co. Ltd. estimated wave direction and the design high water level (3.24m), design low water level (0.35m) and Extreme high (3.68m) and Extreme Low (-0.10m) water levels. Our team notes that the water level calculation methods in the Chinese and foreign codes are different. The design high and low water levels and extreme high and low water levels in the Chinese norms are calculated using historical cumulative frequencies, with tide level data of not less than 1 year and not more than 20 years. In foreign norms (in the case of Sierra Leone), the average high and low tide levels of spring tides are mostly used as the design high and low water levels. Particularly for the sea areas of the Whale Bay which do not have long-term measured tidal data, the water level combination method was used to determine the extreme water levels for comparisons (Ning Guan et al., 2021).

3.5.1. Wave, Storm Surges and Sea Level Rise Modelling

Wave breaking at the Whale Bay area was estimated by calculating significant wave heights for the area using wave direction, fetch length and average depths of the area. Storm surges and sea level rise (SLR) scenarios were estimated based on the maximum of 1(one) occurrence in 100-year return period. Storm surge elevation and potential duration was modelled using input data of bathymetry of the Whale Bay and tidal datum. The tidal datum for the highest astronomical tide (HAT), lowest astronomical tide (LAT), water height due to wave breaking in the Whale Bay and freshwater input from rains and groundwater aquifer were considered in calculating the storm tide, total water level and future storm surge for the Whale Bay area. For accurate estimation of future water level changes, we used the horizontal length of the proposed harbour and the depth of the water column using bathymetric maps of the Whale Bay area surveyed. Changes in mean sea level pressure (ΔPa) in hectopascals at the Whale Bay/Black Johnson locality served as key input.

The atmosphere unit (atm) used as unit of pressure was defined as 1013.25 mbar (101.325 kPa) which is equivalent to 1013.25hpa. Where the elevation of the Black Johnson localities above water level increases, the atmospheric pressure will decrease. Data was obtained from Atmospheric pressure data of the area from the Sierra Leone National Meteorological Agency, global online data portals and bathymetric survey to estimate empirical storm surges for the Whale Bay. We

estimated highest water levels due to wave breaking, flooding and sea level rise using the following model input relationships applicable for the design of highways and harbors:

Storm Tide = Storm Surge + Highest Astronomical Tide
Total Water Level = Storm Surge + Tides +Waves + Fresh Water Input

The highest water level return period of 1 in 100 years was calculated according to Nicholls (2008) as follows:

Future Storm Surge (FSS) = S100 + SLR + (UPLIFT × 100 yr.) / 1000 + SUB + (S100) × x.

Where;

S100 = 1-in-100-year surge height (m), based on barometric pressures, tidal ranges, wind speeds, slopes of seabed and storm surge level in the Whale Bay area;
SLR = sea-level rise (1 m) accounted for Africa),

UPLIFT was measured as the continental uplift/subsidence in mm/yr, based on history of the area. SUB was assumed to be 0.5 m (to account for delta influences on the coast).
The tropical storm prone accounts (x = 0.1, or an increase of 10%) was applied to account for coastal areas of Sierra Leone prone to tropical storms. This was justified by the landslide and flash flooding that occurred in August 2017 in Sierra Leone which killed 1,141 people and destroyed property worth over US$31 million. The landslide was caused by the Tropical Wave Invest 1L and the Tropical Storm Gert. The waves and storms caused heavy torrential rains that aggravated flash flooding and mudslide. The key drivers that aggravated the impacts of the tropical storm on 14th August 2017 is residential development in and around hillside areas of Freetown that weakened the stability of slopes and resulted to vertical movement of soils.

We also estimated the height of depth limited breaking waves (design flood elevation for the harbour, as the percentage of the wave height above still water flood levels, including the velocity of flow of seawater. We explored the use of Surface Water Modelling Systems (SMS) and simulated Extreme storm events by analyzing 40 years of the globe ECMWF-ERA. ECMWF's forecast shows the evolution of weather over a broad spectrum based on ensemble prediction for Whale Bay and Black Johnson location. This was done to indicate the likelihood of a range of future weather scenarios that will impact the fish harbor. Waves and precipitation were modelled to provide information useful for storm surge predictions for the project site, hindcasted over the past 20 years, with base year of 1980.

We investigated Coastal erosion and sea level rise scenarios using coastal erosion due to vertical land movement in the Whale Bay Area under sea level rise scenarios and GHG forcing using Global Position System Solutions (GPS Solutions). The local vertical land movements (local erosion) will be related to absolute sea level rise of the area to obtain sea level rise scenarios. The climate simulation software suit with latest CMIP5 climate data will be used to obtain specific scenarios of climate change of the Whale Bay and Black Johnson area. This will include history of extreme events obtained from Emergency climate data portal (EMDAT), including minimum and maximum temperature, rainfall, humidity and wind speed scenarios. The World Bank Climate Portal and The Climate Simulation Software Suit (SimCLIM) software suit was used for the assessment of risks from climate change for sustainability of the project from climate risks. This will form an important input for the development of environmental management plan (EMP), construction management plan and the development of Environmental Impact Statement (EIS) for the design and construction of the proposed industrial harbour complex at Black Johnson

3.6. ESHIA Study Planning

Here, the project activity description including scoping and project construction and operational areas are identified with possible mitigation and environmental monitoring framework and plans. These are presented in the overall work plan.

3.6.1. Overall Work Plan

The potential environmental social and health impacts to be caused by constructing a fish harbour complex at Black Johnson along the Freetown Peninsula will be investigated in this study. Perceivable impacts of the fish harbour complex construction process on the quality of citizen's lives and land degradation will be systematically described. Environmental and social impact mitigation measures will be suggested. The final report of the **ESHIA** will contain the **EIA** and the **SIA** and should serve as the instrument for obtaining the Environmental License for the construction of the fishing habour in Sierra Leone. The results of the ESHIA study will be used by the relevant authorities in Sierra Leone to determine the most environmentally friendly manner of constructing the fish habour complex along the Freetown Peninsula. The work process involves the execution of eight steps including: Screening; Scoping; Baseline Analysis; Impact Analysis; Mitigation; Reporting (see Table 5)

Table 5: Overall Work Plan and Activities in the ESHIA Project

	Man Weeks														
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Cum.
Initial Environmental Evaluation - meeting and Site visit Analysis of Baseline conditions															
Comprehensive Assessment of Social and Environmental (Impact, Responses, Alternatives, and Mitigation Measures)															
INCEPTION REPORT		1													
Draft Stakeholder information and consultation plan, inclusive all annexes, formats and materials															
Field work (site visits) Focused research and analysis of "hotspots"															
Ground Truthing															
Draft ESHIA Report Preparation (Environmental and Social Impact Management Plans) (ESMP=EMP+SMP)															
DRAFT ESHIA REPORT								2							
Preparation for Public review of final draft of ESHIA report and Consultative meetings															
FINAL DRAFT REVIEWED											3				
ESHIA Final Report Preparation, Finalize ESMP and all annexes (RPF, RAP's, Grievance forms stakeholder meeting notes etc.)															
FINAL ESHIA REPORT														4	

3.6.2. Detailed Description of Activities Per Component

This Subsection details the underlying activities in the project plan. The assessment processes for

the environmental and the expected social impacts of the fish habour complex construction and operation are grouped under activities A to I. Detailed descriptions of the groups of activities are presented in Table 6**.**

As each group of activities labelled A to I is considered to be a component of the Environmental and Social Impact assessment process, each component of the assessment process is presented in separate Tables indicating the period and the days in which the various activities will be implemented. The Tables will be used as guiding documents for the further implementation of the ESHIA project. Before the implementation of each of the outlined project components, the relevant experts will indicate the days on which each of the activities will be executed.

Component A covers the inception period of this project and the underlying activities were implemented according to the activity chart presented below:

Table 6. The ESHIA project activities and descriptions

	Activity								
What	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
ESHIA Process	Screening for ESHIA levels Detailing of Consultancy team members to specific tasks and team Training	Scoping for temporal and spatial limits of impacts study Team training	Baseline study Potential effects vs non project effect	Assessing the significance of impacts	Propose Mitigation measures against project impacts	Draft ESHIA report with Annex containing (ESMP, RAP and RFP)	Reporting and Review of draft ESHIA	Final Draft for public review and meetings	Final Report
Who	Consultant, and stakeholders	Consultant using existing checklists)	Consultant	Consultant, EPA, Environment and Social Protection guidelines	Consultant, EPA	Consultant	Consultant EPA and Public	Consultant	Consultant

Component A: Screening/Inception

Activity	**Deliverables**	**WEEK 1 AND 2 Completion by Days**											
		1	2	3	4	5	6	7	8	9	10	11	12
Determine level of assessment Research data and information from existing frameworks Discussion with key	Level assessment of impacts	**X**	**X**	**X**	**X**								
	Determine boundaries of EIA						**X**	**X**	**X**	**X**	**X**	**X**	

representatives (Stakeholders) Highlight selected developments to be affected in the project Areas	Proposal of impacts on people and relative significance		**X**	**X**	**X**	**X**	**X**	**X**					

Component B: Scoping

Activity	**Deliverables**	**WEEK 3 TO 6 Completion by Days**											
		1	2	3	4	5	6	7	8	9	10	11	12
Detailed investigation of impacts and key issues of the project	Key issues of the project and the Impacts	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Project Boundary definition (spatial and temporal)	Project duration and spatial extent	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
Identify social /environmental concerns and issues	Concerns and issues (Environmental, social)	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Reviewing checklist and guidelines for selection of initial variables and relevant issues for SIA and EIA	Research questionnaires	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Component C: Baseline Analysis

Activity	**Deliverables**	**WEEK 7 Completion by Days**											
		1	2	3	4	5	6	7	8	9	10	11	12
Comparing: Project induced impact and non-project impacts in the project area	Project impacts and non-project impacts			**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
Determining the duration of the impact	List of long- and short-term project impacts	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
Identify potentially affected groups through public consultations	List of potentially affected groups and representatives	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Use of documentation on fish harbour construction and operation	Public perceptions on potential impacts and alternatives as bases for public involvement Programme	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Component D: Assessment of Impact Assessment

Activity	Deliverables	WEEK 9 AND 10 Completion by Days											
		1	2	3	4	5	6	7	8	9	10	11	12
Evaluation of impact significance Impact prediction and analysis Determine Impact Responses and Mitigation	List of impacts and significance	**X**	**X**	**X**	**X**	**X**	**X**						
	Levels of Impacts	**X**	**X**	**X**	**X**	**X**	**X**						
	List of impact duration and extent						**X**	**X**	**X**	**X**	**X**		
	List of impacts and mitigation measures								**X**	**X**	**X**	**X**	**X**

Component E: Mitigation

Activity	Deliverables	WEEK 12 Completion by Days					
		1	2	3	4	5	6
Determine migration recommendations Development of the ESMP, for fish harbour complex construction and operation Determine risk assessment and disaster management plan for project implementation Determine environnemental management plan	Mitigation recommandations	**X**	**X**	**X**			
	ESMP			**X**	**X**	**X**	**X**
	RAP,	**X**	**X**	**X**	**X**	**X**	**X**
	RFP EMP	**X**	**X**	**X**	**X**	**X**	**X**

Component F: Draft ESHIA Preparation

Activity	Deliverables	WEEK 13 Completion by Days					
		1	2	3	4	5	6
Preparation of draft EIA report Preparing the dissemination of the draft report for review by EPA, MFMR, and other stakeholders	EIA report	**X**	**X**	**X**			
	Draft report distributed among stakeholders				**X**	**X**	**X**

Component G: Review of Draft ESHIA

Activity	Deliverables	WEEK 13/14 Completion by Days									
Contact Stakeholders to review draft report	Reviewed Draft Report	1	2	3	4	5	6	7	8	9	10

Component H: Final Draft Report Presentation

Activity	Deliverables	WEEK 13/14 Completion by Days									
		1	2	3	4	5	6	7	8	9	10
Preparation of final draft report Preparation of final draft report for presentation	Final draft report	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	Presentation of final draft report to EPA for public disclosure	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Component I: Final Report Preparation

Activity	Deliverables	WEEK 14 Completion by Days				
		1	2	3	4	5
Preparation of final report incorporating disclosure comments Preparation of final report for EPA Licence	Final report	**X**	**X**	**X**		
	Presentation of final report to MFMR for submission to EPA				**X**	**X**

4.0. Findings of ESHIA Studies for Fish Harbor Construction

Our field visits and environmental, social and health impact analysis was preceded by an inception meeting with key stakeholders at the conference room of MFMR. This presented the opportunity to collect tangible environmental, social and health information/data such as biophysical, socioeconomic and health impact evaluation of the proposed project. This informed the development of mitigation measures covering pre-construction, construction and post construction scenarios and the development of construction management plan (CMP), environmental and social management plan (ESMP), resettlement action plan (RAP) and community development action plan (CDAP). The reports of all study stages including inception, draft reports will be submitted to EPA-SL and validated by stakeholders during disclosure. The final report after disclosure and a summary of key deliverables developed into an environmental impact statement (EIS) will be submitted to EPA-SL for assessment and issuance of EIA license.

4.1. Policy, Legal Framework and Feasibility

Laws, regulations and policies of relevant agencies, departments, and organizations, such as the EPA, MFMR, Forestry and Wildlife Departments, Factories Inspectorate are expected to be considered in the implementation of the project. Our desk review show that the following national and international environmental policies, laws and treaties have been ratified or acceded to by Sierra Leone, and are currently in force:

- Fisheries and Aquaculture ACT 2018
- Fisheries and Aquaculture Regulations of 2019
- National Environmental Policy, 1990
- Environment Protection Agency Act, 2008, as amended in 2010
- Foreshore Act of Sierra Leone, Cap 149
- Environmental Impact Assessment Procedure, 2001
- Forestry Act, 1988
- Forestry Regulations, 1989
- Wildlife Act, 1972
- Factories Act, 1974
- National Lands Policy of Sierra Leone, 2015
- National Water Resources Management Agency Act, 2017
- Sierra Leone Constitution, 1991
- Crown Land Act 1960 No. 19 – Legislation of Sierra Leone, 1960
- Sierra Leone Forestry Policy, 2010
- Fisheries Policy Framework of Sierra Leone, 2016
- Crown Land (Amendment) Act No. 18 of 1963 – Legislation of Sierra Leone
- Law Books of Sierra Leone Vol. 111 – 116 – Public Lands
- Law Books of Sierra Leone Vol. 111 - 117 – Unoccupied Lands
- Law Books of Sierra Leone Vol. 111 – 128 – Survey Ordinance
- Law Books of Sierra Leone Vol. 149 - Foreshores
- Town and Country Planning Act, 1946
- Town Planning Declaration, 2001
- Local Government Act, 2004
- Convention on Biological Diversity – (CBD)
- Convention on the International Trade of Endangered Species – (CITES)
- 1979 Convention on the Conservation of Migratory Species of Wild Animals (CMS)- The Bonn Convention. Entered into force in 1983
- The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972
- The International Convention for the Prevention of Pollution from Ships 1973, as

modified by the Protocol of 1978 (MARPOL 73/78)

- The World Heritage Convention, 1972
- Ramsar Convention, 1971. To prevent the worldwide loss of wetlands through wise use and management of the remaining wetlands including rivers, coral reefs, swamps, marshes, lakes, mudflats, mangroves, or bodies of water
- International Whaling Convention, 1946, for proper conservation of whale stocks.
- The World Heritage Convention, 1972
- United Nations Convention on the Law of the Sea (UNCLOS), 1982
- Convention for the Protection of the Ozone Layer, 1985 (Vienna Convention). For reducing and eliminating manufacture and use of gases that destroy Ozone in the Earth's atmosphere. The objective of Vienna convention. To protect human health and environment against the harmful effect of ozone depletion.
- Montreal Protocol, 1987. Established a target to reduce and eventually eliminate the production and consumption of substances that cause ozone layer depletion
- Convention of Biological Diversity,1 992. It imposes obligations to conserve biodiversity in both terrestrial and marine ecosystems, including access and rights over resource use
- United Nation Framework Convention on Climate Change 1992 (UNFCCC). To regulate anthropogenic (manmade climate change)
- Rio Convention, 1992. To alleviate poverty, prevent local environmental degradation and protect the robustness and integrity of the biosphere.
- Kyoto Protocol, 1997. Emerged from UNFCCC, to mandate country-by-country reductions in greenhouse-gas emissions
- Sierra Leone Conservation and Wildlife Policy of 2010. To protect fauna and flora and adopt and implement the international Convention on Migratory Species (CMS) and the Agreement on the Conservation of African-Eurasian Migratory Water birds implement conservation measures for Marine Turtles of the Atlantic Coast of Africa,
- The National Protected Area Authority and Conservation Trust Fund Act, 2012. To promote biodiversity conservation, wildlife management, research, to provide for the sale of ecosystems services in the National Protected Areas

4.1.1. Desk Review of Fish Harbor Project Feasibilities

International best practice requires the construction of a fish harbor to be preceded by two different studies: 1) Feasibility study and 2) Environmental, social and health impact assessment studies (ESHIA). Both studies are usually required for the issuance of environmental impact assessment (EIA) license. The feasibility studies is the first stage for the site selection and investigation of constructability, which should include geotechnical studies for preliminary characterization of the site and engineering design of the harbor. The second stage which is the ESHIA studies is done for detailed site characterization to investigate conflicting interests, impacts of the project on the environment, health and socioeconomic settings and resettlement action plan (RAP) that should include community development action plan (CDAP). The cycle of ESHIA must include impact evaluation and mitigation measures and plans for construction management, environmental and social management and their monitoring framework at the design, construction and operational phases. We present a review of the following feasibility and ESHIA studies conducted on various sites in Sierra Leone for the construction of fish harbor:

4.1.1.1. Feasibility Options for Fish Harbor Site Alternatives

The need for the construction of an industrial fish harbor was first conceived as far back as 1970, by the Ministry of Natural Resources, Fisheries Division. The first studies was funded by the Commonwealth Fund for Technical Co–operation, for a consultancy service to carry out a survey of potential sites for constructing fish landing facilities in fishing villages along the coast of Sierra Leone and an industrial fisheries harbour complex for Freetown. This early study, which was undertaken by a Port Engineer from Shri Lanka in 1979 (Weeraratne, L. J.,1979) was done for the feasibility and engineering design of Fish

landing infrastructure in coastal villages and a fish harbor at Cline Bay of Kissy area in Freetown, near a private fishing Company, Sierra Fishing Company.
The recommendations of the feasibility and environmental impact studies proposed a harbor, designed using major reclamation area of 10.5 acres and available cove area of 26 acres constructed using revetment for mooring of smaller boats. Two stage construction was recommended with the first stage to consist of a main jetty with berth area of 548.64 m along minimum water depth of 5 m. A second stage would involve expansion to provide for berthing of larger vessels at a 152.4m. The major problem with this design was the requirement for reclamation of large portion of the cline bay, to provide for shore and waterfront installations that can provide 152.4m of quay area, where siltation and shallow water terrains were major risks. The proposed engineering design was a boulder revetment that allows mooring of small boats. In 1995 the Government of the Islamic Republic of Iran expressed interest in partially financing the project and a new set of designs were prepared, excluding the facilities of Sierra Fishing, Company, since it was evident that the company was developing its own independent facilities to service, its requirements.

4.1.1.2. Cline Bay and Kissy Dockyard Feasibility

Under a NEPAD Conceived project, A Feasibility Study on the project site at Cline Bay, Kissy was undertaken by Mr. J.A. Sciortino, FAO consultant, with input from earlier studies done by the Weeraratne. The proposed harbor was to consist of Vessel repair facility for syncrolift and docking of vessels to 600 GRT with associated support and training facilities. A fish landing jetty and Transhipment terminal of 200m and 140m respectively plus bonded cold storage of capacity up to 4,000 metric tons.

A major improvement is the inclusion of Landfill at factory sites, provision for testing laboratory for fish and fishery products and environmental monitoring, environmental management and a compliance monitoring component that provides for training and capacity building of stakeholders. An innovative project management component was to provide for private share holding Company to run the facilities. A second phase for Kissy East Terminal was to provide for transshipment area up to 140m, comprising of bonded cold storage and landfill factory in the East and Western part of Kissy Cline Bay area. The site investigations revealed an advantage of the sea areas of the transshipment terminal, which was deep enough to provide water depths of 8m that can accommodates larger vessels. However, a major impediment is the need for dredging of larger estuarine areas of the waterfront, which provided shallow depth contours of 4 m above chart datum.

Original design for Kissy dockyard completed in 1998 and followed up in 2008 was to be subjected to an ESHIA studies in 2010. However, expansion of the oil refinery made the site unsuitable and it was abandoned in 2010. Although the Kissy cline Bay and Dock Yard areas have possibilities of deep water in an already natural harbor, there exist the problem of conflicting interest with a Private fishing company and the land ownership of Sierra Leone Ports Authority. The expansion of pilot areas serving Sierra Fishing Company, QEII Quay and Kissy Oil Jetty makes the Kisy site unfavorable. In addition, the Harbor construction at Kissy point would require the resettlement of large number of people with very high costs. There was also a conflicting interest for land and sea space with Sierra Fishing Company that was developing its own jetty and vessel repair terminal. The ambition of the Sierra Leone Ports Authority to expand berthing and pilot space to accommodate more cargo vessels further created bottleneck and continues to pose conflicting interests. The project was also hampered by the dredging requirement for reclamation of land and the resettlement needs to meet design requirements. The topography and many shallow depth contours of the seabed was an issue and still remains an issue. The Kissy Cline Bay areas comprises of shallow flat cove within the larger Cline Bay which stretches from Cline Point to Ardon Point. The undulating terrain and shallow seafloor mosaic towards the West creates a gentle cliff towards the East, with littoral drift, thereby slowing down sediment transport and creating sediment build-up. Although the presence of oil refinery close by eases fuel supply for vessels, the location of the refinery on the top of the cliff of the bay creates sand accumulation around the cove which will require regular dredging and high construction and maintenance costs. The deeper waters extend far into the sea from the sea front, with -10m contours found around 400m from shore. The long duration tidal ranges with flood streams lasting around 5 hours causes the deposition of silt from the upper estuary into the cove.

The high deposition of sand bars at the mouth of the Sierra Leone River Estuary in the North prevents free flow of water . The difficult terrain and the financing mode are the main reasons for failure of the project.

4.1.1.3. Feasibility of Western Area Site Options

As the eastern part of Cline Bay areas became unsuitable for harbor construction, various feasibility studies with various recommendations has been done for the Western Area, including the Peninsular and Western Area Rural District.

4.1.1.3.1. White Man's Bay, Murray Town

Although deep waters are available at the White Man's Bay, This option was also problematic, partly conflicting with the Naval Wing Operations for maritime security and the huge cost of resettlement that will be required for a highly populated area.

4.1.1.3.2. Black Johnson, Western Area Peninsular

The Engineering feasibility conducted by Shandong Engineering Consulting Firm in 2018 concludes that the Black Johnson and Whale Bay areas are conducive for the harbor construction with constructible soil profile depicted by geological borehole data. The profile depicts silty fine sand, medium sand, muddy silty clay, block stone and strongly weathered granite that are constructible. The engineering feasibility shows that the Whale Bay is deep enough to accommodate larger vessels. The bathymetric survey conducted by Black Eagle Consulting Firm reveals possible depth contours at around 5m to 6m at seafront areas less than 100m from shore and 7 to 9.5m in the Whale Bay areas less than 400m from shore. The presence of Deeper waters closed to the sea front will require minimal dredging to accommodate large fishing vessels of drafts over 7m. This meets the harbor investment options required for small and medium vessels including, semi industrial vessels and fish processing vessels of 1000 dwt.

4.2. Proposed Project Site

Black Johnson lies at Latitude 8.261320 N and Longitude 13.167029 W. It is situated on the slopes of a mountainous peninsula with a maximum elevation of about 1000 m on the South Bank of the Sierra Leone River Estuary. The sea areas and waterfront site chosen for the location of the harbour complex lies within the Whale Bay. The Whale Bay lies on the Western Area Peninsular - located at about 1.82 km from York village and 1.12 km from Whale River. It is located at 1.12 km from York village closer to Williams Town and about 3.86 km from John Obey and 3.48 km from Tokeh Hills. Black Johnson is characterized by the Black Johnson River system that mixes with runoff water from the rains and groundwater from the mountains before discharging into the Whale Bay at its Southern end and to the West, directly into the Atlantic Ocean. This makes the Whale Bay a natural shelter. The drone footages of the Black Johnson reveal that the Western Area Peninsular Forest on the hills across the street at the Back of Black Johnson. (Figure 20).

Figure 20. Drone Footages of Black Johnson Proposed Fish Harbour Site

4.3. Description of Strategic Activities and Deliverables

Activities performed by Black Eagle - Sierra Leone Limited within the inception period are reported as deliverables. Only summaries of the outcomes of these activities are presented in the inception report. Detailed descriptions of all outcomes will be presented in the draft and final reports of the ESHIA studies. Key informant Interviews (KII's) and discussions with key persons yielded data and information which are placed under Appendices 1 and 2 of this report. Status of key deliverables of activities is presented in Table 7.

Table 7. Description of Activities and Deliverables

ACTIVITIES	Description	Deliverable	Current Status
Initial meeting and Analysis of Baseline conditions, Literature review, meeting other working groups	Official project start, formal meeting with MFMR and other relevant stakeholders, list of relevant local contacts and Stakeholders	Report: List of relevant local contacts and stakeholders:	Ongoing
	Literature review, feasibility reports, technical report for geotechnical studies, Environmental and Social Assessment guidelines,		
Geotechnical studies to establish the physical suitability of site for construction of harbour	Soil stability and consistency studies to gauge suitability	Geotechnical report produced	Done
Comprehensive Assessment of level of ESHIA studies (Impact, Responses, Alternatives, and Mitigation Measures) based on technical proposal	Bureau study and discussions with MFMR, EPA and geotechnical project team for port construction to assess the levels of ESHIA impacts	Guidelines and description of the level of impacts to be studied.	Pending. Awaiting review of material from the geotechnical report.
Bathymetry study and underwater profiling	Black Eagle – Sierra Leone Limited coastal marine study team deployed	Preliminary bathymetry studies Undertaken	Done
Ground truthing and sharing report with consultants	EPA hold discussions with the consultants for ground truthing for project categorization	Ground truthing undertaken by EPA and report Shared	Done
Climate modelling and Meteorology of Whale Bay and Black Johnson	Black Eagle team	Primary climate modelling and tidal prediction	Done
Discissions on questionnaire development for field consultation	FGD and KII Questionnaires administration	Identification of key areas for community development plan (CDAP) and Resettlement action plans (RAP)	Done

Discussions on baseline environmental sample collection and analysis. Identification of Institutions and competent laboratories	National Competent Authority (CA) for fish and fishery products to preside sample collection and testing of environmental samples. Identification of laboratories	The National Water Quality Laboratory and Sierra Leone Standards Bureau identified. Ghana Standards Authority identified for accredited testing	
Discussions on logistics and methodology to fly drones for site characterization and biodiversity survey mapping and benthos and seawater sample collection	Agreement to deploy drones to acquire footages on site. Transect walking discussed and agreed for biodiversity mapping. Sediment probing and sediment particle analysis discussed. Benthos, plankton and seawater sample collection agreed.	Droned of Black Eagle prepared and mobilized to site for deployment. Sample collection for plant species and animal species agreed. Sample equipment mobilization	Done
Hydrographic survey planning, Deployment of bathymetric survey equipment, calibration and survey commencement	Bathymetric survey planned. Crew composition and timing agreed. Calibration procedure and survey casting agreed	Bathymetric survey commencement and instrumentation calibration	Done
Testing of environmental samples including seawater and sediment samples in laboratories	Sample collection and testing of sediment and soils at the Civil Engineering Laboratory of Fourah Bay College Plankton samples tested at Institute of Marine Biology Lab. Sea water samples tested at National Water Quality Laboratory	Testing of sediment samples, seawater samples at national Laboratories	Done
Testing of environmental samples including seawater and sediment samples in accredited Lab	Sample collection and sample testing at the Ghana Standards Laboratory	Initial Contacts with Laboratory by Competent Authority for fish and fishery products of MFMR. Sample collection and testing	Ongoing
Climate modeling Software integration and modeling	Climate modeling for Whale Bay and Black Johnson for water levels, temperature, waves and storm surges	Climates for sea level rise, storm surges and design water levels	Done

4.4. Stakeholder Consultation and Interviews

The general purpose of the interviews and the social study was to understand and to document the ways individuals collectively perceive the harbour complex construction process and its use as a phenomenon and to construct a meaning around it. The interview process was a social study which took the form of direct one- on-one consultation with key stakeholder institutions in Freetown to provide them information about the project objectives and implementation procedures before soliciting and eliciting their concerns and suggestions. Group members were informed about the project objectives and implementation methods before discussing a few issues. Issues discussed in the Focus Group Discussions included: pre-knowledge of the project, views on project benefit and concerns to be considered, sensitive livelihoods in the community that may be affected by the project, community aspirations for developmental interventions and any other issues the community wanted to discuss. Outputs will be used for planning; strategizing or completing community or resource profile; reaching consensus or agreement on implementation methods; or obtaining general perception of community members on important matters like projects, plans and activities. Social study at Black Johnson employed Focus Group Discussions (FGDs) with community gatekeepers. Key stakeholders contacted during the inception period are those defined in the TOR for the ESHIA studies. Additional stakeholders were identified during discussions with MFMR and EPA who suggested other institutions to be consulted. The institutions that have identified for engagement and those institutions engaged during the inception period are presented

in Table 8. Institutional mandates were also sourced from the available public information, to synergize the legal framework for the fish harbor construction.

Table. 8. Relevant stakeholders engaged

Organization	Date visited/To be visited	Office Reference	Contact
SLIEPA	September 2022	Executive Director	+23278814540
Environmental Protection Agency, Sierra Leone (EPA-SL)	June to September	Executive Director and Natural Resource Management Directorate	+23278463417 +23278699316 +23276242300
NPAA/Forestry Department, Ministry of Environment	September 2022	Executive Chairman/Director	+23276627320
Ministry of Lands, Housing and Country Planning (MLHCP)	January to November	Licensed Surveyor	+23279717270
MFMR	Visited and consulted	Minister, Procurement Officer, Project Focal Point	+23278979417
MoE, Director of Natural Resources	Engaged and consulted	Minister, Director of Environment	+23280918120 +23276640113
MLHCP	Engaged and Consulted	Licensed Surveyor	+23277471644
NMA/Mining Engineer	September 2022	Executive Director	+23278975956
Landowners	Engaged and consulted. Another meeting expected in September 2022	Land Owning family Representatives	+23276688114 +23276616849 +23230211141 +23299538172 +23278514330 +23276610848
Black Johnson Community/Leaders	Engaged and consulted	Chiefs, Village Headman, Secretary, , Youth Leaders, Chair Lady	+23278514330 +23288756501 +23299538172 +23277659368 +23279220473 +23288072787
SLP	Engaged and consulted	Head of Operations for OSD	+23276653271
AG's Office	Engaged and consulted	State Council	+23278865676
Ministry of Works	September 2022	Director and Minister and Permanent Secretary	
Ministry of Tourism	Minister		
Ministry of Finance	Senior Finance Officer		+23276221055
Relics and Monument Commission			
Ministry of Information and Communication		Minister, Information Officers	+23276947657
Community School	Teacher	Primary School Teacher	+23277344347
Community Church	Pastor	Pastor	+23299443824

Community Elders, Youth Leaders in Black Johnson, Big Water, York, John Obey,	Community Elders, Youth Leaders, Community Police	Community elders, youth Leaders, Community Police	+23299831772 +23233877600 +23278016250 +23231873431 +23288426351 +23299443824

4.5.. Ground Truthing Lead by EPA-Sierra Leone

The preliminary ground truthing exercise which was held on Monday 27th June 2022 was led by the EPA-SL, the EIA license granting institution, and included Representatives from the MFMR and Ministry of Environment, to verify coordinates of project site, conflicting socioeconomic and cultural issues that would need to be reconciled in order to develop the site into a fish harbour.

4.5.1. Site Interface with Protected Areas

The project site was verified against four protected areas, the Sierra Leone River Estuary Ramsar Site, the Western Area Peninsular Forest (WAPF) reserve, the Western Area Peninsular Marine Protected Area and the Yawri Bay Marine Protected Areas that interface with Western Area Rural District.

4.5.1.1. Sierra Leone River Estuary Ramsar Site

The Whale Bay at Black Johnson is part of the Sierra Leone River Estuary (SLRE) Ramsar Site, which is 195,000 ha and comprises of a drowned estuarythat empties into the Atlantic Ocean. The mangrove cover of SLRE Ramsar Site is19% of the country's mangrove forest. The mangrove cover of the project site is about 400 m^2 (0.04 ha), which is a small coverage compared to the …….. mangrove cover of the SLRE. In order to evaluate the significance of this mangrove cover which will be impacted by the fish harbor project, we estimated the CO_2 offset by the mangroves using ratio of relative atomic mass of CO2 and carbon , with the reference biomass of 840 t of carbon per hectare of mangroves sequestered. We applied a 25 years life span index for mature mangroves to obtain CO_2 sequestered by the mangroves that will be cleared from the construction in million metric tonnes of carbon dioxide equivalence (MtCO2e) (SeeFatoyinbo, et. al.,2017). The result of the analysis and possible plans for mangrove restoration is provided in section …. of the environmental and social management plan.

We also noted that the project site is already under severe vegetation clearance for housing and gardening and coal burning activities by Black Johnson and associated communities for livelihoods support. This have led to the degradation of the fringes of mangrove vegetation and forest and wetland vegetation, making them patchy. The Avecinia and Rhizophora species at the site have also been affected by flood water inundations contributed by heavy rainfall and rising sea levels of Whale Bay . It is therefore obvious that the mangrove vegetation and remaining wetlands and forest would have been further destroyed in the short term on a 10 to 20 years scale in the alternative situation of Do nothing (NO FISH HARBOR PROJECT).

4.5.1.2. The Western Area Peninsular Forest

An important verification during the ground truthing was that the Western Area Peninsular Forest (WAPF) reserves does not lie in the proposed site for the fish harbour at Black Johnson. It was obvious to the ground truthing team that a fish harbour cannot be constructed on top of a mountain where the protected area forest is located. The Western Area Peninsular Forest (WAPF) is located on the hills of the Western Area Peninsular, on the extreme western edge, about 5 km south of Freetown. The forest lies on a chain of hills of about 37 km long and 14 km wide, with highest mountain ranges of Picket Hill in the south, rising up to 900m. The Black Johnson project site lies off the forest reserve, across the Peninsular road, about 1km to 2km westwards to the Whale Bay and Sierra Leone River Estuary, facing the Atlantic Ocean (Figure 21).

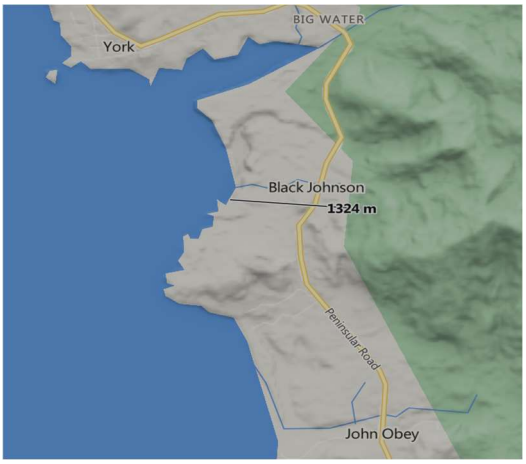


Figure 21. Western Area Peninsular Forest Reserve Proximity to Project Site

The Western Area Peninsular Forest (WAPF) reserve was designated as a national park in 2012 and has been proclaimed supplement to the Sierra Leone Gazette Vol. CXLIII, No.69 dated 29 November 2012. The reserve is tentatively part of the UNESCO World Heritage. Several watersheds drain the hills of the Western Area Peninsular, with the forests covering the steep slopes to provide essential ecosystem services which will be useful for the protection of the fish harbor complex at Black Johnson communities from flooding and mudslides. The hydrological cycle of this forest reserve helps to stabilize the flow of water during the peak of the rainy season, preventing erosion and landslides, and maintaining the quality of water in the small river systems of streams providing source of drinking water for the communities. Run off water and ground water empties into the Black Johnson Lagoon and Whale Bay.

4.5.1.3. Western Area Peninsular Marine Protected Area

The project site at Black Johnson is located in one of the Western Area Peninsular communities delineated as marine protected areas in 2014, under the World Bank supported West African regional Fisheries Program (WARFP). Although not officially gazette, this MPA was delineated to be included among the four gazetted marine protected areas declared in 2012 by the Ministry of Fisheries and Marine Resources (WARFP-SL/MFMR, 2014). The communities were organized into community management associations (CMA) as a Western Area Cluster 1, referred to as the ***Yethkath Cluster community management organization*** which include the following villages : ***York,Tokeh, No. 2 River, Sussex , Baw-Baw, Hamilton , and Lakka***. These communities are located close to the Black Johnson project site and their activities may influence the project development. The delineated MPA boundaries of the Western Area Peninsular is presented in Figure 22.

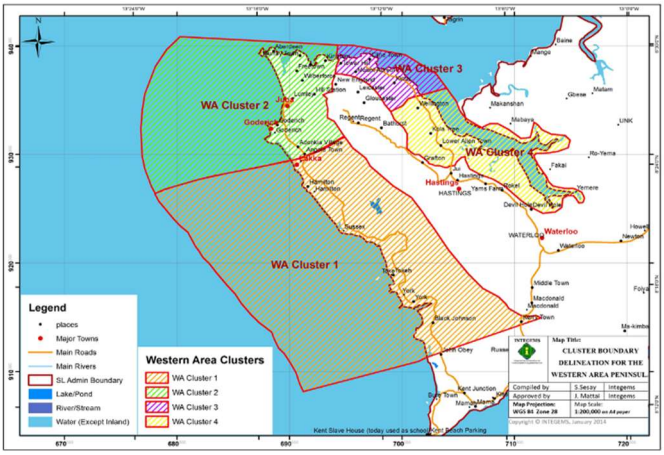


Figure 22. Western Are Peninsular MPA Proximity to Project Site (MFMR/WARFP, 2014)

The fish harbor project is a class A project which will impact on the biodiversity of the ecosystems of Black Johnson by total removal of wetlands, mangrove catchments along the project site of the

Blank Johnson Lagoon and the removal of fauna and flora through reclamation of lands from the Whale Bay and the Lagoon areas. However, the overall benefits of the fish harbor will outweigh these impacts. The mangrove removal will also be cushioned by the large availability of mangrove forests in the Sierra Leone River Estuary, which is a Ramsar Site. The breakwater systems of the fish harbor will minimize the effect of coastal erosion and runoff non the Black Johnson community and adjacent MPA ecosystems. The opportunities that will be associated with the fish harbor, including employment of fishermen, employment of fish processors, works for fish offloading, fishing vessel repair work, factories for fishing net manufacturing and maintenance, boat building and gear maintenance etc..

The fish harbor will also facilitate movement of goods to and from the MPA communities and increase local trade and import and export earnings for communities and for the country. The provision of support to increase export earnings will catalyze the creation of industries and increase in the consumer choice making and competitive business environment. In addition to the provision of economic benefits for people living in the marine protected area communities of Black Black Johnson and other adjacent communities, the breakwater system of the fish harbor will also help reduce the impact of flooding and coastal erosion on communities. The waste management treatment facilities and water management facilities will help improve the hygiene status of communities. Community development actions should consider community support activities for the MPA communities of the Western Area Peninsular in order to reduce pressure on the Western Area Peninsular forest reserves. This reserve is currently illegally used by some people in the surrounding communities as source of fuel wood and logging for housing development. Project interventions and enforcement activities that will encourage communities to use alternative sources of wood for cooking and building materials without using the forest wood from the reserve has been considered in the community development action plan.

4.5.1.4. Yawri Bay Marine Protected Area

The project site at Black Johnson is not located in the Yawri Bay marine protected area, which was declared by the MFMR in 2012 and delineated in 2014. However, the project site is located about 3.4km from the marine protected area community of John Obey, which is part of the Yawri Bay MPA (Figure 22). This MPA was declared with the key objective of the protection of fish resources and marine biodiversity. John Obey Beach and community is about 20 miles south of Freetown, in the western peninsular in the Western Area Rural District (Figure... In 2010, the local community at John Obey formed a partnership with sustainable tourism organization Tribewanted and are involved in eco-tourism community development activities at the John Obey. This is part of Cluster 10 of the Yawri Bay MPA, which comprises of comprises of: Kent, John Obey, Bureh Town, Banana Island and Ricket. The location of John Obey and delineated MPA boundaries is presented in Figure 23 (Left).

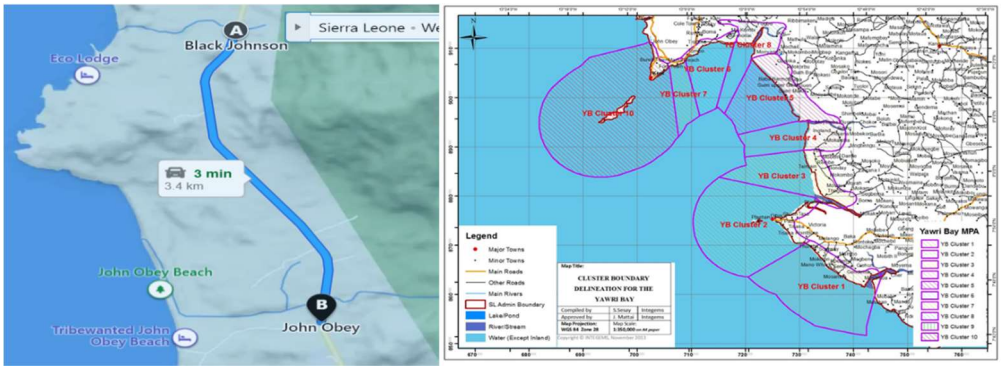


Figure 23. Yawri Bay MPA Proximity to Project Site (Right-MFMR, 2014)

5.0. Biodiversity, Ecology and Environment of Black Johnson

5.1. Plankton Assemblages

There is a plankton niche at the Whale Bay and Black Johnson Lagoon. A replica of these plankton assemblages of the Sierra Leone coastal waters, including creeks and bays have been studied extensively (Watts 1962; Aleem, 1979). In general, high plankton production is between the ends of the rainy season to the middle of the dry season (October-February). There is a decline from March to June, which extends into the rainy season. The major genera of the phytoplankton species are: *Thalassiosira, Nitzchia, Pleurosigma, Coscinodiscus, Thalassoinema, Skeletonema, Amphora, Ceratium, Peridinum,* and *Oscillatoria*. Some blue green algae may occur in the rainy season. In addition, dominant phytoplankton species in the dry season appears to be *Coscinodiscus* and *Thalassiothrix*. During the rainy season the dominant species are *Thalassiothrix*, *Coscinodiscus* and *Thalassiosira*. Algae species are not known to be exploited; no major changes in composition have been observed and are therefore in good condition (EPA-SL, 2015).

5.2. Fish and Invertebrate Assemblages

Historically, based on modifications in taxonomy which takes cognizance of both the biology and the physico-chemical environment, the fisheries and invertebrate assemblages of the project site is part of the marine fishery resources of Sierra Leone. This have been grouped into: a) pelagic, b) demersal, and c) shellfishes (Longhurst, 1969; Fager and Longhurst, 1968; Longhurst and Pauly, 1987; Williams, 1968; 1969) as follows:

The pelagic fish stocks comprise of the true pelagic and a largely loose category often referred to as semi-pelagic (Ssentongo and Ansa-Emmim, 1986; Coutin, 1989). The true pelagic in turn can be divided into inshore and offshore communities. The inshore community consists of the clupeids, with bonga shad (*Ethmalosa fimbriata*), Madeiran sardinella (*Sardinella maderensis*), crevalle jack (*Caranx hippos*), Senegal jack (*Caranx senegallus*), West African Spanish mackerel (*Scomberomorus tritor*), and bonefish (*Albula gorieensis*), among the most important species (Longhurst, 1969; Longhurst and Pauly, 1987; Ndomahina and Chaytor in Vakily et al., 2012). This category of fish is landed more frequently by the artisanal fishery. The offshore pelagic community consists mostly of species associated with three types of hydrographic regimes and include, the European anchovy (*Engraulis encrasicolus*), yellowtail sardinella (*Sardinella rouxi*) and *Trachurus* spp. These are usually found below the thermocline in colder waters (Williams, 1968, 1969; Fager and Longhurst, 1968; Longhurst and Pauly, 1987). In addition, large pelagic species are found associated with upwelling zones and these include Atlantic sailfish (*Istiophorus albicans*), swordfish (*Xiphius gladius*), yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*), little tuna (*Euthynnus alletteratus*) and frigate tuna (*Auxis thazard*). Further, the semi-pelagic species are associated with regions of high zooplankton productivity (Coutin, 1989), and include species such as bigeye grunt (*Brachydeuterus auritus*), grey triggerfish (*Balistes capriscus*), bogue (*Boops boops*), and Atlantic bigeye (*Priacanthus arenatus*) (Okera, 1976; Longhurst, 1983).

The demersal stocks consist of the Sciaenid community, Sparid community, Deep shelf community and Continental slope community. Past records had shown that the Sciaenid community assemblage live above the thermocline, on shallow muddy bottoms, and of the 60- 80 species identified as belonging to this community, approximately 20 species are dominant, including: bobo croaker (*Pseudotolithus elongatus*), longneck croaker (*P. typus*), cassava croaker (*P. senegalensis*), law croaker (*P. brachygnathus*), African sicklefish (*Drepane africana*), Senegalese tonguesole (*Cynoglossus goriensis*), sompat grunt (*Pomadasys jubelini*), giant African threadfin (*Polydactylus quadrifilis*), royal threadfin (*Pentanemus guinguarius*), rough-head sea catfish (*Arius latiscutatus*), daisy stingray (*Dasyatis margarita*) and boe drum (*Pteroscion peli*). Eurybathic species include bigeye grunt (*Brachydeuterus auritus*), canary tonguesole (*Cynoglossus canariensis*) and Guinea flathead (*Platycephalus gruveli*) (Ndomahina and Chaytor in Vakily et al., 2012). The fisheries of the Sparidae family normally inhabit the regions below the thermocline on sandy and rock bottoms (Vakily et al., 2012). There are three sub-divisions of the sparid community, which may differ not only in faunistic distribution and substratum characteristics (Longhurst, 1969), but also in terms of physicochemical properties of the overlying

water (Williams, 1968). The lutjanid sub- community are dominated by species such as the Atlantic emperor (*Lethrinus atlanticus*), grey triggerfish (*Balistes capriscus*), African red snapper (*Lutjanus agennes*), *Acanthurus* spp., and the four-banded butterflyfish (*Chaetodon hoefleri*).

The dominant species may include: bluespotted seabream (*Sparus caeruleostictur*), red pandora (*Pagellus bellotti*), Canary dentex (*Dentex canariensis*), and the brown ray (*Raja miraletus*). The deep sparid community consists of species living in the deep water below the thermocline on the muddy bottom near the continental edge. The dominant genera are *Dentex*, *Lepidotrigla*, *Uranoscopus* and *Pentheroscion*. The Deep Shelf Community refers to demersal species towards the edge of the continental shelf at depths of 200-300m. The dominant genera are the *Merluccius, Chlorophthalmus, Peristedion, Bembrops and Antigonia* (Vakily et al., 2012). Similarly, the Continental Slope Community comprises of the dominant genera: *Chaunax*, *Halosaurus*, *Epigonus*, and *Galeus* which are found below 400m on the continental shelf. (Longhurst, 1969; Longhurst and Pauly, 1987).

For the invertebrates (shellfishes), historical records provide that there are sixteen (16) species of shrimps occurring in Sierra Leone, belonging to eight families. Of these, six (6) are of commercial importance, and include the pink shrimp (*Farfantepenaeus notialis*) which accounts for about 96% of the landings, tiger shrimp (*Melicertus keraturus)*, Guinea shrimp (*Holthuispenaeopsis atlantica*), deep-water rose shrimp (*Parapenaeus longirostris*), red shrimp (*Aristeus antennatus*) and great red shrimp (*Aristaeopsis edwardsiana*). *Melicertus keraturus* and *Holthuispenaeopsis atlantica* inhabit mangrove swamps, estuaries, and inshore continental shelves to a depth of 55m, and *Parapenaeus longirostris* occurs in deeper waters of 40-70m (Okera and Chaytor, 1978). *Aristaeopsis edwardsiana* occurs above the continental slope (Coutin, 1989). In addition, amongst the crabs are the most important species: *Callinectes marginatus, Callinectes pallidus and Callinectes amnicola.* Further, the mollusks consist of three main classes: Cephalopods, Gastropods and Bivalves.

There are three categories of Cephalopods-cuttlefish, squid and octopus. The two common species cuttlefish include *Sepia officinalis,* and the African cuttlefish (*Sepia bertheloti*). These are found in the north and south of the territorial waters on coarse ground at depths of 17-78m. The squid species include *Thysanoteuthis rhombus*, *Todaropsis eblanae* and Ilex coindentti which are largely demersal and are found below 100m (Coutin, 1989). Also, the species of octopus that exist in the territorial waters of Sierra Leone are; *Octopus vulgaris* and *O. macrops*, both of which are purely demersal. Some common gastropod species that are mainly demersal and largely occur in the deep sea include, *Cymbium cymbium, Cymbium glans* and *Cymbium pepo*; those found in the littoral zones include: *Thais haemastoma*, *Murex duplex*, *Pugilina morio* and *Thais cornutus*. Similarly, the bivalves include the intertidal: *Senilia senilis, cardium custatum, Cardiun ringens, Crassosstrea tulipa* (mangrove oyster), *Crassostrea denticulata* (rock oyster) (Aleem and Chaytor, 1980); and deep-water species include: Mactra spp. and mussels.

Comparatively, the fish stocks recorded for the present study were inclusive of those in historical records. In spite of variations in catch rates by fishermen in Black Johnson and beyond, a total of 40 genera of fish were recorded. These species are also either targeted or obtained as bye-catch in the Industrial Trawl fisheries. Table 9 gives the list of recorded fish for this survey with their common names and conservation status. With the exception of *Ethmalosa fimbriata (Bonga Shad)*, all the fish species documented during our studies occur in both coastal and oceanic offshore habitats and are important commercial species.

Of the fish species documented, 10 are of conservation concern and listed in the IUCN Red list with the status as **Near Threatened** (*Albula vulpes, Cynoglossus senegalensis, Galeoides decadactylus and Dentex angolensis),* **Vulnerable** *(Pseudotolithus senegallus and Sardinella maderensis)* or **Data Deficient** (*Sepia bertheloti, Cynoglossus sp., Lutjanus spp* and *Arius latiscutatus*). A study by Seto et al. (2015) had shown that in the artisanal sector, Bonga shad (*Ethmalosa fimbriata*)

represents the largest contribution to overall catches (54%), followed by *Sardinella* spp. (24%). The family, Sciaenidae was also significant (3.3%), and largely comprised of bobo croaker, and law croaker. Baraccuda (Sphyraenidae.), jacks (Carangidae), grunts (Haemulidae.), and threadfins (Polynemidae) also represented 2-3% of annual catches.

Table 9. Catch Records of Some Commercially Important Fish During Field Visit

Species	IUCN Red list Status (Global)
Fish	
Ethmalosa fimbriata (Bonga)	LC
Sardinella maderensis (Herring)	VU
Ilisha africana (Lati)	LC
Pseudotolithus typus (Lady long neck)	LC
Trichiurus lepturus (Silver fish)	LC
Dentex angolensis(Snapper)	NT
Pseudotolithus elongates (Gwangwa)	LC
Galeoides decadactylus (Shine nose)	NT
Sphyraena guachancho (Couta)	LC
Sphyraena afra (Baracuda)	LC
Chloroscombrus chrysurus (Kente)	LC
Cynoglossus senegalensis (Sole)	NT
Arius latiscutatus (Catfish)	DD
Pseudotolithus senegallus (Whiting)	VU (Decreasing)
Pomadasys jubelini (Crocus)	LC
Drepane africana (Sheephade)	LC
Albula vulpes (Tenny)	NT (Decreasing)
Sphyraena afra (Kinni)	LC
Caranx hippos Cowreh	LC
Caranx (Decapterus) Rhonchus (False Scad)	LC
Lutjanus spp. Grouper	DD
Trachinotus Goodei Joefish	LC
Scomber 50aponicas Pacific Mackerel	LC
Scomberomorus tritor W.A Spanish Mackerel	LC
Scomber scombrus (Atlantic Mackerel)	LC (Decreasing)
Alectis alexandrina Pomp	LC
Polydactylus quadrifilis (Spanish)	LC
Raja sp.(Skate)	LC
Cynoglossus sp. (Sole)	DD
Crabs	
Callinectes marginatus	NE
Callinectes pallidus	NE
Callinectes Amnicola	NE
Shrimp	
Farfantepenaeus notialis	NE
Melicertus kerathurus	NE
Parapenaeus longirostris	NE
Snails	
Cymbium cymbium	NE
Cymbium pepo	NE
Cymbium glans	NE
Cuttlefish	
Sepia officinalis	LC
Sepia bertheloti	DD

*NT-Near Threatened, VU-Vulnerable, DD-Data Deficient, NE-Not Evaluated, LC-Least Concern

5.3. . Intertidal Zones and Associated Fauna

The substrates (sand/mud) observed in the mangrove areas of the proposed project concession area in June 2022 were not characteristic of substrates of Rhizophora mangrove species (usually clayey mud). It is therefore possible that the mangrove regenerating propagules that led to a generation of mangroves in the Black Jonson area were dispersed by the tides and are doing fairly well owing to erosion of mud sediments now mixed with sand as substrate. Overall, the intertidal flats (sandy beach and mangrove mudflat) at the project concession sites did not seem to be supporting the diversity of species expected for such habitats. Crassostrea tuliper (mangrove oyster), for instance, known to colossally cluster on mangrove stems and roots, the commonly known mangrove-conglomerated Ghost and Fiddler crabs, and the mudskipper, periophthalmus barbarous known for its commonality in mangrove swamps of Sierra Leone and a critical bio-indicator of coastal pollution (Konoyima, 2020) were all absent in the mangrove swamps present at the proposed Black Johnson Fish Harbour concession sites.

It is possible that the current substrates in mangrove areas are not ideal enough to foster the required environmental conditions that should enhance physiological and dietary adaptations in true mangrove fauna. These, in turn, could have their adverse implications on mangrove species diversity that should indicate the ecological integrity or functional traits of such critically acclaimed natural capital. This, in essence, implies that the Black Johnson mangroves can hardly provide the established biodiversity ecosystem services beyond coastal defence. However, shells of the rock oyster (Crassostrea denticulata) were visible at the study sites though in reduced numbers. Moreover, very scanty occurrences of infauna and epifauna existed as benthos of the Black Johnson sandy shore, averse to what obtains at a rich sandy shore. Table 10 provides the list of recorded littoral organisms in the proposed Black Johnson Fish Harbour concession area.

Table 10. Mollusks and Crustaceans Recorded at Black Johnson

GASTROPODS	Sites on which they occur and status
Thais haemastoma	Black Johnson- epifauna in mid and infra-littoral of sandy shores; shells cast ashore; invaded by hermit crab. Less abundant
Thais coronate	Black Johnson- epifauna in mid and infra-littoral of sandy shores; shells cast ashore; invaded by hermit crab. Less abundant
Tympanotonus fuscatus	Black Johnson. Epifauna, abundant on mangrove substrates
Nerita senegalensis	Black Johnson- forms dense aggregations in pools and crevices of rocks in mid and lower littoral, shells only; invaded by harmit crab; low abundance
Pugilina morio	Black Johnson-recorded at lower Littoral of sand/mud flats; invaded by harmit crab. Less abundant
Nerita glabrata	Black Johnson. Infauna, only shells were seen at lower intertidal. Less abundant
Cymbium cymbium	Sub-littoral, seen on sandy beach. less frequent. Shells only
Cymbium pepo	Sublittoral, seen on sandy beach. Shells only
BIVALVES	
Senilia senilis	Black Johnson. Epifauna, only its valves were visible, and uncommon
Pecten flabellum	Project Area, valves only; very Low
CRUSTACEANS	
Callinectes spp.	Black Johnson proposed fish harbour concession site. shells only but was reported to be a very common coastal water crab.

5.4. Sea Turtles and Marine Mammals

In Sierra Leone, five species out of 7 species of sea turtles have been recorded and seen to make appearances on beaches. The species are loggerhead (*Caretta Caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), Olive ridley (*Lepidochelys olivacea*) and hawksbill (*Eretmochelys imbricate*).. All these turtles occur in the coastal waters of Sierra Leone, including the Sierra Leone River Estuary. The green turtle and the most endangered leatherback turtle nest by laying eggs on the shores and beaches of the Sherbro Island and Turtle Island in Bonthe District of Southern Sierra Leone. Leatherbacks have also been established to nest on the Turners Peninsula to Sulima, stretching about 105km long. Leatherbacks commonly nest on the Sherbro Island beach stretching 52 km and hosts the largest population of nesting leatherback marine turtles(Fretey and Malaussena, 1991; Fretey, 2001 in EPA-SL, 2015).. There is also evidence of nesting activities of the other 4 species of marine turtles on the Sherbro and Turtle Islands, and other beaches of Lumley , Bureh Town and John Obey Turtles in Sierra Leone are of immense conservation priorities by the Reptiles and Amphibians Program-Sierra Leone (RAP-SL). In addition, the species have been identified in the IUCN Red list status as Critically Endangered (Hawksbill), Endangered (Green turtle) or Vulnerable (Olive ridley, Leatherback and Loggerhead).

In spite of the inability of fishers and community inhabitants to identify specific species, the occurrence of two groups of marine mammals in the Sierra Leone territorial waters was reported during this survey. These include the Cetaceans (Dolphins, porpoises and whales) and Sirenian (African manatee-*Trichechus senegalensis*). Little is known about the population status of dolphins and porpoises in Sierra Leone with the exception of sporadic sightings. However, a known species such as the Atlantic Humpback dolphins (*Sousa teuszii*) is of global conservation concern and listed as "Critically Endangered" in the IUCN Red list of threatened species (www.iucnredlist.org). This species is reported to frequently occur in the artisanal bye-catch. Other cetaceans may include the Clymene sp. and common bottlenose dolphins (Tursiops truncates) which are often sighted in deep waters beyond the 50m isobar. These are of least concern for conservation. A recent review in Sierra Leone has shown that the populations of

dolphins and porpoises are in a very good condition, primarily because they are not harvested (EPA-SL, 2015). However, a single representative of the Sirenians, the African manatee (*Trichechus senegalensis*) occurs in river estuaries of Sierra Leone, and has been identified as "vulnerable" in the IUCN Red List of Threatened species (www.iucnredlist.org). The manatee is therefore of global conservation concern. Similarly, according to the Convention on International Trade in Endangered Species (CITES), the African manatee is endangered (Encyclopedia of Life, 2015). Further, a rapid fisher's interview by Moore et al. (2010) had also provided a list of the groups of Sea Turtles and Marine Mammals reported to be captured incidentally or intentionally by local fishermen in the South, West and Northern regions of the Sierra Leone coast as given in Table 11, though the list was yet to be confirmed by the authors.

Table 11. Sea Turtles and Marine Mammals Incidentally Caught by Fishermen (Moore et al., 2010).

Category	**Scientific name**	**Common name**	**IUCN Relist Status (Global)**	**Habitat**
Sea Turtles	*Caretta Caretta*	Loggerhead	VU	Coastal and Offshore
	Chelonia mydas	Green	EN	
	Dermochelys coriacea	Leatherback	VU	
	Eretmochelys imbricata	Hawksbill	CR	
	Lepidochelys olivacea	Olive ridley	VU	
Cetaceans	*Sousa teuszii*	Atlantic humpback Dolphin	CR	Coastal and Offshore
	Steno bradenensis	Rough-toothed Dolphin		
	Tursiops truncatus	Common bottlenose Dolphins	LC	
	Stenalla sp.		NE	
	Delphinus sp.		NE	
	Globicephalla sp.		NE	
	Kogia sp.		NE	
	Megaptera novaeangliae	Humpback Whale	CR	Coastal and Offshore
Sirenians	*Trichechus senegalensis*	West African Manatee	VU	Coastal

CR –Critically Endangered, VU-Vulnerable, EN-Endangered, NE-Not Evaluated, LC-Least Concern

5.5. . Marine Avifauna

The marine environment of Sierra Leone is home to important species of birds that are of global conservation concern. The frequently spotted migratory species in Sierra Leone's coastal waters include the Near Threatened species (Lesser Flamingo-*Phoenicopterus minor,* Great snipe-*Gallinago media,* Curlew sandpiper-*Caladrius ferruginous)* and the Vulnerable Damara Tern (*Sternula balaenarum*). The other migratory birds which include the Royal tern (Thalasseus *maximus*) and Ringed plover (*Charadrius hiaticula*) are of least concern by the IUCN Redlist status. These birds congregate around the mouths of rivers and estuaries on mud and sand foreshores which provide good feeding and nesting areas (Okoni-Williams et al., 2001 in PRCM, 201). Of all coastal estuaries in Sierra Leone, the Yawri Bay is the most important for migrant birds. A study by Van der Winden et al. (2005) provided the list of bird species which occur mainly in the four main coastal estuaries of Sierra Leone (Sierra Leone River Estuary, Sherbro

River Estuary, Scarcies River Estuaries and the Yawri Bay). The list is given in Table 12 with the IUCN Red list status.

Table 12. List of Important Coastal Birds in Sierra Leone (Van der Winden et al., 2005)

English name	IUCN Red list Status (Global)
Long-tailed Comorant	**NE**
Green backed Heron	**LC**
Western Reef Egret	**LC**
Little Egret	**LC**
Grey Heron	**LC**
Hamerkop	**LC**
Yellow-billed Stork	**LC**
Wooly-necked Stork	**NE**
Sacred Ibis	**LC**
Osprey	**LC**
Yellow-billed Kite	**NE**
Palm-nut Vulture	**LC**
Senegal Thick Knee	**LC**
Ringed plover	LC
Kentish Plover	LC
Grey plover	LC
Bar-tailed Godwit	NT
Whimbrel	LC
Eurasian Curlew	NT
Redshank	LC
Spotted Greenshank	EN
Common sandpiper	LC
Ruddy Turnstone	LC
Gull-Billed Tern	LC
Little Tern	LC
Grey Headed Kingfisher	LC
Blue Breasted Kingfisher	LC
Woodland KingFisher	LC
Malachite Kingfisher	LC
Giant Kingfisher	LC
Pied Kingfisher	LC
Curlew sandpiper	NT
Green shark	NE
Great white egret	LC
African spoonbill	LC
Royal tern	LC

*NT-Near Threatened, NE-Not Evaluated, LC-Least Concern

5.6. Vegetation of Black Johnson

Within transects of the proposed Black Johnson Fish Harbour sites, the plant species recorded within ecological transect walks from the Black Johnson Community to the coastal zone were typical of freshwater wetlands and coastal zone of Sierra Leone. Some of the identified plants are vital for economic and medicinal purposes as given in Table 13.

Table 13. Vegetation of Black Johnson

	Botanical Name	Family	Uses	Local Name
	Panicum sp.	Poaceae		

	Cola nitida	Sterculiaceae	Medicinal	Kola (cr)
	Avicinia germinans	Avicinniaceae	Fuel wood	White Mangrove (cr)
	Carpolobia cutea	Polygalaceae	Medicinal	
	Campylospermum amplectes	Ochnaceae		
	Leptoderris sp.	Papilionaceae		
	Ranvolfia vocuitoria	Apocynaceae	Medicinal	Kowoga (me)
	Vanguercopsis discolor	Rubiaceae		
	Smeatumannie laevigata	Passifloraceae		
	Hugonia sp.	Linaceae		
	Anadelphia ceptocoma	Poaceae	Thack House	Foni (me)
	Parkia biglobosa	Mimoceae	Edible	Lokos (cr)
	Morinda geminate	Rubiaceae	Medicinal	Broomstone (cr)
	Anthoslema senegalense	Euphorbiaceae		
	Bridelia micrantha	Euphorbiaceae	Medicinal	Foni-ku (me)
	Parinari ecselsa	Chrysobalanaceae	Edible	Ndawa (me)
	Sporobolies sp.	Poaceae		
	Veruonia sp.	Asteraceae		
	Tetracera alnifolia	Diveniaceae	Medicinal	Ndopa-Ne (me)
	Croton hirtus	Euphorbiaceae		
	Diospyros sp.	Ebenaceae	Medicinal	Ndoku-wulo (me)
	Nauclea latofolia	Rubiaceae	Medicinal	Igbesi (cr)
	Allophylus africanus	Sapindaceae		Kumu Guli (me)
	Plifllanthus sp.	Euphorbiaceae		
	Urena lobota	Euphorbiaceae		
	Combretum gradiflon	Combretaceae	Medicinal	
	Anthocleista nobilis	Loganiaceae		
	Borreria sp.	Rubiaceae		
	Chronolaena odorata	Asteraceae		
	Ixora caxiflora	Rubiaceae		
	Abrus sp.	Papilionaceae		
	Pentadesma butyracea	Guttiferae		

	Panicum sp.	Poeceae		
	Sorindea juglandifolia	Anacardiaceae	Edible	Kafi (me)
	Ficas trichopoda	Moraceae		
	Sargasum sp.		Algae	
	Visnia guineensis	Guttifarae	Medicinal	
	Cuestis ferruginia	connaraceae		
	Sterculia oblonga	Sterculiaceae	Medicinal	
	Dialium guineensis	Caesalpinaceae		Black Tombla (cr)
	Acacia mangium	Mimosaceae	Fuel Wood	Matchis stick (cr)
	Carapa procera	Meliaceae	Medicinal	Kundi (me)
	Borreria verticillate	Rubiaceae		
	Adenia lobata	Passifloraceae	Medicinal	Fish Posion (cr)

	Salacia senegalensis	Celstraceae	Edible	Malombo (cr)
	Mimosa pudica	Mimosaceae		
	Hymonocardia lyrata	Euphorbiaceae		Fagbanjo (me)
	Alchornea cordifolia		Medicinal	Krismes Lif (cr)
	Musanga cecropioides	Cercropiaceae		
	Funtumia Africana	Apocynaceae	Carving	Bobo (me)
	Rhizophora sp.	Rhizophoraceae	Fuel	Red-mangrove (cr)
	Ipomoea pres-capre	Convolvulaceae		

6.0 Environmental Analysis of Black Johnson Proposed Harbour Site

The results of the water quality analysis including Physical, Microbiological and chemical analysis is presented in Table 13.

6.1. Results of Water Quality Analysis at National Water Laboratory

The water samples were analyzed for Physical, Microbiological and chemical contamination. The result shows that water hardness, Sulphate, Phosphate, Zinc and Arsenic at the Black Johnson and Whale Bay areas were below the WHO threshold for all samples, showing less concern. The E-coli and faecal coliform levels in the water samples are very high, particularly for the seawater and underground brackish water, which shows high contamination. The faecal coliform levels for the downstream and upstream fresh water samples were also very high, above 50 (Table 14) E-coli levels in the stream water were relatively lower than the faecal coliform levels. This result provides a baseline data against which an environmental management and monitoring plans will be developed, during the project construction phase and operational phase

Table 14. Results of Water Sample Analysis, SL National Water Lab, June 2022

No	**Parameters**	**Samples**	**Sample**	**Sample**	**Sample**	**Sample**	**WHO Standard**
		Down Stream (mg/l)	**Up Stream (mg/l)**	**Seawater Station1, Fresh water (mg/l)**	**Seawater station 2, Brakish (mg/l)**	**Underground Water, Brackish (NTU)**	
1	Turbidity	0	0	8	0	828	<5.0 NTU
2	TSS	0	7	0	0	-	
3	DO	96.2	96.4	44.9	89.6	-	
4	Ammonia	0.01	0.03	0.43	0.57	1.5	No value
5	Chromium	0.15	0.07	0.05	0.02	0.75	<0.05mg/l
6	Phosphate	0.4	0.00	0.00	0.00	3.9	<20mg/l
7	Sulphate	6.1	0.00	0.00	1.50	82	<400mg/l
8	Hardness	20	20	2,750	2,780	-	<500mg/l
9	Nitrate	12	12	1	1	-	<10mg/l

10	Lead	0	0	0	0	0	
11	Zinc	0.00	0.00	0.00	0.00	0.99	<5mg/l
12	Arsenic	0.00	0.00	0.00	0.00	0.00	<0.01mg/l
13	E-coli	30	20	100	100	100	zero
14	Fecal Coliform	50	60	100	100	100	zero
15	Total coliform	Nil	100	100	100	Nil	<10

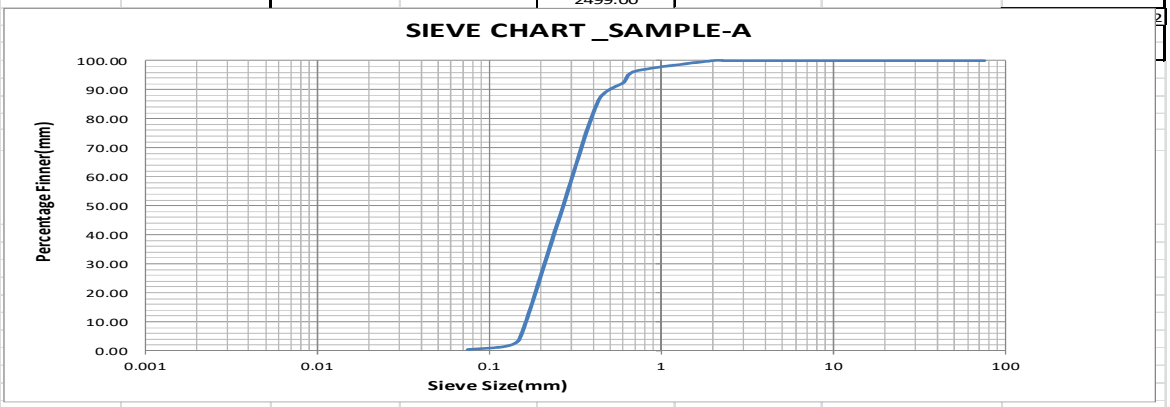
The Stream water of Black Johnson is used by the people of the village for drinking and cooking. This water is heavily contaminated with e-coli and fecal coliforms and must be treated.

6.2. Results of Soils and Sediment Particle Analysis

Soils and sediment samples collected from the project site was analyzed at the Engineering Soils Laboratory at the Faculty of Engineering, Fourah Bay College, University of Sierra Leone. The results of the soil sample analysis is presented in Table 15.

Table 15. Soil and Sediment Particcle Analysis Result, Black Johnson

PROJECT: BLACK JOHNSON SOILS INVESTIGATION			PROJECT LOCATION: BLACK JOHNSON			
CLIENT: NA			CONSULTANT: NA			
CONTRACTOR: NA			Sample(s) ID(s): A		Depth(m): NA	
SIMPLING DATE: NA			TESTING DATE: 09/07/2022		TEST No.:01	
SOIL TEST: PSD - SIEVING			STANDARD TEST REF: ASTM: D-422			
MASS OF ORIGINAL SAMPLE(DRY): 2502(g)			DRY MASS OF SAMPLE AFTER WASH:			
SOIL VISUAL DECRIPTION: SAND (SP), with little fines,light-brown						
PERFORMEDED BY: Mr. SENESIE						
Soil Description	Sieve No.	(Sieve opening) mm	Mass Retained(g)	Cumulative mass retained(g)	% mass retained	% passing
COARSE GRAVEL	3"	75	0	0	0.00	100.00
	2"	50	0	0	0.00	100.00
	3/4"	19.05	0	0	0.00	100.00
FINE GRAVEL	3/8"	9.5	0.00	0.00	0.00	100.00
	#4	4.75	0.00	0.00	0.00	100.00
COARSE SAND	#8	2.36	0.00	0.00	0.00	100.00
	#10	2	0.00	0.00	0.00	100.00
MEDIUM SAND	#25	0.71	90.00	90.00	3.60	96.40
	#30	0.6	101.00	191.00	7.63	92.37
	#40	0.43	154.00	345.00	13.79	86.21
FINE SAND	#60	0.25	1050.00	1395.00	55.76	44.24
	#100	0.15	1002.00	2397.00	95.80	4.20
	#120	0.125	65.00	2462.00	98.40	1.60
	#200	0.075	29.00	2491.00	99.56	0.44
FINES (SILT & CLAYS)	Pan		8			
			2499.00			



Results from Sieve analysis					
% Gravel	1.5291	D60(mm) = 60% finer	0.317577143	Uniformity Coefficient, Cu (D60/D10)	1.930665557
%Sand		D30 (mm) = 30% finer	0.214431138		
%Fines	61.1621	D10 (mm) = 10% finer	0.164491018	Coefficient of gradation, Cc (D30^2/D60*D10	0.880205898

Test Type:Natural Moisture Content		Sample ID: A	
	ITEMS (ACTIVITIES)	Test No.	
Sr.No.		T1	T2
A	Can No.	A	B
B	Mass of Can, M1(g)	16.36	13.51
C	Mass of Can + moist soil, M2 (g)	124	119.68
D	Mass of Can + dry soil, M3 (g)	104.91	99.36
E	Mass of moisture, M2 – M3 (g)	19.1	20.3
F	Mass of dry soil, M3 – M1 (g)	88.6	85.9
G	Moisture Content, w(%) = [(M2 - M3)/(M3 - M1)]*100	21.56	23.67
H	Average Water Content, Avg. w (%)	22.61	

6.3. Bathymetric Chart of the Whale Bay

The preliminary result of the bathymetric survey is shown below. The results of the multibeam survey, including roll, pitch and yaw correction are presented. The bathymetric survey map shows contour lines of the seafloor mosaic for the Whale Bay, including color scale showing various depth profiles.

6.3.1. Multibeam Survey (MBES) Corrections

In order to accurately measure the seafloor, the measurements made by the Multibeam sonar must be relative to true vertical and direction as reported by the inertial navigation. During installation it was not possible to obtain perfect alignment of the MBES on the measured zero axis. Therefore, a standard calibration routine was performed to obtain values for Roll, Latency, Pitch and Yaw mounting angles. The summary of the survey patch results for roll, latency, pitch and yaw is presented in Table 16.

Table 16. Summary of MBES Patch Results

Latency (s)	Roll Port (*)	Roll Stbd (*)	Pitch (*)	Yaw (*)
0.000	0.400	1.600	-5.000	-0.5000

6.3.1.1. Latency

Latency was eliminated by using a (Pulse per second) (PPS) box. This device consistently generated a pulse every second. This pulse was recorded and was used in the processing stage to remove the latency. A constant GPS latency can still be present due to long cables and other influences. This was eliminated by running the same line at different speeds in the same direction. For the roll correction, surveying one line in opposite directions, over flat seabed was performed for the roll calibration. The two profiles generated were compared and a roll offset angle correction derived. This procedure was repeated, and an average angle offset applied for the roll

correction.

6.3.1.2. Pitch Correction

For the pitch correction, surveying a short line, in opposite directions, over a slope feature would usually be performed to determine this correction. The two profiles generated were compared and a pitch offset angle applied.

6.3.1.3. Yaw Correction

In order to determine the yaw correction, we conducted surveys of two parallel lines in the same directions, over a slope feature so that the object appears in the swath outer beams. The two profiles generated were compared and a yaw offset angle applied.

6.3.1.4. Post Processed Trajectory

The GNSS base along with the logged 200kHz INS data was post processed in Qinetria software. A tightly coupled solution, where GNSS and IMU data is processed by an Extended Kalman Filter (EKF) to calculate a Smoothed Best Estimate of Trajectory (SBET) of the vessel. Standard Deviation graphs for position and attitude are below. It is apparent that even though the standard deviations of the INS data are small, there is a small increase in the Standard Deviation towards the end of the day in both the position as well as the motion of the vessel. This could be due to the fact that the bad weather had picked up towards the end of the survey when the survey team was completing the additional lines on the western side of the survey site. This could also be seen as the slight artifact that is apparent on the thematic map provided by the survey team. Figure 24 highlights the above-mentioned occurrence with increasing deviations shown in Figure 25.

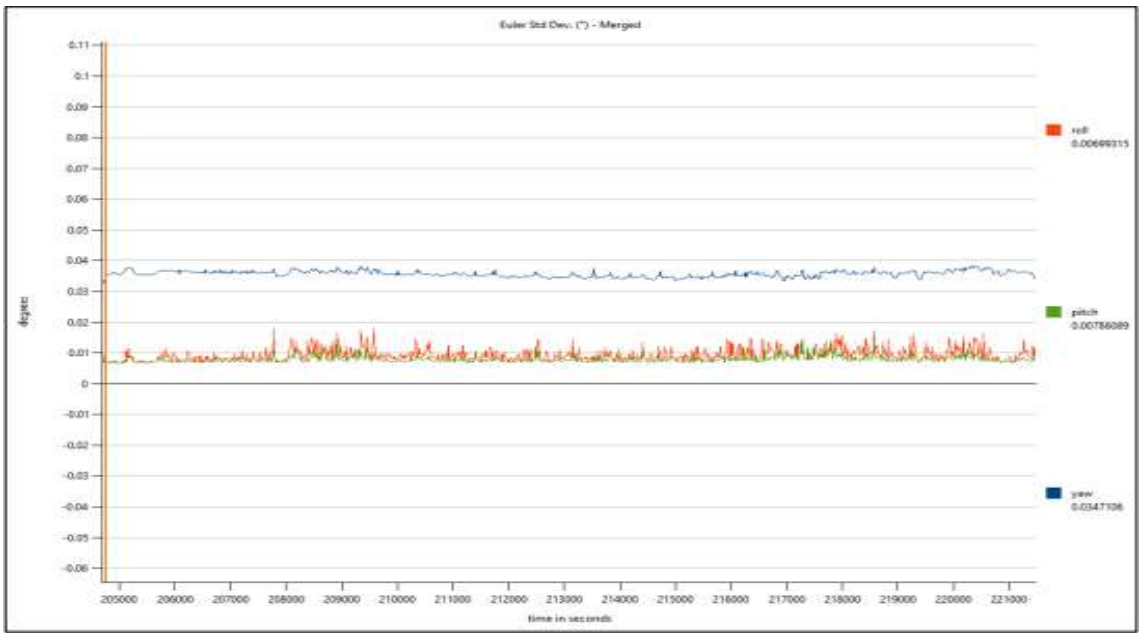


Figure 24. Position of Minor Standard Deviations of Weather Effects

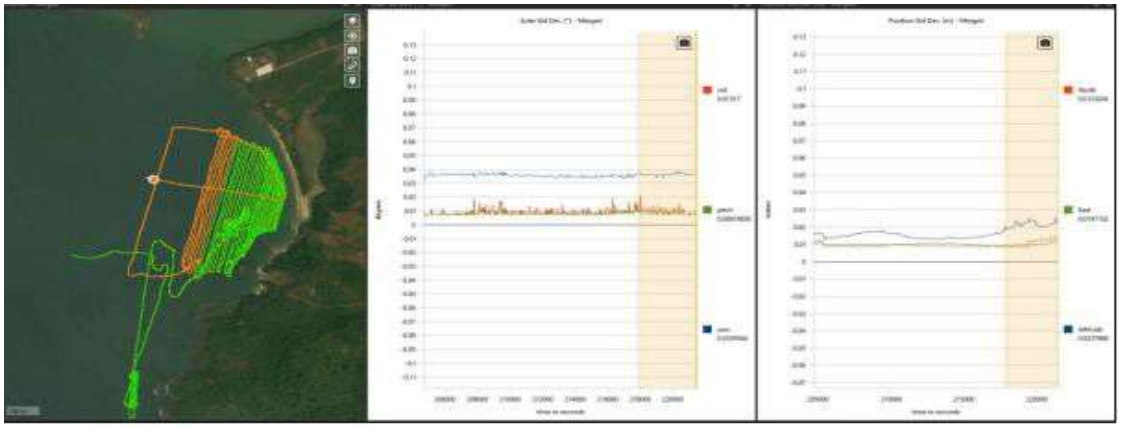


Figure 25. Positions of Increasing Standard Deviations of Weather Effects on Survey

6.3.2. Survey Limitations and Endorsed Remarks

No major difficulties were encountered during this survey and the vessel that was used was in a good condition. The only obstacle worth mentioning is the fact that the gunwale (upper edge) disturbance of the survey vessel) due to movement by crew from forward to the aft was quite high above the water. This limited the swath that was achievable on the port transducer of the system and created "noise" on the outer beams as can be seen on Figure 26. This was minimized by cutting the data on the outer beams and filtering.

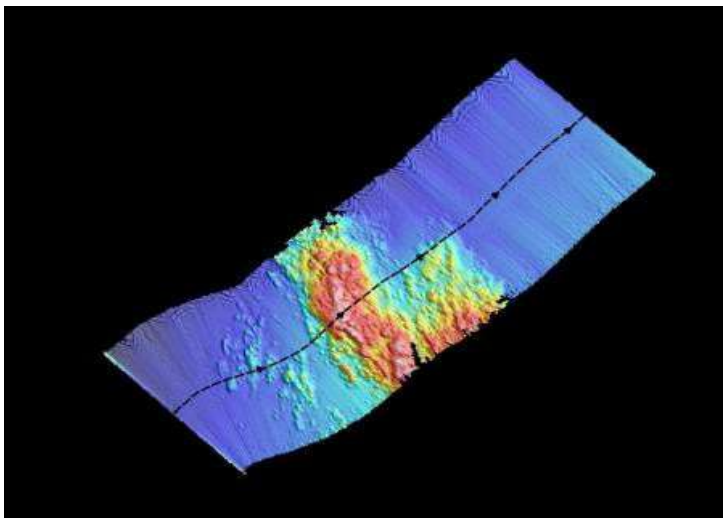


Figure 26. Effect of High Gunwale on Port Transducer

The overall conditions were fair, despite we encountered two severe thunderstorms on the first day and towards the end of the survey on the last day. A good data set was achievable and no problems were encountered that we could not overcome.

Date: 30 June 2022

Stefan Kruger
Project Director, Black Eagle SL Ltd.

6.3.3. Bathymetric Map of the Whale Bay

The preliminary bathymetric map of the Whale Bay is presented in Figure 27. The colour scale indicated the depth profiles that correspond to the contour lines, depicting the isobath of the Whale Bay. This is the seafloor mosaic that will guide the construction of the fish harbour for pile driving and the construction of breakwater systems for the fish harbour terminal.

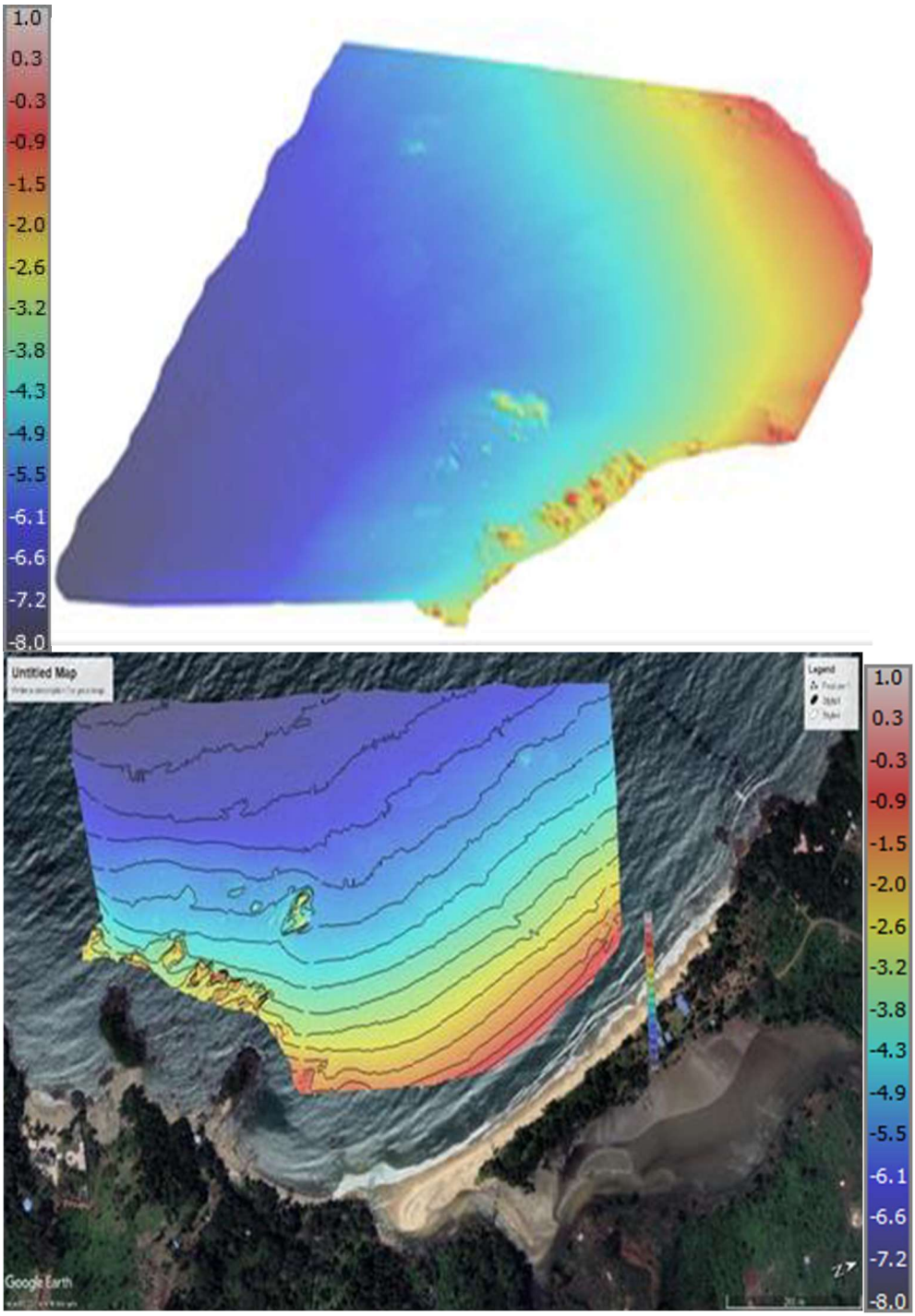


Figure 27. Bathymetric Chart of Whale Bay at Black Johnson

Shallow areas of contours of 0.3m to 1.5m depths are indicated by red as shown on the scale bar. Intermediate deep waters of 5.5m to 6.6m ate indicated by the blue contour bands. Deeper waters above 7m to 10 m contours are indicated by the dark bands and are obtainable at less than 100m from shore

line, which means that limited reclamation will be required to obtained the seafront that can permit berthing of fishing vessels of drafts more than 5m. This is permissible for large tuna vessels and merchant vessels for oil and fuel supply and reefer vessels that will be used to supply materials to fishing vessels and in transshipments for fish export.

7. Climate and Meteorology of Black Johnson and Whale Bay

7.1. Description of Tidal Regime

On the southern part of the Black Johnson Estuary, sand bars affect the flow of water into the Whale Bay, which provides an extended beach area that is submerged during high tide. The sand bar increases the velocity of the tidal stream. During the dry season (November to March), the flood stream runs from about 1 to 1.4 knots and last for about 5 hours for spring tides. The stream on the ebb tide varies from 2Knots to 2.45 knots and lasts for about 7 hours. During the rainy season, tidal prism is increased by the flood discharge from the Black Johnson River Estuary that receives runoff water and ground water from the hills. The velocity of the ebb stream of the Whale Bay during this period can go up to 5 knots. The tide brings in fair quantities of silt from the upper reaches of the Black Johnson Estuary. The Highest Astronomical Tide or maximum tidal range goes up to 3.5 m above the Lowest Astronomical Tide. The tidal regimes above the Admiralty Chart Datum for Whale Bay area is presented in Table 20.

7.1.1. Design Water Level for Fish Habour Construction

The Whale Bay is in class H-hydrographic regime, located in the Western Area of Africa, and lies on 8°16'16" N and 13°10'24" W. Its UTM position is GQ01 and its Joint Operation Graphics reference is NC28-16. Our team notes that the water level calculation methods in the Chinese and foreign codes are different. The design high and low water levels and extreme high and low water levels in the Chinese norms for the Engineering feasibility studies were calculated using historical cumulative frequencies, with long time tide level data up to 20 years. In Sierra Leone, the average high and low tide levels of spring tides are mostly used as the design high and low water levels. This is important for the sea areas of the Whale Bay which do not have long-term measured tidal data, the water level combination method is mostly used to determine the extreme water levels (Ning Guan et al., 2021). The preliminary tidal regime for the area calculated from is presented in Table 17.

Table 17. Preliminary Tidal Regime and Design Water Levels

Tidal regime	Values (m)	Comments
Highest Astronomical Tide (HAT)	**3.38**	Similar to the Sierra Leone River Estuary (SLRE)
Lowest astronomical tide	**0.2m**	
Mean High water springs (MHWS)	**3.14**	**Design water level**
Mean Low Water Springs (MLWS)	**0.35**	**Same as design water level for the fish harbour**
Mean High Water Neaps (MHWN)	**2.315m**	
Mean low water Neaps (MLWN)	**1.0**	

7.1.2. Wind and Wave Regime of Wale Bay

The two principal winds are the northeast trade winds and the southwest trade winds. The northeast trade winds blow during the dry months (December to April), and the southwest trades blow during the rainy season (May to November). The northeast trades blowing over the coast are cool and humid. The Southeast Trade winds originate from the southern hemisphere and are deflected at right angles as they pass through the Equator. Around the Whale Bay, the prevailing seasonal winds are affected by land breezes. The most frequent wind directions are from northwest and southwest and can attain speeds from 4 to 12 knots.

Waves and swells of medium height are persistent in the Whale Bay and originate from the Atlantic Ocean and could disturb fishing vessels at their moorings. This swelling occurs mostly during the wet season, when both frequency and amplitude of the waves are at their highest. The maximum amplitude of wave breaking in the Whale Bay region is about 1.1m. Wind waves around 0.8m -1m regime can be found and can occur briefly during short spells by the end of April to October. Mostly during the year, the Whale Bay is relatively calm, attaining wave height below 0.50 m. However, much higher waves can occur briefly during the onset of seasonal changes (End of February to April and by end of August to October). The waves, storm surges and sea level rise scenarios of the Whale Bay areas were modelled to provide realistic prevailing climate situations. A preliminary assessment of key sea level rise parameters is presented in Table 18.

7.2. Climate Modeling and Meteorology

Existing Information from weather station records on rainfall, temperature, humidity, wind direction and wind speed data and additional information was collected from secondary sources such as the UK's Met Office, Sierra Leone Met Department, Climate Watch and the World Bank Climate Data Portal. We have characterized the climatic and meteorological regime of the Black Johnson and Whale Bay areas using We note that an Engineering Feasibility by Shangdon Engineering Consulting Co. Ltd. estimated wave direction and the design high water level (3.24m), design low water level (0.35m), Extreme high water (3.68m) and Extreme Low water (-0.10m) levels for the Whale Bay. *Our team notes that the water level calculation methods in the Chinese and foreign codes are different*. The design high and low water levels and extreme high and low water levels in the Chinese norms are calculated using historical cumulative frequencies, with tide level data of not less than 1 year and not more than 20 years. In foreign norms (in the case of Sierra Leone), the average high and low tide levels of spring tides are mostly used as the design high and low water levels. Particularly for the sea areas of the Whale Bay which do not have long-term measured tidal data, the water level combination method was used to determine the extreme water levels for comparisons (See Ning Guan et al., 2021).

7.2.1. Temperature, Wave, Wind and Atmospheric Pressure

The output of the multi-model Ensemble analysis for high GHG emission scenarios (RCP 8.5) for the short term (2020 -2039) at 90th Percentile for the Black Johnson and Whale Bay area is presented in Figure 28. The wave and atmospheric pressure regime from ECMWF global model using coordinates of Whale Bay at Black Johnson is presented in Figure 29.

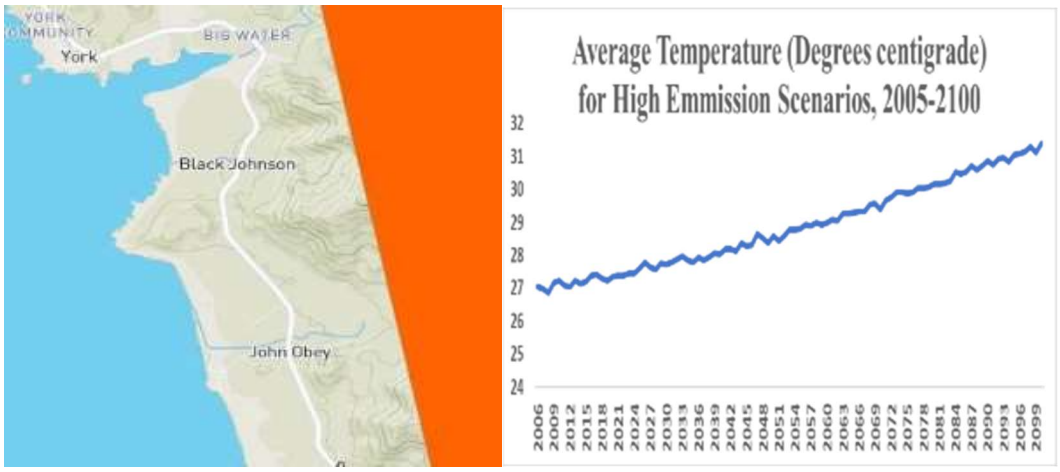
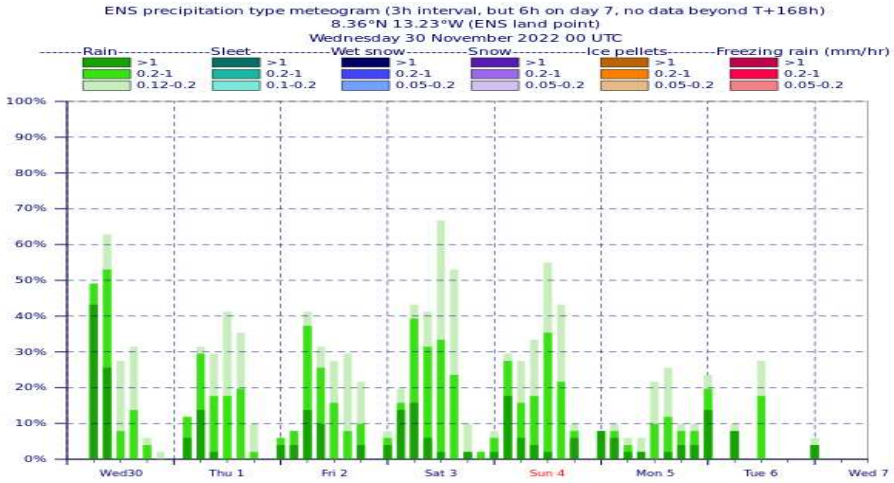
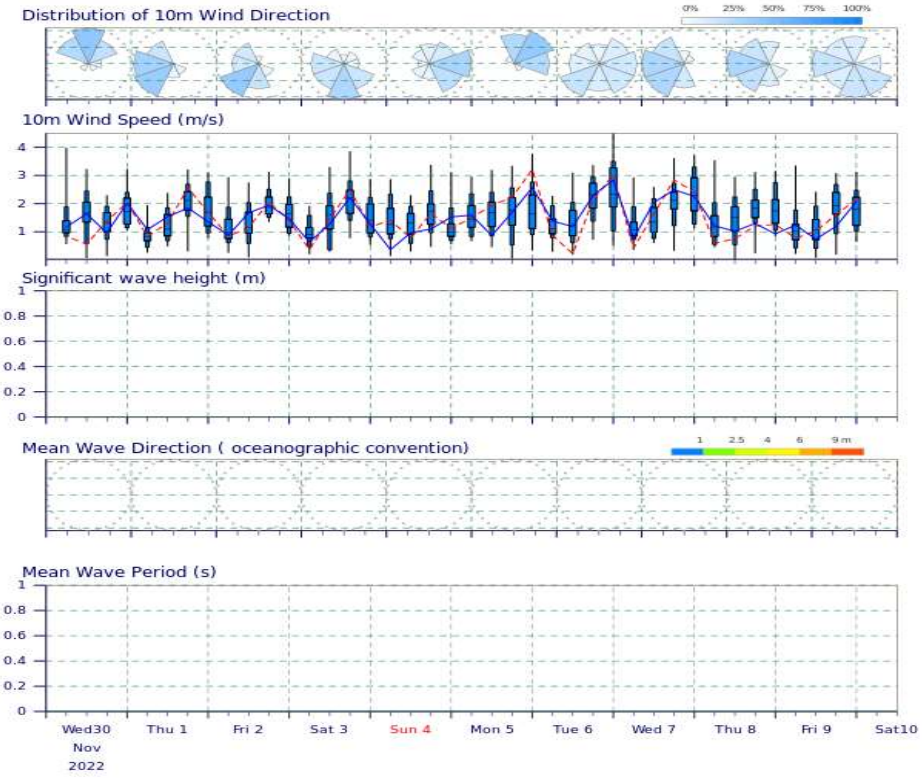


Figure 28. Temperature projections for Black Johnson and Whale Bay



Wave ENSgram
8.36°N 13.23°W (ENS sea point)
High resolution forecast and ENS distribution Wednesday 30 November 2022 00 UTC



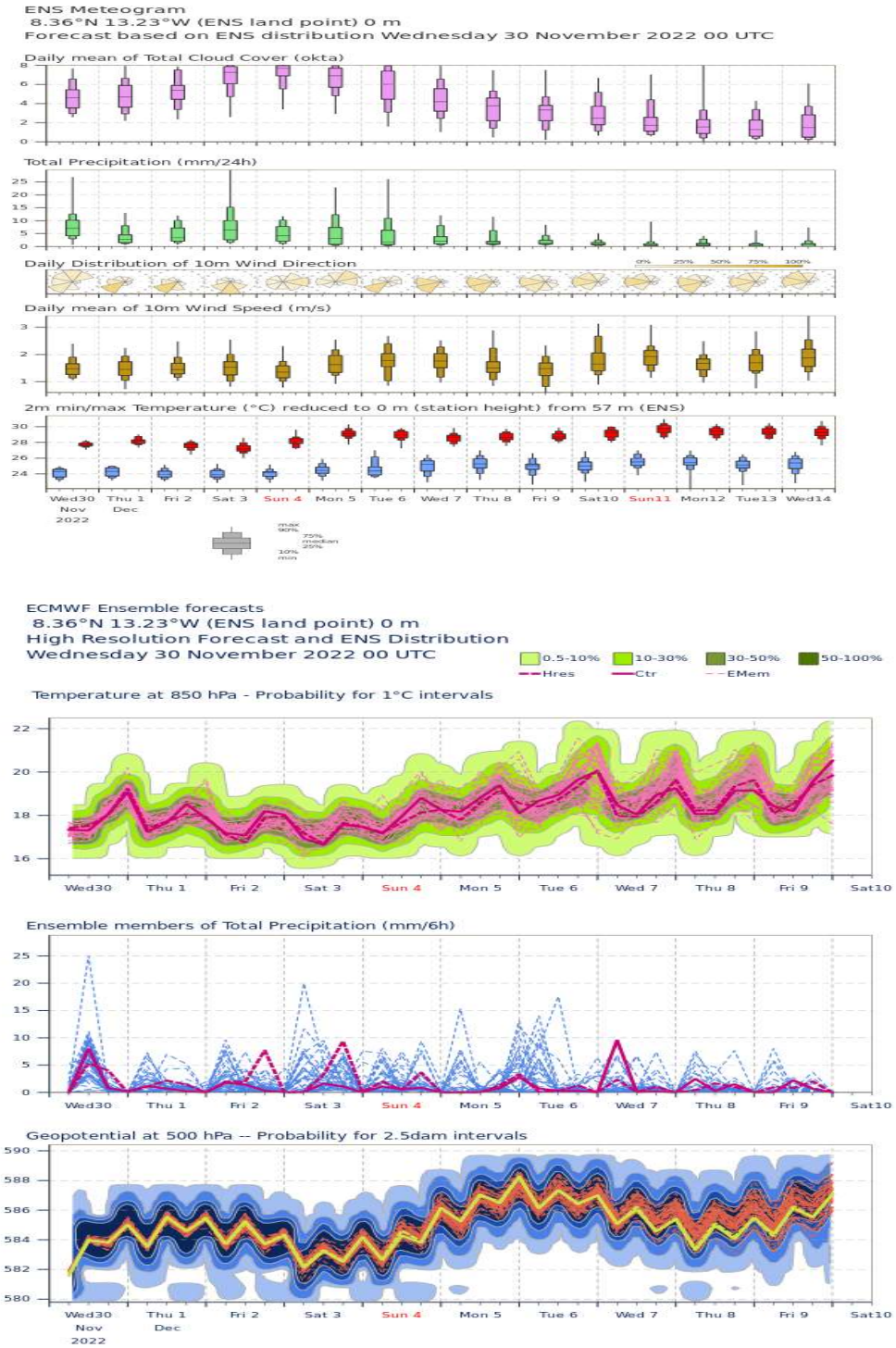


Figure 29. ECMWF Model Output for Wave, Wind and Atmospheric Pressure

Probability is high that pressure will be above 500hpa.Geopotential is the work that must be done against the earth gravitational field to raise a mass of 1 kg from the sea to a point on the earth. Pressure is usually around 1000 hpa and don't usually get lower than 950 hpa. The 500hpa halfway up the atmosphere. Beneath this level, there is a level of convergence and there is divergence above the 500hpa level. There is high probability that atmospheric pressure at the site will not fall to 500 hpa, implying that tropical storm disturbances are very unlikely within the next 40 years (1980 is base year for the ECMWF).

7.2.2. Sea Level Rise and Coastal Erosion Modeling

The output of sea level rise and coastal erosion modeling for Black Johnson area using the ClimSystems sea level rise and vertical land movement (VLM) applications is presented in Figure 30. The software combines the ESRI ArcGIS and Garmin global positioning systems (GPS) and datasets of permanent service for mean sea level (PMSL). The sea level rise (SLR) values are taken as the median values from an ensemble of 28 generalized circulation models (GCM) from the Coupled Model Intercomparison Project Phase 5 (CMIP5) database. Estimates are under the assumption of the largest greenhouse gas (GHG) emission scenario, described by the representative concentration pathways (RCP8.5) in the Intergovernmental Panel for Climate Change (IPCC) fifth assessment report (AR5).

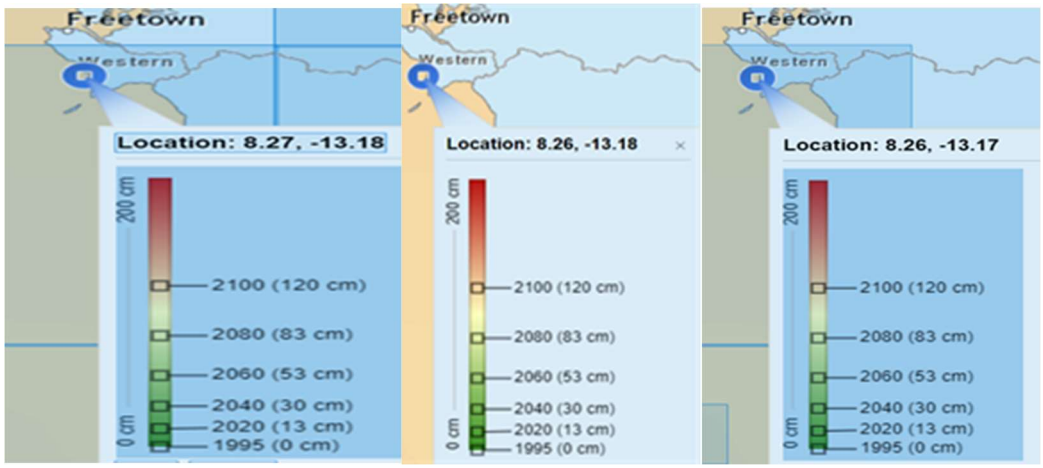


Figure 30. Sea level Rise Screening Output for Whale Bay and Black Johnson

A summary of the results of the SLR and coastal erosion modeling is summarized in Table 18. The coordinate ranges (8.27°N,-13.18°W; 8.26°N,-13.18°W; 8.26°N-13.17°W) were screened for local sea level rise and vertical land movement scenarios.

Table 18. Sea Level Rise Scenarios of Whale Bay and Black Johnson, 1995 to 2100

Periods	Local SLR (cm)	Comments
1995 to 2020	13	13 cm rise in sea level in past 25 years
2020 to 2040 (Short term)	30	30 cm rise in sea level expected in 20 years period
2040 to 2060	53	53 cm rise in sea level expected in 20 years period
2060 to 2080	83	83 cm rise in sea level expected in 20 years period
2080 to 2100	120	120 cm rise in sea level expected in 20 years period

From the results above, the value of 120 cm (1.2m) estimated for sea level rise between 2080 to 2100 is similar to the sea level rise values projected for West Africa by 2100. A recent World Bank funded study suggests a 1.06m (106cm) rising sea level due to high incidences of rainfall with a temperature increase of about 2°C for West Africa by 2100 (World Bank, 2020). This is projected to be associated with high rate of coastal flooding. The results of the vertical land

movement (coastal erosion) anomalies at Whale Bay and Black Johnson is presented in Table 17. The coastal erosion (vertical land movement) screening results is presented in Figure 31.

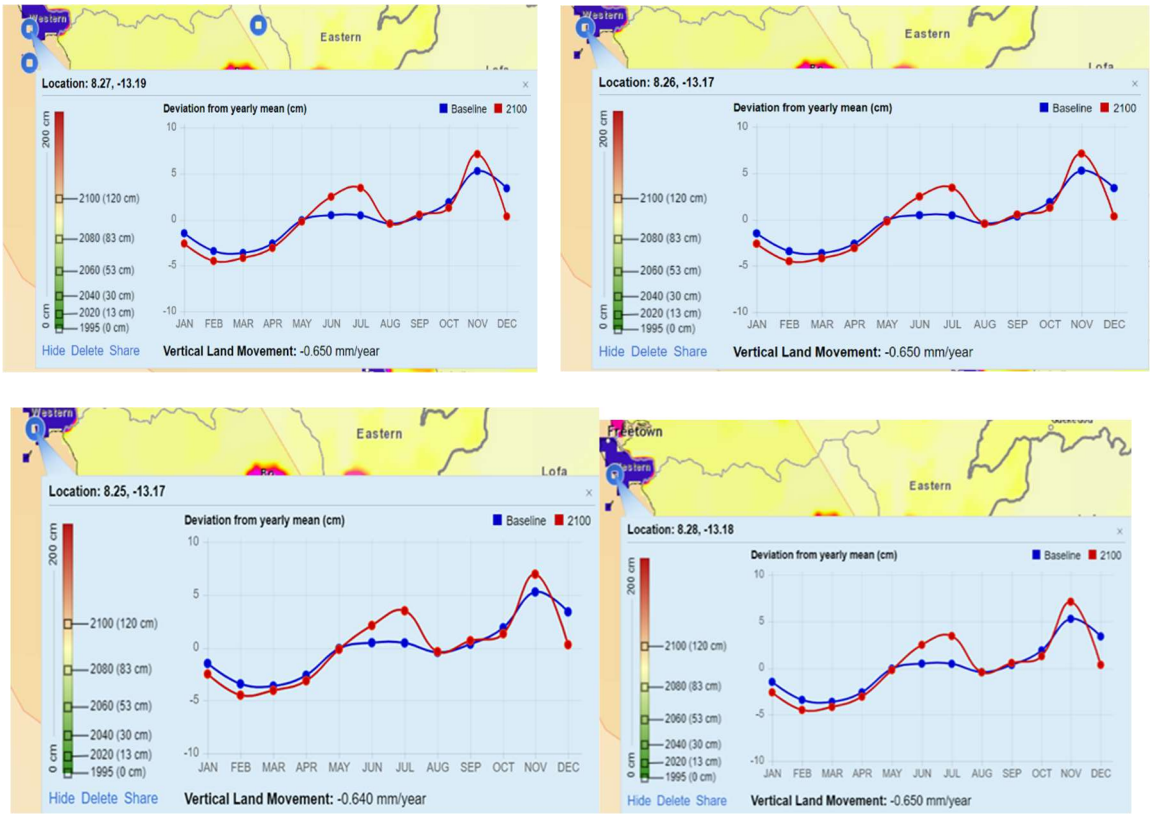


Figure 31. Coastal Erosion (Vertical Land Movement) at Black Johnson, Phase 1

Our result further shows that within the next two decades, sea levels will rise by 0.5m around the Whale Bay area of Black Johnson. There is therefore a compelling need to adopt climate resilient infrastructure development around the Black Johnson area. This must be followed by disaster risk management plans, and nature-based solutions such as tree planting, in order to protect coastal livelihoods around communities. The construction of breakwater system for the fish harbor at Black Johnson should consider the above effects of SLR scenarios of 30cm to 53cm rise within the next two to three decades.

Our study projects a rise in sea level up to 1.2m for the Whale Bay by 2100, with a 100% agreement for the entire coordinate range of the project site area, covered during the bathymetric survey. This value is very close to the 1.06m sea level rise projected for West Africa by the year 2100 (World Bank, 2020), which is critical for the fish harbor project at Black Johnson. Climate change effects is expected to exacerbate the effects of flooding and coastal erosion at the Whale Bay and Black Johnson areas with water levels expected to rise. The climate sensitivity selected for the sea level rise and coastal erosion modeling is under the conditions of highest GHG emission scenarios (RCP8.5), realizing that the Black Johnson experiences severe flooding during rainy season. Residents of Black Johnson Village confirmed that they sometimes experience severe flooding due to rises of water levels of the Black Johnson Lagoon and Whale Bay, due to severe rains and runoff from the Peninsular mountains, rainwater, and groundwater extrusion. The model output selected is the median (or 50-percentile) from a 28 GCM ensemble. The effect of vertical land movement is modelled as a spatial interpolation of local observations at specific locations to estimate coastal erosion values, which depicts dominant sink (negative VLM). The Black Johnson beach and land areas are under severe erosion due to flooding that is caused by rising sea levels under the influence of runoff during heavy rains, deforestation and groundwater extrusion and

displacement and reclamation of wetlands for gardening, housing, and hotel development. We have estimated a coastal erosion rate (rate of VLM) of -0.640 mm/year to -0.650 mm/year for the Black Johnson area by 2100 for high GHG emission scenario (Figure 32). When the VLM>0, it depicts a rising land, and when VLM<0, it implies that the land is sinking at Black Johnson. The model output shows sinking land at Black Johnson due to coastal erosion. The sea level rise model application is focused on the highest sea level in the year for both the baseline, 1995 and the projected year (2020, 2040, 2060, 2080 or 2100) for highest GHG emission scenario (RCP8.5). In order to compare with existing studies, the mean sea level rise per year is used. In this study, we have considered changes in the short term (2020-2040), Medium Term (2040 to 2080) and Long terms (2080 to 2021).

We used the following empirical relationship to estimate the absolute sea level rise and coastal erosion for Whale Bay for the time periods under study:

Local observed SLR (Normalized Sea Level) = local absolute SLR – local VLM
Local absolute SLR (ASL) = global SLR (GSL) × local normalized sea level (NSL)
Local Vertical Land Movement = ASL - Local Observed Sea Level (NSL)

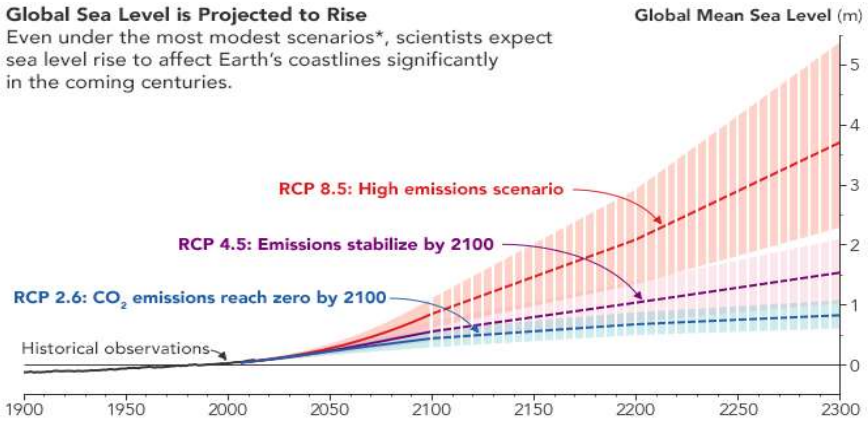


Figure 32. Global Mean Sea Level Rise, 1900 to 2300 (IPCC, 2019)

From Figure 32 above, the IPCC projects 0.6 to 1.1 meters of global sea level rise by 2100, which is about 15mm/year, with high GHG emission scenarios (RCP8.5) (IPCC, 2019). The local absolute sea level rise calculated for high emission scenario (RCP 8.5) for Whale Bay and Black Johnson for the periods considered in this study is presented in Table 19.

Table 19. Sea Level and Coastal Erosion Forecast for Whale Bay & Black Johnson

Periods	Global Sea Level (GSL) (m)	Normalized Sea Level (NSL)(m)	Local Absolute Sea Level (ASL)(m)	VLM (Coastal Erosion) (m)
1995 – 2020	0.5	0.13	0.065	-0.065
2020 – 2040	0.6	0.3	0.18	-0.12
2040 – 2060	0.8	0.53	0.424	-0.106
2060 – 2080	0.96	0.83	0.797	-0.033
2080 – 2100	1.1	1.2	1.32	0.12
Model Yearly projections				-0,64 to -0.65mm/yr

The absolute sea level rise projections calculated for the Whale Bay and Black Johnson shows an increase in sea level by 0.4m within the next three decades. Absolute sea levels for Whale Bay at Black Johnson are projected to rise-up at a rate of 0.3m to 0.4m for every two decades (20 years), with sea levels projected to rise to 1.32m by 2100. This is significant for the fish harbor construction at Black Johnson. The rate of

SLR projected for Whale Bay and Black Johnson is similar to IPCC projections (IPCC, 2019). The IPCC projects that if significant GHG reduction is made by countries (RCP 2.6), a rate of 0.3m to 0.6 meters of sea level rise will be expected by 2100. These values are also like the sea level rise projections which we modelled using the World Bank Climate Change Knowledge Portal (Figure...). Using the portal, Sea Level Rise data was derived from the CMIP5 database at 1 x 1-degree resolution and shows a rise in sea level for coastal West Africa up to 0.4m by 2070 and up to 0.7m by 2100.

The projected sea level rise values for the Whale Bay at Black Johnson can be attributed to natural variability in regional winds, particularly those blowing from the Cape Verde Islands and ocean currents. It can also be attributed to global events including the melting of ice caps of Antarctica and Greenland. Localized factors influencing sea level rise include sand mining and subsidence of the ground, changes in water tables due to ground water extraction and the effects of coastal erosion (vertical land movement). From the World Bank Climate Data Portal, the projected sea level rise for various coastal areas of Sierra Leone including the Black Johnson and Whale Bay areas is presented in Figure 33.

Figure 33. Projected Sea Level Rise for Coastal areas in Sierra Leone

The coastal erosion estimates (VLM) of -0.12m, -0.106m and -0.033m and -0.64 and -0.65mm/year for Black Johnson (Table 17), shows a sinking land situation in the short term, medium term, and long term. Coastal erosion at Black Johnson is caused by runoff water from the Peninsular hills, ground water extrusion and degradation of wetlands and mangrove habitats for farming, sand mining from the Black Johnson beach, coal burning, gardening, and housing development.

In order to further diagnose the climate situation of Black Johnson, the Climate Watch Data Portal was used for screening of GHG emissions (Climate Watch, 2022). The emission records which is also contained in the Sierra Leone NDC reports shows that in 2019, Sierra Leone emitted 9.45 million tons of CO_2 equivalent ($MtCO_2e$) representing 0.02% of global emissions (Figure 34). Emissions due to Land-Use Change and Forestry is about 3.38 MtCO2e (35.73%), Emissions due to Agriculture is 3.55 MtCO2e (37.59%) and those due to waste disposal is 1.45 MtCO2e (15.37%). This makes Sierra Leone as the World's 142nd largest emitter, with a total share of 0.02%. This is a very small amount of emission compared to the those from developed countries wrecking climate impacts of flooding and sea level rise, which Sierra Leone is currently suffering from on a yearly basis. Communities located on low elevation coastal zones such as the Black Johnson and adjacent villages are most exposed. The fish harbor construction provides an opportunity for flood mitigation as the breakwaters of the harbor will protect communities from flood impacts.

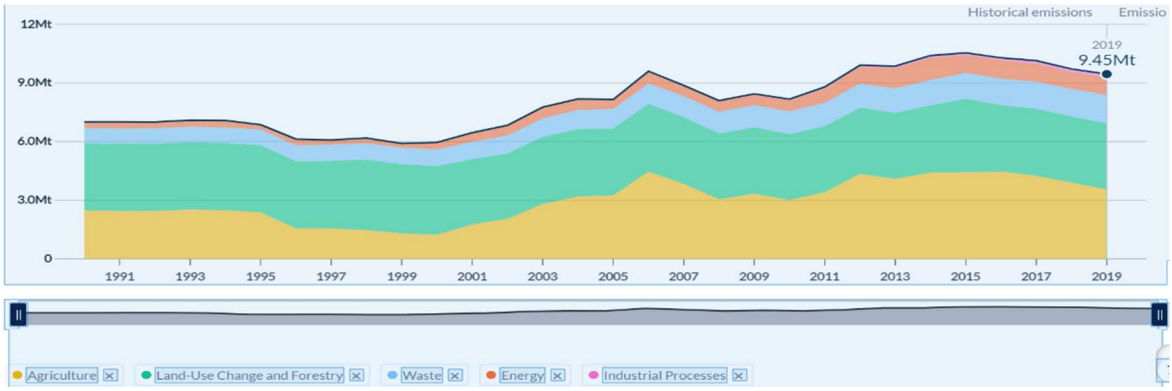


Figure 34. Green House gas emission profile for coastal Sierra Leone, 1991-2019.

7.2.3. Climate Hazards Screening for Black Johnson

Using the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR) hazard screening tool-ThinkHazard, the Black Johnson project location and surrounding communities were screened for multiple natural hazards. The hazard screening tool provides information on hazard level and risk management for surrounding communities . The output is important in the mainstreaming of disaster risk information in the design and construction of the fish harbor . It also provides guidance on the likelihoods of climate disasters occurring, which might affect project site and associated communities. The climate disaster risk classification for Black Johnson and associated communities is presented in Figure 35.

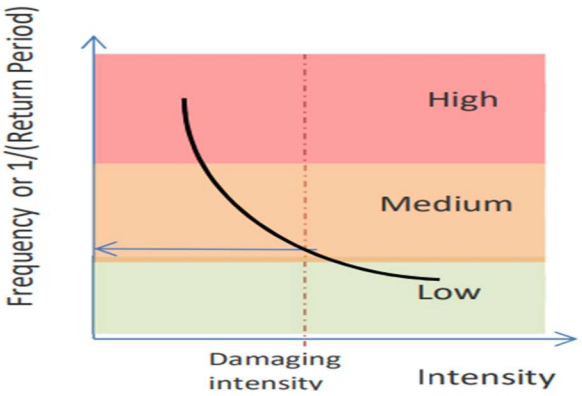


Figure 35. Climate disaster risk classification for Black Johnson

Queries using the ThinkHazard shows that coastal flood hazard is classified as **'Medium'** for Black Johnson coastal areas (Figure 36). This classification means that there is greater than 20% chances of potentially damaging coastal flood waves occurring once in the next 10 years in Black Johnson locality. The impact of coastal flooding should therefore be considered in the design, construction and operation of the fish harbor at Black Johnson. Project planning decisions, project design, and construction methods should take into account the level of coastal flood hazards and the mitigation and adaptation needs as identified in the environmental management plan presented in section 7 of this report.

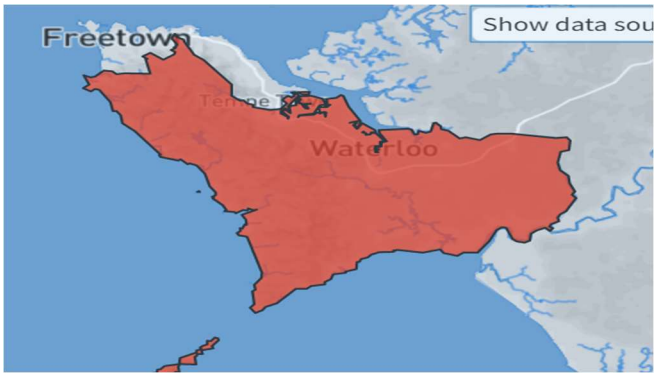


Figure 36. Medium Flood hazard regions in Western Rural Sierra Leone

7.2.3.1. Storm Surge Model for Whale Bay

For accurate estimation of future water level changes of Whale Bay at Black Johnson, we built an empirical model using the horizontal length of the proposed harbour and the depth of the water column from bathymetric map of the Whale Bay area surveyed at Black Johnson. The changes in mean sea level pressure (ΔPa) in hectopascals at the Whale Bay and Black Johnson locality served as key model input. The atmosphere unit (atm) used as unit of pressure was defined as 1013.25 mbar (101.325 kPa), which is equivalent to 1013.25hpa. Where the elevation of Black Johnson localities above water level increases, the atmospheric pressure will decrease. Data was obtained from Atmospheric pressure data of the area from global online data portals and bathymetric survey to estimate empirical storm surges for the Whale Bay and Black Johnson.

7.2.3.1.1. Empirical Storm Surge Model Parameters

Two forcing fields of weather systems occur over the Whale Bay, which is part of the Sierra Leone River Estuary:

1) Static amplification of storm surge (the inverse barometer effects), where atmospheric pressure gradient is normal to the sea surface (Sei, S, Baio, A and Kruger, S., 2019). This creates a reduction in pressure of 1 hpa . This causes temporal sea level rise by1 centimeter. Under this situation, a tangential wind stress of about 0.6m/s blows South East (SE) and travels over the sea surface to cause dynamic amplification which will push seawater to create pile of water towards the coast and foreshore. The dynamic amplification (AD) is related to Static Amplification (AS), using : $\boldsymbol{Ap}=\boldsymbol{As}.\mathbf{1}/(\mathbf{1}-\boldsymbol{v}\mathbf{2}\boldsymbol{w}/\boldsymbol{c}\mathbf{2})$

2) For deep water areas along the Whale Bay, at about 5m to 10m depth c>vw and AD >AS. Conversely, for shallow water areas towards the Black Johnson Beach under the influence of the Black Johnson Lagoon, c will be closer to vw and AD will become larger. When c and vw are equal, AD will become infinite and assume an upper limiting value due to friction. This creates a relationship between the storm surge amplitude and the water depth as follows:

$$\mathbf{S=K.w^2/D}$$

Where S= storm surge amplitude; w= wind speed; D=water depth, K is a constant accounting for estuarine and lagoon characteristics (stratification due to freshwater input from rains and ground water extrusion. The shallower the water, the greater the surge amplitude with effects of SE wind direction. The wind speed and water depths are the main determinants of storm surge amplitude. Tidal ranges, wind waves, river flow, ground water extrusion and rainfall of the Black Johnson area will increase surge amplitude when it strike the Whale Bay and Black Johnson lagoon areas. This produces the relationship:

$$\boldsymbol{S/d = (K10\ U^2 10\ L)/2gd2}$$

where U10 is the wind speed, 10 m above sea surface, d is depth of estuary, L is fetch length of wind speed, S is downwind surge amplitude and K10 is the wind drag coefficient given as 3.3×10^{-6} (wind drag coefficient). This accounts for the estuarine bottom stress, stratification of the water body due to fresh water input, atmospheric stability, nature of the sea surface (whether rough or smooth), and the angler direction at which the wind is blowing in and around the Whale Bay, Black Johnson Lagoon and associated land areas. Therefore, the most important parameters in determining the storm surge amplitude in this situation will be the wind speed and the water depth. In this case, the surge amplitude is directly proportional to the square of the wind speed. When the wind speed doubles, the surge height will increase four times and the surge amplitude become inversely proportional to the water depth. Therefore, the shallower the water of the Whale Bay becomes, the greater will be the surge amplitude. As the storm surge enters shallow waters, the wave energy reduces and attenuates into the vertical column of the water.

It should be noted that the reduced equation above is dimensionless and obeys a form factor multiplication effect that is affected by the shoreline and coastal features of Whale Bay. Since the Whale Bay is located in the continental shelf of Sierra Leone, a uniform variation of storm surges from a depth d1 to d2 at the shelf edges near the coast is assumed. If L is the width of the continental shelf and F is the wind fetch length, the depth ratio d2/d1 can be expressed in terms of L/x, where x is the theoretical distance inland at which the plane of the seabed would meet the mean water level. For extra tropical storms, F will be less than L. In this case, when V, the movement of the wind field equals zero, the wind field becomes static. This reduces the surge relationship as:

$$Sd1 = KU^2 L\ gd1\ 2\ 1(1- d1\ d2\ )\ \text{Ln d1 /d2.}$$

Due to the influence of the Whale Bay and Black Johnson Lagoon, the seafront of the fish harbor and vessel navigation routes can be shortened with tidal flows moving freely across. The navigation route of the main harbor entrance at the foreshore of the Whale Bay and Black Johnson Lagoon will therefore become obstructed by sand waves and debris. This will prevent free movement of tidal flow across the Whale Bay and cause siltation. We note therefore that when a wind field is moving across the Whale Bay and Black Johnson River Estuary, approaching the foreshore, the forward part of the surge wave system (forward speed of storm -(FSS) will be reflected as the waves generate close to the fish harbor. This will result to the reduction in the atmospheric pressure and increasing storm effects. The storm surge must therefore account for this reduction in atmospheric pressure. This makes equation to reduce and the storm surge equation will now become:

$$Sa = (103 - Pc)0.033$$

Where: Sa = the surge amplitude in feet; Pc = the atmospheric pressure at the storm centre .As from the previous equation above, this new functional relationship accounts for inverse barometer effects, indicating a decrease of 1 hectopascal in atmospheric pressure as a result of corresponding rise of 1 centimeter in the water level. Therefore, the storm surge function for the Whale Bay can now be further reduced and denoted as:

$$S = B + P + X + F\text{S}$$

where: B = the rise due to sea level pressure reduction at the center of the storm, P= offshore wind induced water piling level against the coast of Black Johnson, with influence of sand waves; X = height of wind induced wave crest, X = the height superimposed on the general rise of the water level; F = the effect of forerunners (Sylvester, 1971; Rao and Mazumdar., 1966). P and X are the most important parameters for

the Whale Bay, which is associated with a drowned estuary (The Sierra Leone River Estuary) and the Black Johnson lagoon, both of which have freshwater input effects from rainfall, stream and ground water flows. The resulting contributing factors of B, P and X will therefore generate a final storm surge equation for the Whale Bay and Black Johnson area as follows

$$s = \frac{5}{3} \times 4.5 \times 1/109W2 \times \Sigma \Delta D/D + \frac{\left(\frac{5}{3}\right)\Delta Pa}{g} \times 1/103$$

Where: W is the average wind speed that will be sustained onshore by the fish harbor due to cyclone events, ΔD = the horizontal length of the fish harbor extending in to the sea during phase one (9 berths for fishing vessels + shipyard berth+ support facility breakwater+ Length of Whale Bay Surveyed (Bathymetry distance (m)) (635m +278m+100m +500m); d = the depth of the water column of the Whale Bay surveyed (Bathymetry depths (m)); Δ Pa = the mean sea level pressure in hectopascals at the Whale Bay area. The Storm surge calculations for various water depths surveyed is presented in Table 18. The design wind speed was obtained from the most extreme storm event making landfall in Sierra Leone (See next subsection).

7.2.3.1.2. Design Wind Speed for Fish Harbor Construction

We estimated the design wind speed required for the construction of the fish harbor at Black Johnson by reviewing the wind speed and mean sea level pressure of the most extreme tropical storm events occurring in Sierra Leone and the West African region from 1928 to present (Table 20) queried from the International Disaster Database (EMDAT).

Table 20. List of Historical Cyclone Events for Sierra Leone (EMDAT Database, 2022)

Period	Name of Storm and Origin	Sustained Wind Speed (mph)	MSL Pressure (hPa)	Wind Direction	Places Affected
August 14, 2017	Tropical Cyclone Gert from Cape Verde Island-Thunder storm	110	962	NWN	Freetown (Flash Flood & mud slide
	Tropical Storm 16 Over Guinea, West Africa	60.8	996	NWS	Puerto Rico
August 31, 2015	Hurricane Fred- G. Bissau	76	986	NWS	Guinea Bissau
August 3r, 2000	Alberto, Senegal, Off WA	108	950	NWS	Senegal, WA& Berm.
Sep 1928	Lake Okechobee Hurricane Off West Africa Coast	139	929	NWS	West Africa-Cape Verde, US & Canada
July 31 1980	Hurricane Allen – ATL Basin	165	831	NWS	Caribbean, Mexico
Sep 9 1938	New England-West Africa	139	940	NWS	USA
Sep 1976	Freetown	64	980	NWS	Freetown
Sept 8, 1988	Tropical Storm 13-Near WA	161	888	NWS	Mexico, Nicaragua

The highest reference value of wind speed is for the tropical cyclone Gert (Category 2 Cyclone) of wind speed 110 mph (95.58 knots) (49m/s). This is the design wind speed for the fish harbor, for the most extreme storm event striking Sierra Leone Western Area Peninsular of Mount Sugarloaf and sustained for more than 1 minute on August 14, 2017. This event was characterized by heavy thunderstorm, torrential rainfall and landslide that killed more than 1000 people and damaged property worth over US31 million. Therefore, the design wind speed for the structural forms of the fish harbor at Black Johnson is 49m/s. This is critical for the harbor construction as the project site is proximal to the mountainous Western Area Peninsular and share boundaries with slopy landforms.

7.2.3.1.3. Storm Surges

For the storm surge calculation, we obtained prevailing meteorological data for the Blacnk Johnson and Whale Bay area including for various depths, including wind fetch lengths, and calculation of significant wave heights (See Table 19)

The relationship between significant wave height, fetch length and wind speed is presented in Figure 37.

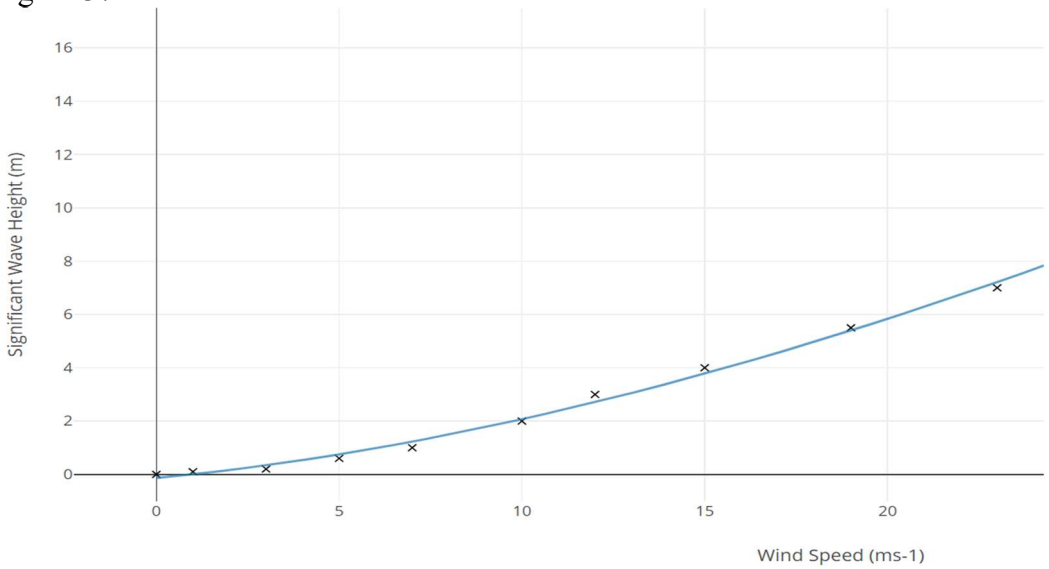


Figure 37. Wind Speed and Significant Wave height relationship

Significant Wave Height calculated followed the Brettschneider model denoted as:

$$Hs = W^2 \times (0.283 \times \tanh(0.0125 \times ([g]) \times Fl/W^2 \times 0.42/[g]$$

Where Hs is the significant wave height (m), which is the average of the highest one-third of waves. Average wave height is equivalent to about 5/8 of significant wave height. Fl is the fetch length, which is the length of water over which the wind blows without obstruction. The value '**g**' account for forces due to gravity and is equivalent to 9.8066 m/s^2. The value W is the Wind Speed which is influenced by the movement of air from high pressure areas to low pressure areas due to changes in temperature. The storm surge calculation considered the wind speed for most extreme event (Table 21) that made land fall in Sierra Leone, sustained for at least 1 minute. Most tropical storms (cyclones) that have made devastating landfall in Sierra Leone originates from Cape Verde Island. Cape Verde Island which is located off the coast of West Africa is known as the place where hurricanes are born and make devasting effects from landfalls in other countries. Over 85% of all hurricanes affecting the Americas and West Africa come from this region.

Therefore, we considered tropical storm events of devasting effects in Sierra Leone associated with these storms, queried from the EMDAT database and online sources.

Table 21. Prevailing wind speed at Whale Bay and Tropical Storm

Wave Direction (WS)	Average Depth (m)	Fetch Length (m)	Max. Wind Speed (m/s)	Atmospheric Pressure (mbar)	Wave height (m)	Significant Wave height (Hs) (m)
SW	0.3	500	2.06	1007	0.6	0.122
SW	0.4	1000	4.12	1007	0.7	0.489
S	1.5	1500	2.56	1005	0.8	0.189
SW	2	2000	3.60	1006	0.8	0.487
SW	2.6	3000	4.11	1005	0.8	0.487
S	3.2	4000	4.11	1005	0.7	0.2615
SW	5	2000	3.09	1005	0.6	0.4875
S	3.82	5000	4.11	1007	0.8	0.276
SW	4.3	5,700	3.08	1006	0.5	0.27376
NE	4.9	5,800	4.11	1002	0.3	0.4875
NSW	5.5	7,600	3.081	1005	0.5	0.2739
NE	6.1	3,000	2.54	1009	0.5	0.4875
NE	6.6	5,000	2.03	1002	0.8	0.2738
E	7.2	500	3.03	1010	0.8	0.2738
E	7.5	800	3.03	1002	0.8	0.4875
NE	7.9	700	3.03	1002	0.8	0.265
NE	8	600	39.61	929	10.06	16.09
NE	9.0	1000	32.91	980	11.25	18
E	**10**	**5,800**	**49.1**	962	7.71	12.34

The ECMWF global wave model was used for further screening of wave regime to show evolution of weather events around the Whale Bay and Black Johnson area, dated back to 1979 (Table 22), Figure 38. These wave anomalies were used in the calculation for storm surge.

The storm surge model output is presented in Table 23. Tropical Storm that caused landslide in Sierra Leone in August 2014 which originated from Cape Verde Island had winds that blew from the NWS direction, with a speed of 110mph (49m/s or 95.6 knots). This storm made landfall at Mount Sugarloaf, situated along the Western Area Peninsular of Freetown. Deforestation of the Western Area Peninsular Forest was one of the major causes of the landslide caused by heavy rainfall triggered by Tropical Storm and thunderstorm.

Table 22. ECMWF Wave Model output for Black Johnson (Hindcasted to 1979)

Date	Wave Height	Wave Period	Direction
August 14, 2017	1.3	15.15	S
August 14, 2011	1.12	10.2	SW
August 14, 2014	1.78	6.71	SW
August 14, 2022	1.3	15.15	S

Table 23. Storm Surge of Whale Bay and Black Johnson

D(m)	ΔD (m	ΔD/D	W(m/S	W^2	ΔhPa	$g(m/s^2)$	ΔhPa/g	$109*W^2$	$1/109(W^2)$	(5/3)*ΔPa/g	1/103	(5/3)*4.5	S (m)
0.4	1513	3783	4.12	17	1007	9.8	102.76	1850.21	0.0005405	171.2585034	0.0097087	7.5	1.663
1.5	1513	1009	2.56	6.55	1005	9.8	102.55	714.3424	0.0013999	170.9183673	0.0097087	7.5	1.659
2	1513	756.5	3.6	13	1006	9.8	102.65	1412.64	0.0007079	171.0884354	0.0097087	7.5	1.661
2.6	1513	581.9	4.11	16.9	1005	9.8	102.55	1841.239	0.0005431	170.9183673	0.0097087	7.5	1.659
3.2	1513	472.8	4.11	16.9	1005	9.8	102.55	1841.239	0.0005431	170.9183673	0.0097087	7.5	1.659
5	1513	302.6	3.09	9.55	1005	9.8	102.55	1040.743	0.0009609	170.9183673	0.0097087	7.5	1.659
3.82	1513	396.1	4.11	16.9	1007	9.8	102.76	1841.239	0.0005431	171.2585034	0.0097087	7.5	1.663
4.3	1513	351.9	3.08	9.49	1006	9.8	102.65	1034.018	0.0009671	171.0884354	0.0097087	7.5	1.661
4.9	1513	308.8	4.11	16.9	1002	9.8	102.24	1841.239	0.0005431	170.4081633	0.0097087	7.5	1.654
5.5	1513	275.1	3.081	9.49	1005	9.8	102.55	1034.689	0.0009665	170.9183673	0.0097087	7.5	1.659
6.1	1513	248	1.54	2.37	1009	9.8	102.96	258.5044	0.0038684	171.5986395	0.0097087	7.5	1.666
6.6	1513	229.2	1.03	1.06	1002	9.8	102.24	115.6381	0.0086477	170.4081633	0.0097087	7.5	1.654
7.2	1513	210.1	1.03	1.06	1010	9.8	103.06	115.6381	0.0086477	171.7687075	0.0097087	7.5	1.668
7.5	1513	201.7	1.5	2.25	1002	9.8	102.24	245.25	0.0040775	170.4081633	0.0097087	7.5	1.654
7.9	1513	191.5	1.5	2.25	1002	9.8	102.24	245.25	0.0040775	170.4081633	0.0097087	7.5	1.654
8	1513	189.1	39.61	1569	929	9.8	94.796	171015.8	5.847E-06	157.9931973	0.0097087	7.5	1.534
9	1513	168.1	32.92	1084	980	9.8	100	118126.2	8.466E-06	166.6666667	0.0097087	7.5	1.618
10	1513	151.3	49.1	2411	962	9.8	98.163	262778.3	3.805E-06	163.6054422	0.0097087	7.5	1.588
		9826											

Figure 38. ECMWF Model output for Black Johnson Hindcasted August 2011

A summary of the various water levels and design parameters estimates for the Black Johnson project site for fish harbor construction is presented in Table 24. Since no time series data of tidal epoch for 20 years period was available, the design high water level (highest astronomical tide) was calculated as the average of two consecutive high waters occurring within 24 hrs, using data from the British Admiralty Tide Tables for Sierra Leone. This value should be used for the design parameters for wharf construction including Wharf apron.

Table 24. Water level calculations for Project Site (Chinese and English Norm)

Water levels and Harbor Design Parameters			
Chinese Norm (Engineering Feasibility-Shangdong Gangstong Eng. Consulting, 2018)	Values	ESHIA (Black Eagle, SL Ltd. 2022-English Norm (This Study)	Values
Design High Water Level	3.24m	Design High Water Level (Highest Astronomical Tide)	3.4m
Design Low Water Level	0.35m	Design Low Water Level (Lowest Astronomical Tide)	0.2m
Extreme High-Water Level	-0.10 m	Storm Surge for Extreme High Water	1.646m
Extreme Low Water Level		Storm Tide =Storm Surge + Design High Water level	5.046m
		Design Wind Speed	49m/s

A storm surge for extreme high water of 1.646m was obtained for the Black Johnson, which is the possible height of water above the normal predicted astronomical tide. There is a potential of tropical storms pushing water onshore. We estimated a storm tide of 5.046m, which is the combination of storm surge and normal high tide. Using the AQUEDUCT global flood assessment model, we note that there

will be no return period of surges for the next 100 years for the project site at Black Johnson. However, there is flood inundation risk possibility due to storm surges for associated communities of Hamilton, Tokeh, Bambatuk and Bawbaw, Number 2 Village and John Obey. Severe inundation are projected to occur at water debts of 5 to 10m on a return period of 1 in 5 to 10 years for the Lakka, Hamilton Tokeh areas and i1 in 50 to 100 years for John Obey (Figure 39.)

Figure 39. Flood Inundation Model Output for Black Johnson up to 2030 (Left) and 2080 (Right)

These risk scenarios for the Black Johnson concession area for the fish harbor project was compared to the model for the rest of Sierra Leone. The output mirrors the situation of high sea level influence which influences inundation. This shows that formidable breakwater systems must be employed for the fish harbor construction at Black Johnson.

The Sea level rise annual damage probabilities is presented in Figure 40 below. There is low probability for a 50% annual damage. There is low likelihood for any annual disaster for the site.

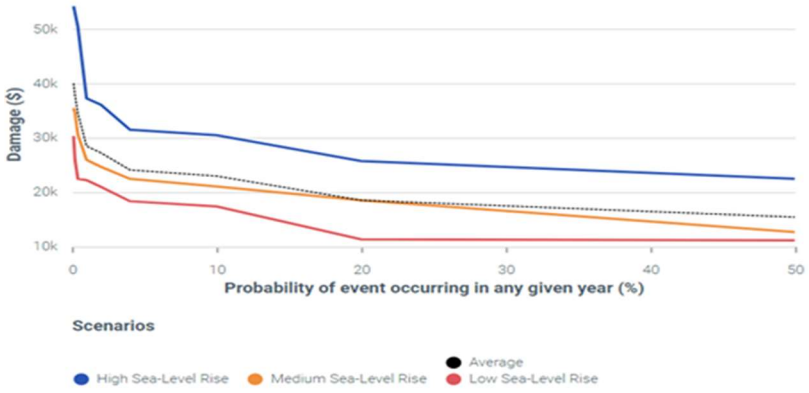


Figure 40. Sea Level Rise Annual Damage Probabilities for Black Johnson, RCP 8.5

7.2.3.1.4. Future Storm Surge (FSS) Modeling

Further screening for extreme water level (Total water level) and Future Storm Surge (FSS) was necessary for Black Johnson project site which is subjected to coastal erosion due to flooding. The flooding impacts at the Black Johnson Lagoon had inundated mangrove forests and breakwater and local bridge relics that once served as transit route for Slaves from York, across the Whale Bay to Bunce Island (Figure 41). A stakeholder meeting with Relics and Monument

Commission, the MFMR and Ministry of Tourism recommended removal of the relics to construct the fish harbor.

Figure 41. Flood Inundation of Mangroves, Breakwater, and Bridge at Black Johnson Lagoon

In order to model high water level return periods with tidal effects, we used the estimated storm surge values as input to calculate total water levels and Future Storm Surge (FSS), due to wave breaking, flooding and sea level rise scenarios. The following empirical model which is applicable for the design of highways and harbors was used (Nichols et. al., 2010; 2011).

(i) Storm Tide = Storm Surge + Highest Astronomical Tide
(ii) Total Water Level (SLR) = Storm Surge + Tides +Waves + Fresh Water Input

The contribution of waves and freshwater input from whale river and groundwater was estimated following Nicholls (2008) for a 1 in 100 years return period, assuming a 10% contribution of high water every year.

Future Storm Surge (FSS) = S100 + SLR + (UPLIFT × 100 yr.) / [1000 + SUB + (S100) × x].

Where;

S100 = 1-in-100-year surge height (m), which is the total observed seawater level during storm. This is based on the contribution of barometric pressures, tidal effects, wind speeds, slopes of seabed and storm surge height; x = 0.1, is the tropical storm factor which represents the storm effects applicable for coastal areas prone to tropical storms. This was justified by the Tropical Storm Gert that caused landslide and flash flooding in Sierra Leone in August 2017. This event claimed over 1,141 human lives and destroyed property worth over US$31 million.

S 100 = Storm tide = Storm Surge + Design Water Level = 5.046m

UPLIFT was measured as the continental uplift/subsidence in mm/yr, calculated as vertical land movement (coastal erosion), which is -0.640mmm/yr to -0.650mm/yr. This gives an average of -0.645mm/year. **SUB was assumed to be 0.5 m (to account for delta influences on the coast of Whale Bay and Black Johnson Estuary.** As a result of storm surge and flooding, Black Johnson has a deltaic coast, where the Whale Bay carries sediment to the coast and deposits it at the foreshore beyond the bay mouth. Tidal currents and waves re-work the newly deposited sediments, which has influenced the shape and form of the coast over time (Figure 42). The Black Johnson lagoon water is less dense than the basin water of the Whale Bay, leading to the formation of river delta on the coastline after flooding events. **The project site is therefore characterized by hypopycnal flow of the Black Johnson river water as a result of its slow mixing with the denser basin water of the Whale Bay**. This caused the deposition of fine sediments

transported at some distance and settling out of suspension. Some rocks are also characterize some part of the coastal feature when tide recedes.

Figure 42. Black Johnson Site with Sand Dunes and Deltaic coast

The August 14 landslide was caused by the Tropical Wave Invest 1L and the Tropical Storm Gert. The tropical wave developed into a category 2 Cyclone (Storm) which was associated with pronounced thunderstorms that caused heavy torrential rains that aggravated flash flooding and mudslide. As residents around Mount Sugarloaf area degraded the hilltops from deforestation, the soils laid bare and became saturated by heavy rains which weakened stability of slopes, which aggravated the vertical movement of aggregates and flood water downhills.

8.0 Impact Identification for Fish Harbor Construction

The important areas of environmental, social and health impacts emanating from the construction of fish harbor at Black Johnson has been categorized into : a) Impacts during the pre-construction phase, b)impacts during the construction phase and c) impacts during the operational phase. We have analyzed these impacts based on the biophysical and socio-cultural environment. The impacts on the biophysical environment evaluates impacts on the following: i)Human health, ii) Waterways, iii) Rivers and streams , iv) Soils and Sediments , v) Air quality, Noise , vi) Flora and fauna viii) Ecological sensitive sites

The impacts on sociocultural environment evaluated the following: Population, ii) Cultural heritage, iii) Social and recreational activities, iv) Community livelihoods Infrastructure, vi) occupational safety and health , vii) Land tenure and land rights, viii) land use ix) Employment x) Agriculture xi) fishing x) Public health

The impacts were evaluated against various impacting activities during the preconstruction, construction and operation of the fish harbor at Black Johnson and Whale Bay. The preconstruction phase interfaced with the following impacting activities:

i) Site selection and land acquisition process
ii) Land tenure and land rights

iii) Engineering feasibility investigations including borehole drilling
iv) Land demarcation
v) Process of preparation and submission of ESHIA report for EIA license
vi) Stakeholders engagement
vii) Environmental sample collection
viii) Mobilization and deployment of hydrographic survey and topographic survey equipment.

Considering that the land-water interface will be engineered during the construction phase, the following impacting activities were identified:

i) Site clearing and fencing
ii) Mobilization and storage of construction materials and equipment
iii) Land reclamation from the Black Johnson Lagoon, Streams and Whale Bay
iv) Site clearing and fencing
v) Earth movement and paving
vi) Road construction and diversion of waterways
vii) Construction of electricity and water supply
viii) Construction of breakwater systems
ix) Excavation and transportation of aggregates
x) Construction of offices, residents, and installation of construction equipment
xi) Mobilization and accommodation of workers
xii) Waste collection and treatment System installation
xiii) Construction of fire and lighting protection systems

The operational phase will interface with several impacting activities including the following:

i) Operation of Cold Storage facilities for fish processing (Aquatic product processing park and support area
ii) Transshipment and local discharge of fish, including onloading and offloading of catches
iii) Port inspection controls by Government Authorities
iv) Operation of Ship building and fishing gear repair areas
v) Operation of experimental fish farm (demonstration and experimental fish farm)
vi) Office and residential operations (Residential service area)
vii) Operation of fish market (aquatic product trading area)

The impact identification matrix is presented in Table 24. The impact identification matrix is presented in Table 25. The impact matrix shows numerous potential beneficial impacts (+2) of the fish harbour operation at Black Johnon. This includes livelihoods improvement of the people of Black Johnson and surrounding communities and improved economic benefits for the people of Sierra Leone through increased investment, revenue earnings and household incomes. The construction phase will significanty affect the ecological systems, land tenure and community livelihoods (-2), through earth movement, land reclamation and dredging activities that will lead to loss of flora and fauna. This will be mitigated through the Environmental and social management plans, community development action plans and resettlement action plans which are detailed in the next sections of the ESHIA report.

Table 25. Impact identification matrix for fish harbor project at Black Johnson

Activities	Bio-physical Environment							Socio-cultural Environment										
	Human Health	Water ways, rivers, streams	Soils	Air quality	Noise and vibration	Fauna and fauna	Ecological sensitive Sites	Population	Cultural Heritage	Social and recreational	Community livelihoods	Infrastructure	Occupational safety & Health	Land tenure, ownership	Land use	Employment	Agriculture	Public Health
Pre-construction phase																		
Land acquisition at Black Johnson	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2
Ground Truthing by EPA-SL	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	2+	2+	2+
Compensation of Land Owners	0	0	0	0	0	0	0	0	0	0	2+	0	0	0	0	1	1	0
Resettlement of Land Owners	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+
Community Engagement	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Feasibility & ESSHIA Studies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mobilization of Equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2		1	1
Construction Phase																		
Site clearing and layout	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	2+	2+	1
Earth movement and Reclamation	1	1	1	1	1	1	2	2	2	2	2	2	2	0	1	2+	2+	1
Mobilization and storage of plant equipment and construction materials	1	1	1	1	1	1	2	2	2	2	2	2	2	0	0	2+	2+	
Construction of offices and equipment inst.	1	1	1	1	1	1	2	2	2	2	0	0	2	0	0	2+	2+	1
Operation Phase																		
Operation of Cold Storage Facilities for fish processing and marketing	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2+	2	1
Transshipment and local discharge of fish onloading and offloading of fish catches	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2+	2	1

Key: 0 No potential impact or significant impact

1 Potential effect, expected to be insignificant

2+ Potential significant beneficial impact

2 **Potential Impact**

9. 0. Construction Management Plan

The fish harbor will be constructed by Expert Engineers from China, working with counterparts from Sierra Leone. The construction specifications and standards are presented in the Engineering Feasibility Study Report for the fish harbor, undertaking by a Chinese Firm, Shangdong Gangtong Engineering Co. Ltd in 2018. This Engineering feasibility will be submitted to EPA-SL, together with this draft ESHIA study report for their review. Both studies will be publically disclosed by the Experts, to facilitate the issuance of EIA license for the fish harbor construction. This section contains detailed plans for construction management for the various phases of the fish harbor construction to prevent harbor failure over a period of 100 years.

9.1. Long Term Fishing Port Development

The fish harbor construction project proposes a two stage construction scale to achieve a long term development scale of 15 berths for fishing vessels with a total berth length of 938m for the fishing port. A total berth length of 9000m with a breakwater of 745 m is envisaged for berthing of up to 20,000 tons of bulk cargo and 100,000 tons of container ships. The remaining 38m berth area will be reserved for future development. A ship building and ship repair area of 147,600m^2 will form the main shipyard to accommodate a 5000 ton slipway. This slipway will have three berths on the west end of the harbour with 27m length to berth up to 120 fishing vessels annually.

There will be a fish processing platform and supporting area of 276, 000m2 to accommodate 120 fishing vessels per year. This Fish Processing platform will comprise of a workshop area for fish processing material maintenance and fishing gear maintenance, a cold storage and fresh water treatment plant and sewage treatment plant. It will also consist of a bonded warehouse for fish packaging and vessel repair materials, and entrepot trade warehouse for storage of transshipment goods essential duty free construction and fishing materials useful for private sector trade for fish business operators and fishermen using the fish harbor.

The major housing infrastructure for the fish harbour will include a Chinese Office building and a '**Fisheries and Marine Resources House'** as office building for the MFMR. Staff residential houses, Fuel Stations with Mini Supermarket, Canteen, Generator house and Car Parking lot will be part of the development. An oil storage area of 6,600m^2 will be constructed to support harbour construction and facilitate fueling of fishing vessels. The project will construct an Experimental Fish Farm and Demonstration facility, with an area of 320m^2. The aim is to establish a formidable fish hatchery for fish breeding in tanks, with experimentation facility to accommodate sedimentation tanks, water storage tanks, fingerling production , and brood stock production and a fish bait ponds. We recommend this component to be a marine park built at the Black Johnson Lagoon area, which will integrate the Mariculture demonstration area. This will be the first marine park that can be named- '**The Sierra Leone Marine Park'** that will be operated by the MFMR and the Black Johnson Community, which will form part of the ***Community Development Action plan (CDAP). The details of the construction management of the fish harbor to accomodate the 'Sierra Leone Marine Park (SLP) is included.***

A fish market will also be constructed on a 150,000m^2 land area which will include a fish market hall, a fish trading and auction market and a parking lot for refrigerated trucks and other fish transport vehicles and visitor vehicles. The harbor development will consist of an affordable residential area for MFMR staff and other Civil Servants, which will be built for a defined free hold insurance

scheme. The reserved area of 38m long could be used for future development, including possible hotel development. The first phase of the project proposes construction of 9 fishing berths on a 635 m coast line. One of the berths will be used for berthing one vessel at a time, preferably a reefer vessel or processing vessel with 10,000 dwt. Three of the berths will be used for vessel maintenance and repair, with syncrolift capability.

A 'U shaped' harbor basin is envisaged with 395 m width between the fishing vessel berths and the vessel repair and maintenance berth to prevent cross contamination during maintenance operations. The length of the fishing vessel repair area will be 278m, with possibility of berthing 3 vessels on the mechanical vessel repair area at a time, with berth length of 162m. The Western area of the main berths will accommodate. Five fishing vessels on a berth length of 273m and width of 30m (See the Engineering Feasibility report). The northern end of the harbor seafront encompassing the Whale Bay will consist of dike type berths to accommodate vessel of 10,000 dwt. The nature of the land will permit the construction of a sloping breakwater, made of piles. This will be more suitable for use at the Black Johnson site where intertidal areas around the seafront and lagoon consist of soft soil conditions.

9.2. Construction management for First Phase Harbor Construction

The construction management plan (CMP) presented in this report is for the first phase construction highlighted above for each of the development areas, to avoid harbor failure. Particular attention should be paid to the hydrological parameters of high water, low water and extreme high water including accounting for the storm surge calculated for the site. The first phase construction will determine the final development, as construction issues and management requirements will evolve. The following are recommended for the management of the various stages during the construction:

9.2.1. Site Layout, Access, Accommodation and Security

Considerations will be made for site layout to consider site access to the location of offices and accommodations, storage area, electricity generating plants, temporary services, security (fencing and security personnel), health, and safety. The site should be in order to provide easy access and a safe, economical and well secured flow of materials and workers to the project site. This will facilitate efficient placement for materials to prevent double or triple handling of materials at the site and effective work time utilization. This is also required for work safety and work productivity. Our assessment of possibilities for ease of access shows that there are two possibilities:

i) Ease of Access to the project site from Black Johnson Village will be easier and shorter, but this will require site clearing, and the diversion of stream water flows.
ii) Ease of access through Big Water village and Yankai Resort property. This access will particularly be important for seafront development, as the Yankai resort area is located at the foreshore very close to the Whale Bay.

We recommend the reclamation of the entire foreshore area including where Yankai Resort if situated for the seafront development (Figure 43). This area can form a major component of the seafront of the fish harbor, where construction equipment should easily be deployed. Yankai resort is located on the foreshore area that do not qualify for compensation by Government. However, realizing the investment in the hotel development there, Government will require to give considerations for a special negotiated compensation on the principles of livelihoods and resettlement. If this takes longer time to settle, the first option for site access for mobilization of construction equipment should be considered. The suitability of the access roads is important for the transportation of construction

equipment and materials. This would minimize occupational accidents and reduce the time for access to the project site.

Figure 43. Yankai Resort on Foreshore of Whale Bay and Black Johnson Lagoon

9.2.1.1. Staff Accommodation, Storage and First Aid

Staff resident facility and staff offices must be constructed onsite at the early stage of the construction work. In addition to self-contained water, sanitation and hygiene equipment at offices and core staff resident facility, we recommend the construction of modern public toilet, hygiene facility and messrooms with kitchen facilities separately. This facility should be used for the main labour force to provide required services during the construction work. The facility must be constructed not too far from the main construction site, to reduce the walking time for works. This will reduce double handling of materials and coordination of work and deployment of staff and various equipment. A first aid and health facility must be included in the accommodation package, to ensure immediate response for the provision of basic health services for the personnel when required, particularly in responses to minor accidents. Accommodation and Storage facilities must consider the use of anti-rust roofing systems and the use of corrosion free or stainless-steel materials for all iron elements including cooking utensils. The Black Johnson site is affected by the sea breeze which contains ferrous oxide that can cause corrosion of iron and metal elements. The use of aluminum materials is strongly recommended for the exposed building elements including windows and doors.

9.2.1.2. Storage, Security and Energy

The construction of warehouse for storage of construction materials onsite priori to commencement of key harbor construction is strongly recommended. This provides additional early opportunity for efficient storage of materials and construction work commencement. Although staff presence onsite provides additional security for construction materials and equipment. We recommend the recruitment of police personnel, at least 4 personnel including a firefighting officer is recommended. The storage provisions must consider the quantity and type of materials and the weather conditions of Sierra Leone, realizing the commencement of rainy season in the months of April and May. The warehouse must also consider use of anti-rust roofing materials and the use of aluminum materials for the window and doors of the warehouse. We realize that iron doors are more dependable for warehouses. These must be double doors with iron doors outside and metal doors inside, to prevent material corrosion. The iron door must also be protected from corrosion using anti-rust and anticorrosive agents.

Although the project site and land coordinates have been demarcated with beacons, it is strongly recommended to provide reliable fencing for the site to strengthen security. The Engineering feasibility studies suggest the installation of three 1200kw high voltage diesel generating set to be built as main power supply source for the project. We recommend an immediate connection of the

national electricity grid to the Black Johnson community and the project site. This should be a combined effort by the project and the ongoing national electricity connection drive. We recommend the installation of a solar grid to contribute to the power requirement for the site, realizing that sunshine is guaranteed for up to six months every year. The solar grid can be used for lighting of the street lamps, alternating with the main grid during low power outputs from the solar. t This plant should also support the staff offices and other workstations at the site. We recommend linking Black Johnson village to the Electricity facility at the project site. This is among the major needs of the Black Johnson community which has been identified inr the CDAP. A substantial Solar electricity facility will contribute towards Sierra Leone's targets for reducing GHGs towards their nationally determined contributions (NDCs). Sufficient space must be allocated for the electricity plant and solar park.

9.2.1.3. Geotechnical Features, Sedimentology and Hydraulics

A geotechnical borehole survey undertaken by Shangdong Geotechnical Survey Institute reveals a soil profile of silty fine sand, medium sand, muddy silty clay, block stone, silty clay and weathered granite (Shangdong Gangtong Engineering Consulting Co. Ltd., 2018). Our sediment probing and soil profile analysis using Particle Size Distribution (PSD) sieving at the Engineering Department of Fourah Bay College also showed a soil profile of fine silt and clay, medium sand and silty mud, block stone, fine gravel, fine sand, coarse gravel, silty clay and muddy silt and clay. However, there is high elevation of the land shoreward at the back of the Black Johnson Lagoon and Whale Bay. The land consists of steep slopes and rocky features including strong rocks which should be removed by drilling and blasting. There are ripping areas of interspersed discontinuous rocks on the mainland and foreshore of the Whale Bay and Black Johnson Lagoon. These rocks were deposited due to stream water flow from the Whale River, rain-water runoff, and ground water extrusion over time. The rocks consist of proterozoic crystalline igneous and metamorphic basement rocks. The freshwater from whale river and groundwater flowing thorough the rocks into the lagoon and Whale Bay is used as a source of drinking water and water use.

9.2.1.4. Ground Stabilization Requirements

The proposed site possesses deep slope descending to the foreshore of the Black Johnson Lagoon, which will require ground stabilization. The sedimentary sequence of the coastline of the Whale Bay and Black Johnson estuary consists of fluvial and marine processes advancing seaward consisting mainly of white silty sand. Silty clay characterizes the intertidal areas of the river system. There are thin beds of deposition of limestone, calcareous grit and lignite. The Seafront areas consist of sand bars creating a deltaic coast that lie parallel to the Southwest current direction, separating the bay from the lagoon. The Engineering feasibility report proposes a slope stabilization of graded step for the high elevation land extent, while backfilling is proposed for the Wharf extent, where fish processing platform and vessel repair dock will be constructed (Shangdong Gangtong Engineering CO. Ltd 2018) We also note that the demolition of existing structures at the site and the excavation activities will result to formation of excavated rock slopes. The stability for these slopes should be maintained throughout the design life of the project.

9.2.1.4.1. Soil Density and Diggability Management

In order to investigate stability, a free mass will be taken from the slope towards the waterfront areas of the Black Johnson proposed harbour site. We will use known or assumed values of the forces acting on the mass closed to the Lagoon and Whale Bay waterfront. Calculations will be made to estimate the shear resistance required for equilibrium of the soil. This shearing resistance will be compared

with the estimated or available shear strength of the soil to give an indication of the factor of safety. The stability analysis will give a conservative result with an indication of the modes of failure that may occur, and information relating to the shear strength of the rock mass, or the shear strength along discontinuities on the site. This is required for use in stability analysis. The joint inclination will be the most important parameter for slopes of medium and large height, whereas density will be more important for small slopes landward of the Black Johnson site. The principal types of harbour failure that occur in rocky slopes such as found on Black Johnson site are important to stabilize in order to prevent toppling failures. Most of the part of the land area towards the Black Johnson village possess are horizontal strata, where excavation and slope determination will be easier will be managed easily. Vertical slopes can be excavated in the sandstone areas cemented shales which are expected for the soil and sedimentary structures of the Whale Bay. We consider that slopes of 60º and 75º to be safe for the terrain, however 45º. Slope stability for clay fissures around the intertidal zone would lead to failure. The steep slopes at the Black Johnson site should be flattened and back filled. During this excavation, surface water runoff should be prevented. We recommend the installation of a drainage ditch at the top of an excavated slope towards the seafront in order to collect drainage from above. The ditch, especially in soils, should be lined to prevent erosion, otherwise it will act as a tension crack. These mitigation measures to prevent harbour failure will form part of the construction management plan (CMP). Land reclamation, earth movement and excavation should ensure compaction of the soil back into the trenches formed. This should be done using aggregate mixture of soil, rocks, and stones to protect structural foundations for the roadways and slipway layout. The backfilling will ensure ground improvement to prevent future damages of the harbour structural elements. Based on the ground conditions, a pile driving for foundation element will be favorable construction mode for the breakwater system. In addition to the construction standards proposed in the Engineering feasibility report, we have used the standard density bulking factor and diggability of some common soils at the site, to determine the strength, density, and fracture patterns within the rock masses and constructability of the site for proper construction management, The values for diggability are presented in Table 26.

Table 26. Density, Bulking Factor and Digability Standards for Soils

Soil density	Bulking Factor (Mg/m)	Diggability
1.8	1.25	E
1.7	1.15	E
1.95	1.15	E
1.65	1.3	M
2.1	1.35	M-H
1.6	1.3	M

The value E represents digging loose, free-running material such as sand and small gravel; M is the medium digging value for partially consolidated materials such as clay and clayey soil. M–H denotes the medium-hard digging value for materials such as heavy wet clay, gravels, and large boulders. These values are important to consider for the stability of slopes in open excavation including cuttings for the land sea interface where slopes are required to be designed to resist slope failure. This could be e aggravated by heavy rainfall at the site and the density conditions of soils at the foreshore areas.

9.2.1.5. Backfilling and Slope Stabilization Management

The project will involve backfilling earth works for the reclamation of additional 37.6-acre (152162 m^2) land from the sea. From the site feasibility studies, the landward extent of the project site stands

at an elevation of +14.5m and the wharf areas for the ship repair facility and fish processing areas stands at an elevation of +4.5m. The earth movement and excavation will require slope stability for which **graded steps has been proposed for the landward extent, while backfilling is recommended for the seaward extent of the wharf** (Shangdong Gangtong Engineering Co. Ltd., 2018).

The land reclamation process from the sea and lagoon should involve dredging and backfilling using Versi cutter suction dredger (Figure 44) to dredge sediment and soil material and pump it for backfilling. A cutter suction dredger cuts hard soil into fragments with a rotating cutter head. The material is sucked up by dredge pumps lowered to the seabed and discharged to a deposit area through pipelines across sea and land. They are capable of dredging water depths up to 25m which is good for dredging the Whale Bay areas surveyed with a maximum depth of around 9 to 10m. Versi cutter suction dredgers are good to dredge all kinds of soils, including sand, clay, silt and rock which is found on the project site..

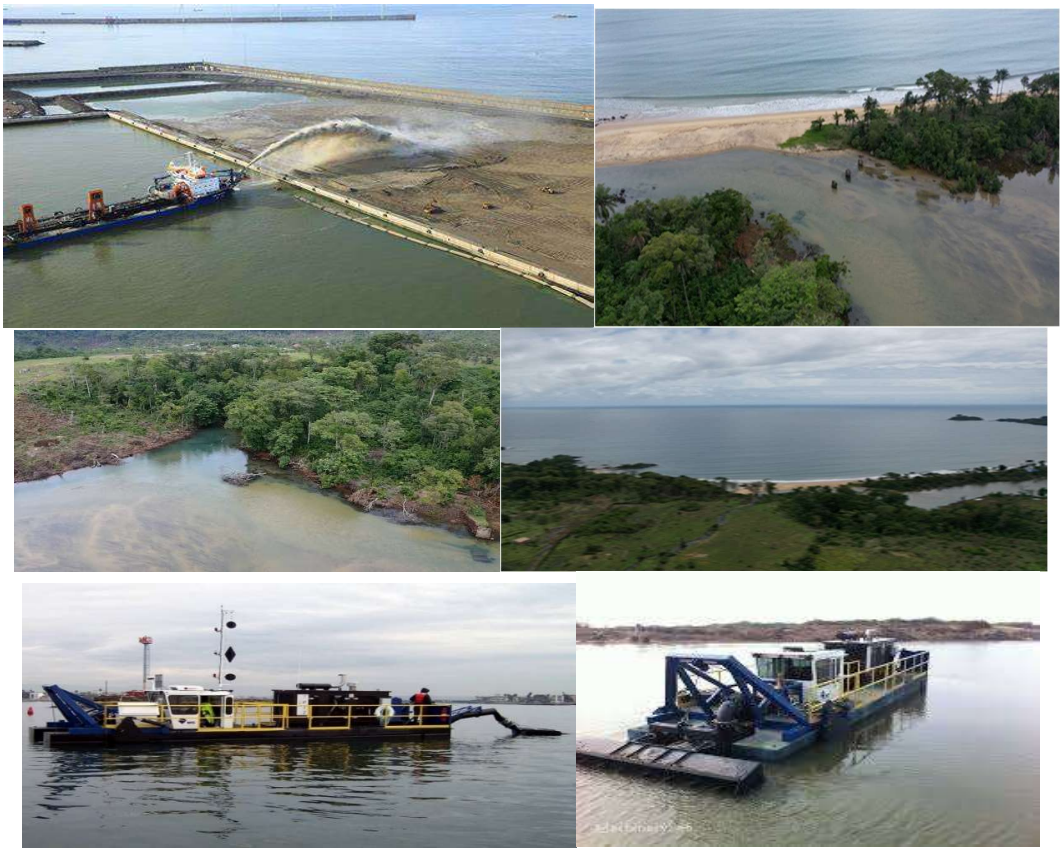


Figure 44. Landscape of Sea Areas and Dredger for Reclamation and Backfilling

This dredger consists of a spud that is lowered in the seabed during operations, to secure the vessel. The vessel remains stationery and uses winches and anchors and swings sideways and the cutter head cuts and remove the soils. **We recommend combination of the Versi cutter suction dredger with split hopper barges that can be moored alongside the cutter suction dredger to transport the dredged materials to the required deposit areas for unloading**. Dredged materials must be tested

for contaminants and treatment of the materials used for backfilling is important when they are contaminated. Our initial test of seawater samples from the Lagoon and Whale Bay shows seawater hardness more than 2,000, which is above the WHO limit. Fecal coliform counts (is greater than 50 per 100ml of water, which is more than the WHO minimum standard.

Instability of soil or rock masses is expected during excavation and slope stabilization processes on land. In order to manage this situation, we propose that excavation sites should have geological formation of bedding planes dips away from the excavation plane, for both stable and unstable rock slopes formed during excavation (See Figure 45).

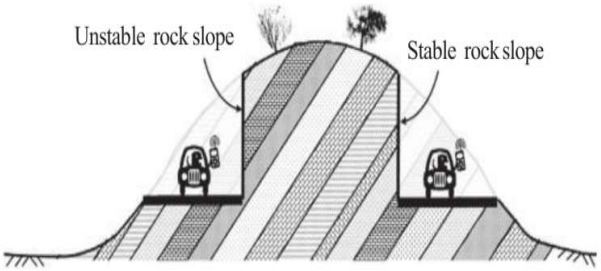


Figure 45. Example of Rock slope stability planes

In areas where slope stabilization is eminent, we recommend two approaches of geometrical technique or hydrological technique for the landward and the lagoon and reclamation areas respectively. Failure to meet slope stability will cause downward movement of soils or rock masses which may cause landslide and slope failure during heavy rainfalls. A better slope management is possible during the dry season, which is the best time for site layout and earth movement for the project site.

For demolition and excavation during site preparation, slope stabilization must include the removal of part of the soil and rock to flatten the slope. Depending on the soil densities tested, load should be removed from the top of the slope to reduce share stress on planes. Pressure berms must be constructed at the toe of the slope to prevent toppling. Due to existing erosion of the project site at Black Johnson, slipped materials may occur during excavation and should be replaced by free draining materials to reduce build-up of pore water pressure. This should be followed by recompacting of slip debris to create resistance of the materials against loading. We strongly recommend the testing of soil densities at excavation layers to inform the diggability mode as provided in table a step to avoid slope failure. We recommend the following for the stabilization of slopes after demolition and excavation:

i) Flatten the slope
ii) Remove part of the excavated or demolished soil or rock materials
iii) Remove some load of soil masses from the top of the slope to reduce the shear stresses on critical planes
iv) Erect pressure berms at the toe of the slope to prevent toppling and slope failure extra
v) Replacement of slipped materials by free-draining materials to reduce the build-up of pore water pressure
vi) Re-compaction of all slipped debris to provide more resistance against loading, particularly

in areas of saturated soils around the seafront and intertidal areas

A hydrological slope stabilization may be required at the intertidal zone during land reclamation and earth movement. The coastal aquifers possess higher ground water table. The stabilization of slopes in these areas during excavation should include the lowering the water content of the soil or rock materials by reducing the groundwater table. This will require the and reduction of pore water pressure through the installation of surface and subsurface drainpipes for dewatering. As the climate in Sierra Leone is tropical with long duration of dry season this method may not be required if most of the site construction activity is done during the dry season.

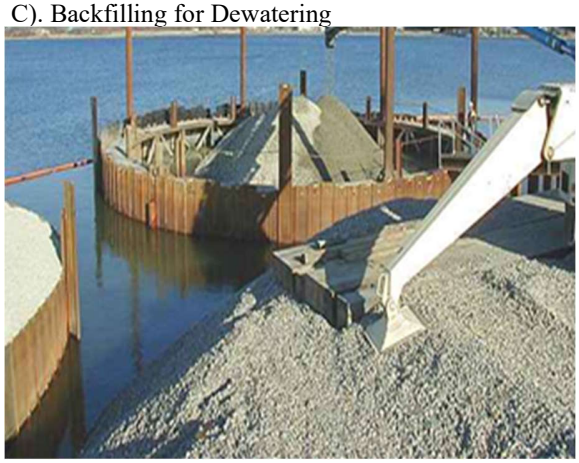
The hydrological slope stabilization technique is particularly recommended for areas where the soils are heavily saturated due to heavy rainfall events. We therefore strongly recommend carrying out most of the construction during the dry season. This is important considering the site location region has a history of heavy rainfall, land slide and subsidence. The coastal erosion modeling for the site suggests a vertical land movement of -0.065mm/year on a 25 years historical scale (1995 to 2020). The model also projects -1.12mm/year on a 20 years scale (2020 to 2040) at RCP 8.5 GHG emission scenario. Backfilling management will therefore be invaluable during the site layout and excavations (See examples in Figure 46).

Figure 46. Examples of Slope stabilization for construction management

A)Backfilling Bulkhead Construction by dewatering

B) Bulkhead foundation backfilling

C). Backfilling for Dewatering



D) Dredging for backfilling

E. Rock -Rip Rap Breakwater Proposed

F. Fish Harbor Plan for Black Johnson

Shandong Gangton Eng. Co Ltd., 2018

9.2.1.6. Shortcrete stabilization of slope

The use of fine aggregates and mortar is recommended for pneumatical matica application on layers of 50 to 100 m for the stabilization of slopes after excavation during site layout. This can be applied to rock faces to protect zones of beds of fractured rock elements. This will prevent block of rocks from falling freely. This will improve the tensile and shear stress of slopes, prevent slope sliding and slope failure during site preparation

9.2.1.7. Management of Breakwater, Berth and Wharf Construction

A 100m breakwater system is proposed for the fish harbor complex to protect a 300,000 tons fish cargo unloading port, capable of unloading at least 10,000 tons per year**.** The fishing berth structure of the fish harbor is proposed to be built using ***gravity block system, with berth area of 6000m^2 (200m long and 30m wide).***

The 100m breakwater system is proposed to be built as a sloping breakwater, with Rock- rip-rap slope structure. The upper layer of the breakwater will be covered with accropod and the inner part lined with large stones arranged on the Northern side of the Wharf, protecting the harbor basin of the Whale Bay (See MFMR/ Shandong Gangtong Eng. Co. Ltd, 2018). The wharf top elevation is 4.5m and bottom elevation of -5.5m, -6.5m and -8.5m. The berthing jetty and the Wharf jetty will be separated by turning water area of 282m wide with a water area of 120m^2 . The berthing jetty of the harbor will be designed to berth up to Eight (8) 600HP fishing vessels on a 435 m seafront and another 1 large refrigerated vessel to give 9 fishing vessel berthing possibility at a time. The western part of the berthing jetty will consist of a a three-vessel repair and maintenance berth that can accommodate one (1) 5000dwt refrigerated fishing vessel and Two (2) 600Hp fishing vessels. This will take a berth length of 255.4m and a seafront length of 278m. Another berth will accommodate a refrigerated fishing vessel of 10,000 dwt to berth at deeper areas of the inner side of the Western Breakwater. This will take a berth length of 193.875m occupying up to 200m length of the jetty. Vessels to within the length of 46m and width of 7.2 m with aft draft of 3.7m will be easily accommodated. Refrigerated fishing Vessel of dwt of 1000 with length of 141m, width of 22.6m and 8.3m draft will be for deeper waters.

9.2.1.8. Management of Wharf Elevation Areas

We recommend adjustment of the elevation of the Wharf Apron and the Bottom Elevation of the sea areas of the Wharf, based on our calculation of the design water level. There is no time series of tide predictions over tidal data epoch (TDE). ***We calculated the design high water level (Highest Astronomical Tide) as 3.4m*****, as the average of two consecutive high waters occurring within 24 hrs, using data from the British Admiralty Tide Tables for Sierra Leone** (OPII, 2019). Our value slightly differs from the **value of 3.24 calculated using the Chinese Norm.** This must be considered in the determination of Wharf Apron elevation and the bottom elevation of the seafront (water in front of the wharf). The differences in design high and low waters is provided in Table 27. We recommend consideration of these differences to account for the final design of the Wharf apron and bottom elevation of the sea front of the Wharf (See Master Design Code of fishery Port) (SC/t9010-2000)8.5.2 and SC/t9010-2000) 8.6.6.

Table 27. Differences in Design High and Low Waters for Wharf Elevation

Values	Chinese Norm (Feasibility Studies)	ESHIA Studies
Design High Water Level	3.24m	3.4m
Design Low water level	0.35	0.2m

9.2.2. Fish Processing Development Area

This area is proposed to cover 68 acres for the construction of fish processing plants and cold storage facilities. The development will include a freshwater treatment plant, a repair workshop for fish processing equipment, sewage treatment plant and bonded warehouse for wrapping materials and other materials used for fish packaging. We recommend a fish canning factory to be constructed to leverage on the sardines, tuna fish and mackerel which can be produced as sardines. There will be a fish trade warehouse and office area for the Chinese Engineers and National Engineer involved in the project. Restaurants and Generator Rooms will also be constructed at this development area. The community stakeholders will leverage on these facilities on rental basis to support their livelihoods. There will be a reserved area of about 1.6 acres.

9.2.3. Aquaculture Demonstration Site and Pilot Marine Park

An available Lagoon provides an opportunity for lagoon fish farming at Black Johnson. Feasible culture species will include oysters (Grassotrea tulipa), Penaeid shrimps and spiny lobsters, which will be practiced for the first time. We propose the integration of this aquaculture development with a Marine Park, which is ideal for the Lagoon. This can be called **" Sierra Leone Integrated Marine Park**" comprising of **a Mariculture Park and a Marine Park for Dolphins, Manatees and Sea Turtles.** These species should be subjected to captive breeding. This will provide a large marine park that can attract touristic visits by both the working population and the ordinary citizens of Sierra Leone and International Tourists. This will provide job opportunity for the people of Black Johnson and surrounding community. The Mariculture Park development will serve as a demonstration and experimental area for hatchery development, feed production. A pilot local fish feed production factory and experimental center is proposed to be developed to consist of sedimentation Tanks, bait production pond and water storage tanks and cultivation Tank. The total land area for the Sierra Leone marine Park isabout 80 acres.. More land space from the adjoining lagoon leading to Big Water should be used for the development of the Marine Park. We note that the People's Republic of China and Sierra Leone can build on existing relations through exchanges of Chinese experts to develop a marine park that can entertain people of Sierra Leone, including nearby hotel residents and future aquarium development, learning from the demonstration Park.

We also note the provisions of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (C.I.T.E.S), the International Air Transport Association (I.A.T.A) and pursuant to Section 45 (3) of the Fisheries Management and Development Act of Sierra Leone to ensure that there will be no trade of wildlife during this cooperation. The cooperation will allow Sierra Leoneans to learn from skills of aquariums development and the development of marine Parks through exchange visits and studies. We propose the development area to be called: Sierra Leone Experimental Mariculture and Marine Park. Due to salinity of the lagoon and possible seawater extrusion in the area, we strongly recommend a Lagoon fish farming (mariculture) for Black Johnson instead of fresh water fish farms.

9.2.3.1. Integrated Mariculture and Marine Parks Along Fish Harbour

This harbour project will establish the first marine park in Sierra Leone and will facilitate cetacean survey during capture phase, to document the distribution and abundance of Dolphins in the fishery waters of Sierra Leone, and exchange visits to China for Marine Scientific Research in Aquariums. The Mariculture Park and Aquariums will provide support to the communities as part of the CDAP. The benefits of the Sierra Leone Marine Park will include the following:

i) To provide entertainment through display of dolphins and manatees to provide social services for the people of Sierra Leone
ii) Regular water quality analysis and capacity building on park management, and the identify existing environmental conditions for the establishment of the Marine Park.
iii) Capacity building in capture and quarantine activities for aquariums and aquarium exhibition and eventual promotion of scientific research in captive breeding in Chinese aquariums
iv) Capacity building in fish feed development and hatchery production through fish feed factory and local feed development

9.2.4. Fish Market Development for Aquatic Product Trading

The engineering feasibility proposes a 37-acre land area for fish trade development support infrastructure component of the fish harbour at Black Johnson. This will comprise mainly fish market and parking lots for fish retail market promotion. Private sector investments will be promoted through this development corridor. See details in Engineering Feasibility report attached.

9.2.5. Marine Resources Office and Residential Service Development

This development considers the construction of a modern office building to house the Ministry of Fisheries and Marine Resources. The reserved area will also be used for the construction of 300 social housing facilities preferably for retirees of Government who would otherwise not be able to own a house at retirement. This scheme should be integrated with the National Insurance Trust (NASSIT Scheme), realizing that Government workers are already contributing to their NASSIT package for retirement benefits. This can be leveraged upon through arrangement within a Public Private Partnership Arrangement. The detailed description of this mode will be provided in the draft ESHIA report

9.2.6. Construction Management Plan for Water and Aggregates

A natural fresh water source from groundwater from the mountains empties into the Black Johnson Lagoon and Whale Bay. This freshwater should be piped, to provide a major source of water for construction work. It should be noted that water makes working conditions difficult if not well managed. Poor piping and flow of water into the excavation can often result to erosion and failure of the sides. In the case where materials collapse during construction, they

should be removed and reused as part of the construction management, to prevent the introduction of materials into the Whale Bay. All dredged materials should not be deposited in the sea of the Whale Bay. The use of dredged materials in backfilling construction and reclamation of the Black Johnson lagoon will be considered in the development of construction management plan. our team collected

and analyzed data relating to the groundwater conditions of the Black Johnson land areas and Whale Bay as part of the construction management plan for the first phase of the project. We note that the first phase of the project will entail the following:

i) Water area of 120,000m^2 with length of 346.4m
ii) Fishing berth of 635m long for 9 berths to accommodate 120 vessels per year
iii) Ship repair berth of 278m278m
iv) Break water of 100 m long

Our Hydrographic Survey (Bathymetry) covered 500m length of Whale Bay, above survey mandate of 400m. Therefore, total horizontal length of the harbor including sea extent used in the storm surge calculation was applied as:

D = length of fishing berth + horizontal length of ship repair berth + horizontal length of breakwater + sea area surveyed = (635m +278m +100m + 500m) =1513m

As a preliminary recommendation, we propose the use of freshwater sand for the construction to prevent future corrosion of reinforced steel elements of the harbour jetties. We also recommend reducing the water table of coastal aquifers through dewatering and the diversion and piping of ground water of the site for use for both the construction and as a source of treated drinking water for the communities. It is strongly recommended that the ground water from the hills should be piped for use as source of water for construction of the harbour and for use by the communities for treated drinking water. In addition, some areas would require the use of impermeable barriers, such as steel sheet piles and diaphragm walls, for the removal of water out of excavations. This is recommended particularly if the major harbour work will be carried out during the rainy season. Our team will recommend construction management and risk mitigation for each stage of the construction proposed by the Engineering feasibility

9.2.7. Recommended Aggregate Management Equipment

Telescopic Chutes (Figure 47) are ideal for outdoor stockpiling or ship loading for their ability to contain product during freefall and accommodate a variety of application sizes and flow rates. Typically used for outdoor stockpiling of material or to load ships or barges. Contains product during freefall from conveyor to pile, minimizing wind-blown dust. The sloping breakwater is made of piles of natural stone which is protected by a protective layer in the form of concrete or large rocks of a certain shape. This type of breakwater is more suitable for use in soft soil conditions and is not too deep. The sloping breakwater is more flexible so that if it is hit by a strong wave attack, the damage will not occur suddenly he granular arrangement of the breakwater should consists of several layers, to consist of large stones and the smaller the size goes inside. The shape of the grains used will also affect the bonds between the grains so that the grain forms used generally have sharp edges due to the bonds between the grains. This must be considered in the construction of the rip-rap slope breakwater of 100m long.

Figure 47. Telescopic Chute to Minimize Freefall of Aggregates (PEBCO, 2020)

9.2.8. Climate Adaptation Management at Construction & Operation

The fish harbor may be subjected to damages caused by climate impacts and impacts from human activities which may destroy the physical infrastructure of the area including water supply system, and future damages of the harbor itself. The chain of supply of these critical services should be considered and contingency plans developed for each service (e.g., water, electricity, transportation networks). In particular, ensure that the policy can cover aggregate weather hazards including those related to flooding (such as wind and extreme rainfall).

the emergency response procedures laid out by your Adopt your own emergency response procedure leveraging response plans already in place regionally. Be sure to secure and maintain proper emergency equipment for personnel including medical kits. Train personnel on emergency response procedures. Prepare for real-time response with unannounced drills and conduct post-mortems to improve personnel preparedness. clearly advertise its location and include access and supplies as a part of your overall emergency response plan. We discourage the storage emergency equipment in the basement or lower stories of the building. Flooding may inundate the lower levels and render generators and other critical assets inoperable.

Remain aware of your government meteorological organization's watch and warning protocols. When a warning is issued, be aware of the meaning of such a warning and be prepared to clearly communicate its implications to your personnel and visitors. Clearly define the circumstances that would lead to retreat to a safe room, voluntary and mandatory evacuation procedures, operations shutdown, etc during bad weather. Develop a task checklist for your emergency response plan and maintain that list at least once per year. The checklist can be customized to each stage of your project or draw attention to tasks more critical in a particular stage (e.g., construction sites will have more potential outdoor airborne debris).

It's imperative to plan in advance for all aspects of a catastrophic weather event. In major coastal flooding events flood debris is inevitable, especially in built up areas, but often unplanned for. In addition to preparing for exacerbated damage from debris, and the associated injuries and health hazards, you should plan for debris clean up, especially if it is expected to interfere with operations of the residence or business. Keep in mind debris comes from other areas, buildings, and surfaces, thus be aware of surrounding structures especially if hazards (e.g., explosive material) may be contained in nearby structures or adjoining grounds. Where coastal flooding is a product of cyclone winds, the most common debris include damaged building components and building contents,

sediments, green and bacterial waste, and personal property. Other forms of debris are associated with the strong winds and debris from coastal surges can occur many miles from the coast. Debris collection and removal can be extremely costly, and recent experience has shown debris removal is often more costly than direct physical damage.

9.3. Construction Management Administration

The following are recommended to form part of the construction management administration to prevent health and safety problems during construction. They are safeguards that must be implemented for the management of construction materials to prevent their wastage and to protect the general construction environment at Black Johnson.

9.3.1. Site Planning Administration

The architectural drawing of the site plan and site layout for the fish harbor at Black Johnson must include the following:

i) Location of all signages (Site posts), and electricity poles and lighting positions for site including Wharf areas
ii) Areas for storage of construction materials including for unloading of aggregates
iii) Demarcation of perimeter fencing and waste disposal bins
iv) Areas for materials hoist, concrete mixer and sanitary facilities.
v) Clear designation of construction work zones for key fish harbor development areas
vi) Location of scaffolding hoardings or gantries.
vii) Demarcation of crossovers or other access points.
viii) Demarcation of wash down areas for trucks.
ix) Parking arrangements for site personnel, concrete, barge, and delivery trucks
x) Deployment areas for barges and dredgers and boosters for dredge materials for land reclamation
xi) Areas for redirection of pedestrian traffic.
xii) Public Safety and Traffic Management inventories

9.3.2. Signages and Essential Security Measures

There must be signages specifying security measures and these must be erected on the perimeter fence of the project site or other strategic locations. Telephone contact details must be provided for emergency situations to contact workers at the project site whenever entry is required by visitors. These will form part of the required safety signs for the protection of workers and the public around the construction sites: Signs such as ***'Danger- Fish Harbour Construction Work', ''No Unauthorized Access is allowed'*** and All Visitors Report to Site Office). (Figure 48).

Figure 48. Example of Construction Sign Post for Safety

9.3.3. Community Information and Complaints Management Plan

The project management unit and the MFMR and Site Engineer must put in place an information management system through the news and print media, TV programs to inform the public on a regular basis about the fish harbour construction stages at Black Johnson. A complaint management system must be put in place to ensure that the Site manager promptly respond to all complaints associated with construction and can escalate complaints to the Grievance redress Committee established by MFMR. All parking and noise complaints must be addressed promptly withing one-hour period to ensure the smooth progress of the construction work. A Complaints Register must be maintained and can contain the following:

i) What is the Name of complainant (if known)
ii) What is the Date and time of complaint
iii) What are the Actions taken

9.3.4. Black Johnson Community and Public Management

Any damage to the footpath, road, stormwater drains and street furniture that results from excavation, demolition and building work is the responsibility of the project. Any hazard which may impact on pedestrians, cyclists and motorists' safety should be repaired immediately. Alternative routes for the public adjacent to the project site is important. The general public must be protected from construction activities, including vehicle loading and off-loading within the public areas and precautions must be maintained at all times, including the following precautions:

i) The use of spotters and traffic controllers during construction-The community youths of Black Johnson can be hired for temporary jobs for this
ii) Restriction on the hours of operation and designation of non-park hours .
iii) Security mesh or barriers to separate the public from the fish harbour work area.
iv) No obstructions must interfere with pedestrians or traffic in a public place.
v) All construction materials must be stored onsite and not in the street or public space.
vi) The type and size of trucks entering the site must be specified for crossovers.
vii) The loading and potential for damage to the existing crossover and footpath must be considered
viii) The nature of protection of crossover and pavements is important
ix) Conduct dilapidation survey of the footpath during site payout and prior to construction commencement

9.3.5. Noise, Vibration, Air And Dust Management

The objectives of noise, vibration and dust management controls for the fish harbour project at Black Johnson should include the following**:**

i) Minimizing the impact of noise and vibration on the immediate neighborhood of project site
ii) To minimize damage to adjacent buildings and structures.
iii) Control air quality (airborne dust and pollutants) in and around the project site within required thresholds throughout construction.

The above construction management measures must be taken for all noisy works including blasting and excavation, jack hammering, pile driving, rock breaking, demolition works , or other instances where explosives are used.

9.3.5.1. Noise Management Plans

The following noise management plans must be implemented throughout the construction phase:

i) Construction work being undertaken should comply with the control of environmental noise practices in use by Contracting Firm and national and international regulations
ii) The equipment used for the construction work or demolition work must be the quietest reasonably available equipment in the market.
iii) The work must be carried out in accordance with a Noise Management Plan detailed here

9. 3.5.2. Works Out of Hours

For working outside the hours of 7am to 7pm, a notification or announcement must be made to inform the Black Johnson community. All large-scale demolition and construction works should ensure that notifications and announcements are made to inform communities adjacent. The following checklist must be completed prior to commencement of construction. Checklist must be submitted to MFMR and EPA-SL:

i) Control measures for noise and vibration reduction – e.g. equipment design/ site and work practices.
ii) Submit procedures to be adopted for monitoring noise emissions –i.e. verifying actual noise levels.
iii) Provide details of complaint response procedure, such as Provisions to provide notification to identified noise sensitive premises
iv) Detail follow up procedures and investigation of ongoing or unresolved noise issues. Include contact details of persons who will be available to receive reports relating to noise issues during work time and after hours work.

9.3.5.3. Control of Sand and Dust

We recommend that site engineer for fish harbour project must provide notification of what methods are proposed to control the drift of sand and dust from the site. This must include any equipment and activities that may cause excessive dust or otherwise effect air quality. Dust suppression techniques/equipment may be required depending upon the following:

i) Prevailing Weather and wind conditions

ii) Possible Exposure to the public and surrounding project site
iii) Proximity to air intake vents on adjacent communities. Intake from these vents must be prevented throughout the installation of adequate filters or other approved measures.

Care must be taken to minimize dumping of loose materials onsite. If dumping of loose material is unavoidable, detail methods for preventing dust and other airborne matter impacting on the surrounding areas must be evaluate. Site engineer must minimize airborne dust arising from trucks and other vehicles entering and leaving the site by watering down driveways and trucks with consideration to water efficiency. Perimeter fencing must be designed to minimize the impact of dust on the public and adjacent areas. All equipment powered by internal combustion engines must be properly maintained and regularly serviced. This will prevent the discharge of excessive pollutants, including smoke and/or toxic fumes or odours, and must meet acceptable noise levels by stipulated by existing regulations.

All construction aggregate materials should only processed in designated areas set away from boundaries and public areas. E.g. Specifying quarry site (e.g. At John Obey). There must be adequate dust (and noise) suppression. Where cutting needs to occur insitu, localized dust suppression measures must be utilized.

9.3.5.4. Vibration Control

The construction operations or earthworks for the fish harbour project will involve the use of equipment that could possibly cause damage by vibration or settlement to the property of adjoining property or the adjacentroads. The vibration management mode must be provided.

9.3.5.5. Vehicular Traffic Management Plan (VTMP)

The following key measures must be considered for the management of the vehicular traffic during construction, realizing that the Peninsular road adjacent to the project site is a semi-busy traffic:

i) Analysis of existing traffic volumes (vehicles, pedestrians and cyclists)- To be done as part of final ESHIA report
ii) Speed limits should be specified and sign post placed
iii) Existing on and off site car parking facilities.
iv) The construction will not interfere with the main traffic route of Freetown Peninsular, therefore no permanent controls by the Road Safety Authority is envisage

9.3.5.5.1. Temporary Road Closures

Whenever temporary road closure is needed for mobilization of heavy equipment, the Road Safety authority must be contacted for approval and all residents and community adjacent to project site must be informed. The general public must be protected from construction activities including vehicle loading and off-loading within the public domain. The following precautions must be applied for temporary traffic closure, which is not envisaged, as the main traffic is situated off the project site:

i) The use of spotters and traffic controllers.
ii) Restriction on the hours of operation of vehicles plying the Freetown Peninsular
iii) Security mesh or barriers to separate the public from the work area.

9.3.6. Security of Construction Work Zones

The project site must be used for the exclusive construction of the fish harbour and the following signs must be displaced on the adjacent roads and all roads leading to the site:

Whenever the footpath and verge is proposed to be obstructed by the installation of the work sheds, the Black Johnson Villages may require the shed to be placed on gantries above the footpath or may require the installation of kerbing, to provide safe pedestrian access on the road.

9.3.7. Water Discharge and Washdown Facilities

Water discharge during construction should not be allowed to flow to adjacent private or public property and should be adequately contained within the project site through piping. The following construction management is recommended:

i) Drainage of the site to be designed based on the proposal in the Engineering feasibility and any modifications must be communicated to MFMR and EPA-SL. See Engineering Feasibility Report done by the Chinese Consulting Firm (Attached)
ii) Stormwater in sediment control points is to be filtered prior to entering the discharge piping as described in the Engineering Feasibility report
iii) Waste materials, including liquid wastes such as paint, concrete slurries andchemicals, must not be discharged into a stormwater drains
iv) Wash down areas must be located near the project site entrance and must be designed to capture and treat water prior to discharge into the stormwater system. See Engineering feasibility.
v) The storage of loose materials such as soil, sand and gravel must be carefully considered and measures put in place to prevent their displacement
vi) All Activities on construction site must consider permanent water saving measures. All water hoses must be in good condition and fitted with a trigger nozzle etc.

9.3.8. Protection of Adjacent Trees During Construction

All trees and wetlands adjacenet to the Black Johnson Project Site must be protected by employing the following construction management measures (Figure 49) :

i) A tree protection zone should established around the trunk of the trees, to include a temporary barricade/fence, erected around the tree to protect the root zone and trees near the project site during construction works.(preferably with a tree protection zone sign displayed
ii) Construction materials including rubble and/or debris should not be placed or stored against the barricade or within the tree protection zone.
iii) Any tree branches requiring removal for clearances to facilitate the project development works should only be undertaken by professional engineers

Figure 49.Typical Verge Street Tree Protection Barricade with Signage

10. Environmental and Social Management Plans (ESMPs)

Realizing that the fish harbor construction at Black Johnson is an impacting project in category A where some impacts are irreversible, the Environmental and Social Management Plan (ESMP) provides details of possible remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical, biological, socio-economic, socio-cultural and health of the environment and community of Black Johnson. It also addresses the general occupational safety and health of employees and visitors associated with the project.

10.1. Policy and Safeguards for Environment Social and Health Safety

The Contractors of the fish harbor construction and their employees are required to be committed to minimizing the impact of their operations on the environment. They are required to adheres to the principles of sustainable environmental resource utilization and management to contribute to the welfare of the people of Black Johnson and associated communities that will be affected by the fish harbor project. We propose the following principles to guide the environmental and health safety for the fish harbor design and construction

i. Compliance with relevant and existing legal instruments on the environment including continuous dialogue and communication with stakeholders on environmental concerns including climate change mitigation and adaptation
ii. Establishment of environmental management system (EMS) to facilitate collaboration with other stakeholders and stakeholder institutions for the promotion of environmental research
iii. Enhance the implementation of existing policies for sustainable environmental management and development, including climate change policies and nationally determined contribution (NDC) reporting and other UNFCCC initiatives
iv. Provide support for training of project employees and motivate them for the implementation of environmental protection safeguards including proper disposal of wastes and waste treatment
v. Continue the implementation of climate smart fishing and fish processing innovations
vi. Sensitize Black Johnson communities about the project design and engage them in the identification and implementation of projects that can improve their standard of living. Particularly people that are adversely impacted by the fish harbor construction

10.2. Specific objectives of the ESMP

The specific objectives of the Environmental and Social management Plan for the construction of fish harbor at Black Johnson includes the following :

1. To ensure compliance of ESMP with national and international legal instruments on environmental protection, biodiversity and energy conservation
2. To Establish an Environmental Management System (EMS) that ensures integration of environmental concerns in all areas of project design, construction and operation of the fish harbor, including risk mitigation and the development of sound environmental monitoring framework
3. Ensure compliance with both national and international instruments on environmental management and climate change mitigation and adaptation
4. Promote environmental awareness campaigns through education and community engagement throughout the project cycle
5. Include communication strategy for environmental management;

6. Identify research areas and develop and implement projects to promote environmental research, management and innovation
7. Promote activities for the formulation of public policy and programs that promote sustainable natural and environmental resource use and management, including climate change financing negotiations
8. Provide cooperate social responsibility that can improve the standard of living of the Black Johnson and adjacent communities and protect the environment.

10.2.1. Compliance with relevant Environmental Legal Instruments

The ESMP developed improves upon the environmental protection and energy conservation plan provided in the preliminary engineering feasibility report by the Chines Engineering Company (Shangdong Gangstong Engineering Consulting, 2018). We recommend compliance of ESMP with the following specific legal instruments, ensuring that stringent guidelines of instruments is applied in the case where it exceeded the national requirement (Table 28).

Table 28. Legal Instruments for ESMP for Fish Harbor at Black Johnson

No	Legal Instrument
1	Part V and VI of the Environmental Protection Agency Act of Sierra Leone of 2008 as amended in 2010 on ozone depletion substances and hazardous substance allowed for environments in Sierra Leone
2	The Sierra Leone Maritime Administration Act ofd 2010
3	The Fisheries and Aquaculture Act of Sierra Leone, 2018 and Regulations of 2019, relating to Conservation and management measures, monitoring and compliance measures, hygiene and sanitation for fishery products and fish processing establishments
4	World Bank Environment Health and Safety (EHS) Guidelines for Harbors and Ports (World Bank Group, 2017), applicable to marine and freshwater ports, harbors, and terminals for cargo and passengers.
5	The Environmental protection law of the P.R republic of china, 1989 and other standards including design codes for port engineering (JTS149-1-2017)
6	Chinese environmental protection regulation administration for construction projects No.253 of State Council 1998
7	Noise limits for sites, GB12523-90;
8	Chinese emission standards for air pollutants, GB 16297-96
9	effluent standards for pollutants from ships, GB3552-83
10	Chinese regulation for pollution control of marine environment, 90 Decree No. 62 of State Council
11	Chinese integrated waste water discharge standard, GB8978-96)
12	Noise standards for Chinese industrial enterprises (GB12348-90
13	a) International Labor Organization (ILO) Code of Practice for Safety and Health in Ports (2005)
14	IMO Code of Practice for Solid Bulk Cargo (BC Code);
15	International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code);
16	International Code for the Safe Carriage of Grain in Bulk (International Grain Code);
17	Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code); and
18	International Maritime Dangerous Goods Code (IMDG Code).
19	Fishing harbor planning, construction and management, FAO Tech. Paper No. 538

10.2.2. Environmental Management System

In order to maintain control over the implementation of fish harbor construction and to ensure buy in of project communities, an Environmental Management System is developed. This provides adherence to responsibilities by contractors and personel for the fish harbor project, the identification and implementation of training schemes for project staff. We propose the establishment of Project Environmental Management Team with the following responsibilities:

i. Ensure project's compliance with all relevant environmental, social, health and safety regulations.
ii. Contractors of the fish harbor project should liaise with all relevant regulatory bodies and organizations, including EPA-SL, Ministry of the Environment and National Protected Area Authority to identify existing and emerging environmental concerns throughout the final design, construction and operation phase of the project
iii. Review and implementation of environmental and social policies and practices associated with fish harbor construction and management
iv. The Fish Harbor Contractors and project Client should Liaise with relevant health and environmental safety authorities on all health and social matters related to the fish harbor construction
v. Provide support for the education and training of project staff on environmental, social and safety awareness and safeguards.
vi. Ensure the allocation of project budget for the implementation of sound environmental management scheme for the fish harbor construction
vii. Ensure the implementation of all environmental and social monitoring activities for the fish harbor project

10.2.3. Environmental Resilience and Biodiversity Protection

10.2.3.1. Impacts from Design, Construction and Operation

The fish harbor project will impact on the ecology and biodiversity of the project site. There will be site preparation and earth movement, including removal of existing vegetation. There will also be site reclamation and hydrodynamic changes of water bodies and the grading and excavation of soils for the installation of structural foundations and site utilities. There will be air pollution and changes in productivity of the waters of the Whale Bay due to sediment perturbations and mixing of construction materials. All these will impact the biodiversity of flora and fauna. Including organic loading that will create anoxic conditions in the Black Johnson River, flowing sreams and the Whale Bay.

The removal of vegetation including wetland and mangroves will aggravate climate change impacts on the environment, requiring adaptation and mitigation measures and the protection of biodiversity. The environmental resilience plan and biodiversity protection will cover the fish harbor project site and key adjacent coastal communities along the Western Area Peninsular which are proximal to the Western Area Protected Area Forest (WAPF) (Figure …). This will contribute towards the protection of flora and fauna in the protected areas and areas of cultural values located near the Black Johnson project site (Figure 50)

Fgure 50. Localities for Resilience and Biodiversity Protection

10.2.3.2. Climate Change Awareness and Adaptation Capacity

10.2.3.2.1. Current Situation

There is an ongoing climate adaptation program for coastal communities implemented by MFMR, funded by the United Nations Development Program (UNDP). Under this program, the MFMR has been engaged in conducting public awareness campaigns and capacity building for coastal communities through the training of community leaders, formation of youth groups and training them through training of trainers (TOT) scheme on various climate adaptation measures. This youth group formation and training of trainers has created climate change awareness among 25 Community Leaders comprising of 50% women and youth groups in six localities of Shenge in Moyamba District, Lakka , Hamilton and Tombo along the Western Area Peninsular, Konakridee and Turtle Islands in the Bonthe District. The training and awareness campaigns target climate change risks, costs and benefits of climate adaptation and how to prevent exposure to climate disasters. Fishermen and community leaders were also trained on fisheries laws related to environmental protection and resource conservation.

10.2.3.2.2. Recommended Action Plans

i. Extend sensitization and awareness campaigns and capacity building for youths and community leaders on climate change adaptation to cover the strip of coastal communities of Black Johnson and adjacent communities, including York community, Bigwater and John Obey.
ii. Extend sensitization campaigns on provisions of fisheries act and regulations to Black Johnson and adjacent communities of York, Sussex, Hamilton, Bawbaw, Tokeh, No.2 River, Bigwater, and Johnobey
iii. Promote nature based climate mitigation and adaptation through tree planting, particularly the planting of economic trees and mangrove forests. This will reduce GHG emission from the atmosphere and enhance biodiversity of the adjacent ecosystems. Mangroves can sequester CO2 from the atmosphere more than four times compared to other forest plants

10.2.3.3. Alternative Livelihood Support for Communities

10.2.3.3.1. Current Situation

Alternative livelihoods support scheme for environmental protection for various coastal communities are also rolled out by the MFMR. Under the UNDP project, the MFMR **p**rocured and distributed five (5) artisanal fishing boats and eight (8) outboard engines of 15 HP & 40 HP and fishing nets and to youth groups involved in sand mining and Women in Fisheries groups as alternative livelihoods at Lakka, Hamilton, Goderich and Konakridee (Figure 51).

Figure 51. Alternative livelihoods to minimize sand mining (MFMR, 2022)

The youths in these localities have been organized into groups and trained on fishing net mending and seamanship, to incentivize them to minimize sand mining from beaches.

10.2.3.3.2. Recommended Action Plans

1. Extend alternative livelihoods support scheme for sand miners in the Black Johnson community and adjacent communities of York, Big Water and John Obey. This will help protect the fish harbor from coastal erosion and siltation into seafront and navigation channels of the fish harbor.
2. Prohibit sand mining on all beaches adjacent to the project site, including Lakka, Hamilton, Sussex, Bawbaw, No.2 River, Hamilton, Sussex and John Obey beach. Sand mining on beaches can aggravate siltation and coastal erosion which will cause high dredging costs and disruption of berthing and navigation of fishing vessels at the harbor.

10.2.3.3.3. Promote Climate Smart Fish Processing and Fishing

10.2.3.3.3.1. Existing Situation

The MFMR through support from the Icelandic Government is currently promoting climate smart fish processing in various communities by constructing improved fish smoke houses using Kilns that reduce the use of fuel wood (Figure47) (MFMR, 2022). Under the UNDP project, five solar powered 20ft container cold rooms have been procured and installed at Goderich, Tombo, Konakridee, Shenge and Turtle Island (Figure 52)

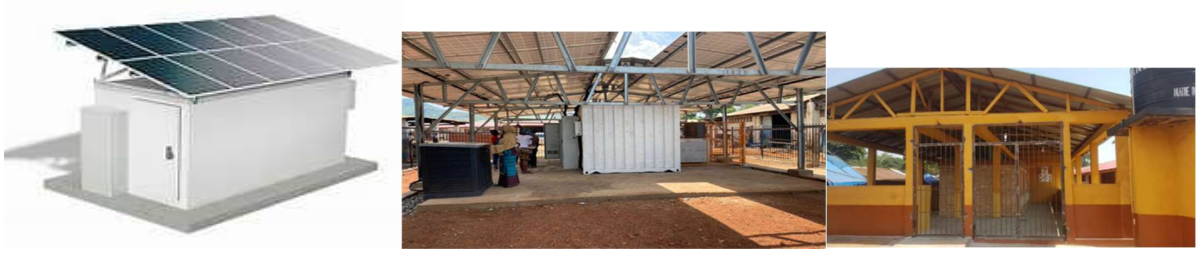


Figure 52. Solar Powered cold-rooms (Top) and Improved Smoke Ovens for fish

Women in Fisheries groups at the various coastal fishing communities have been trained on fish smoking and fish preservation techniques using the improved smoke ovens and the use of solar powered cold rooms. This climate smart fish processing should be extended to fish harbor project community and adjacent communities of Lakka, Hamilton, Sussex, Bawbaw, York, Bigwater, Black Johnson, and John Obey. This will enhance the reduction of GHG emissions and promote climate change adaptation by protecting mangrove forests and the Western Area .

Sierra Leone is active in climate policy dialogue to attract climate financing support. The country has committed to climate actions for the reduction of CO_2 emission levels to 5% by 2025, 10% by 2030, and 25% by 2050 (See Sierra Leone NDC, 2021). This commitment was reaffirmed by the country's effective participation at the 27th meeting of the country of parties to the United National Framework Convention on Climate Change in Egypt (COP27) of UNFCCC. The MFMR was represented at the COP 27 of UNFCCC and the issues of climate smart fishing and fish processing and coastal community adaptation were identified as key areas for climate financing for the fisheries sector.

Sierra Leon acceded to the legally binding Paris Agreement on Climate Change and is among countries that communicate their nationally determined contributions (NDCs) to the UNFCCC. This includes actions for adaption to the impacts of rising temperatures due to global climate change.

The 6th assessment report of the IPCC also reports that Africa is warming up faster than the rest of the world, despite the continent's slow emission of greenhouse gasses. West Africa and Africa's warming rate is faster due to high rate of warming, with high rate of sea level rise. Within the last two decades for example, Sierra Leone has experienced mean annual temperature around 26.5oC and the country experienced very high temperature up to 40^{o}C with highest monthly rainfall over 612.7m in the month of August in 2021, modelled from World Bank Climate Data Portal). The Black Johnson and Whale Bay temperature projection is expected to record over 31^{o}C by the year 2100. The effects of global changing temperature and rainfall events are felt in Sierra Leone, exemplified by a very serious disaster of flash flooding and mudslide that occurred on August 14, 2017. This event was characterized by a very heavy torrential rainfall that is more than three times the monthly average resulted to heavy flash flooding and mudslide that killed over 1000 people and destroyed property worth over US$31 million in Sierra Leone. This is critical for the Black Johnson area, as both Black Johnson and Mount Sugarloaf are located on the Freetown Peninsular.

10.2.3.3.4. Recommended Action Plans

i) Extend ongoing climate smart initiatives for fish processing to Black Johnson and adjacent fishing communities by constructing improved smoke houses and providing solar powered cold rooms for communities. This will contribute towards reduction of GHG emissions.

ii) The construction of improved smoke houses for fish and the use of solar powered cold rooms for fish preservation will

iii) promote the reduction of pressure on mangrove forests and other forests around the project site of Black Johnson.

iv) Provide support for the planting of 1 million mangrove trees per year at degraded habitats around project site. Mangrove trees can sequester Carbon from the atmosphere more than 4 times other forest trees. One acre of mangrove forest can sequester 840t of carbon and 3,082.2 t of CO_2.

v) Rehabilitate wetlands and forests along intertidal zones and low elevation coastal zones (LECZ) located at 10m or less than 10m above sea level. These and other ecotypes along Big Water village, York , John Obey and Whale River Communities must be preserved. The preservation and rehabilitation of forests will reduce the actions of runoff water on the fish harbor and prevent harbor failure.

There is seeming deforestation pressure on the Western Area Peninsular Forest reserve, which is harvested for livelihoods purposes by community people resident near project site. Community development action should include micro credit scheme for communities adjacent to the protected forests. . A tree planting initiative for 1 million trees per year in degraded habitats of the Western Area Peninsular Forest is also strongly recommended. The MFMR should continue participation in climate policy dialogue at the international stage to attract climate financing and collaborate with relevant institutions for the implementation of climate mitigation and adaptation programs, including the development of NDC's

10.3.4. Conservation of Endangered Species

The conservation of endangered species of fauna and flora is identified as key component of environmental and social management plan for the fish harbor construction at Black Johnson.

10.3.4.1. Protection of Marine Turtles and other Reptiles

10.3.4.1.1.Current Status

Marine turtles do not nest at the Black Johnson Beach, but they are caught as bycatch in fishing nets by fishermen fishing in the Whale Bay and Sierra Leone River Estuary. Therefore, the construction of the fish harbor at Black Johnson will not have any direct effect on sea turtle populations in Sierra Leone. However, there is a record of sea turtle nesting site at the John Obey Beach, which is 3.4km from the Black Johnson Beach. Community engagement and development efforts by the MFMR and Reptiles and Amphibian Program in Sierra Leone (RAP-SL) have been rolled out through support from the US Fish and Wild Life Services. This include the provision of support for Fisheries Enumerators and community beach monitors for sea turtle nesting site. Sensitization campaigns have included the education of School Children about sea turtles and their protection needs. The community monitoring and support schem included species identification and data collection training along the Sherbro River and Turners Peninsular communities where nesting sites have been discovered for sea turtles..

In addition, the MFMR has included marine turtle conservation in the Fisheries and Aquaculture Act currently in force . These regulatory instruments prohibits incidental catches of marine turtles during fishing operations. The Signing of the Convention for the Conservation of Migratory species of wild

animals (CMS Convention) by Sierra Leone provides additional instrument for sea turtle conservation (CMS Convention, 1979; https://www.cms.int/).

10.3.4.1.2. Recommended Action Plans

The following are recommended for the conservation of sea turtles along the beaches and in fishing operations for communities of Black Johnson and John Obey, as part of the ESMP for the fish harbor project:

i. Enforcement of the fisheries and aquaculture regulations for prohibition of catch of sea turtles
ii. Development and implementation of integrated marine park project for sea turtles and marine (e.g. manatees, Dolphins) for the fish harbor experimental mariculture project
iii. Community sensitization and beach monitoring for sea turtle nesting site for John Obey Beach
iv. Sea turtle bycatch monitoring for artisanal fisheries for Black Johnson and John Obey wharf areas and for industrial fishing vessels
v. Monitoring and documentation of resident crocodiles of Black Johnson and associated communities

The above initiatives should be developed by the MFMR in consultation with communities and NGOs with interest in sea turtle conservation, including the Reptiles and Amphibian Program of Sierra Leone (RAP-SL).

10.3.4.2. Protection of Marine Mammals

10.3.4.2.1 Current Status

The Ministry of Fisheries of Sierra Leone has ratified the Agreement For The Implementation of the provisions of the United Nations Convention on The Law of the sea of 10 December 1982, relating to the conservation and management of straddling fish stocks and highly migratory fish stocks. The conservation of marine mammals is provided for in the Fisheries and Aquaculture Act of 2018 and Regulations of 2019. The protection of endangered species including marine mammals is also provided for in the Sierra Leone's Second National Biodiversity Strategy and action plan (NBSAP) which is codified in our fisheries regulations.

Whales pass through waters of the Sierra Leone River Estuary during their annual migration and have been found breaching at the Banana Island, which is a major tourist destination for whale watching. The Humpback Whale (Megaptera novaeangliae) and Sperm Whales (Physeter macrocephalus) are common species commonly seen the fishery waters of Sierra Leone when they breach to scare their prey and help them feed, or to help them shed loose irritating skin. Humpback Whales have been rescued severally on the beaches of Sierra Leone including the Lumley Beach, thereby providing economic benefits for communities and tourism industry.

The MFMR has been involved in the rescue of stranded whales on beaches and the Ministry participates in research to document the population of cetaceans in the West African Region. The fisheries laws of Sierra Leone also provides for 'zero catch limit' for commercial whaling and the regulation of incidental catches of marine mammals in the industrial and artisanal fisheries. Section 10 (2d and e) of the Fisheries and Aquaculture Act of 2018 provides for area closure, seasonal closure,

gear restriction, effort limitation, reduction of by-catch and prohibits fishing for species that will cause adverse effects on fish stocks.

Section 10 (1 and 2) of the Fisheries and Aquaculture regulation of 2019 also provides for declaration of endangered fish species and prohibits the catching of endangered species (Zero catch Limit). The MFMR also collaborate with CITES in the implementation of trade restrictions and other conservation control measures for endangered species, including marine mammals**.**

10.3.4.2.2. Recommended Action Plans

We recommend the following as action plans for the conservation of marine mammals in the waters of Whale Bay and Adjacent waters to Black Johnson:

i. Continue the effective implementation of the conservation measures of the fisheries Act and regulations for the protection of endangered marine species, including the zero catch limitation for marine mammals
ii. Support community sensitization campaigns on marine biodiversity conservation
iii. Provide support for the rescue of stranded marine mammals by MFMR and fishing communities and provide equipment and training for saving stranded marine mammals on beaches.
iv. Development and implementation of integrated marine park project for sea turtles and marine mammals (e.g. manatees, Dolphins) for the fish harbor experimental mariculture project
v. Provide support and participate in research for cetacean monitoring and whale watching
vi. Implement licensing scheme for sport fishing and provide training for sport fishermen associations and collaborate to improve their establishments along the Western Area Peninsular communities from Lakka to kent.

10.3.4.3. Environmental Health and Occupational Safety

10.3.4.3.1. Design/Construction/ Operational Risks

The fish harbor project at Black Johnson is an impacting project with potential adverse environmental and social risks that could be irreversible. The project activities involves environmental, occupational health and safety risks emanating from the design phase during sample collection for environmental monitoring, borehole drilling, topographic and hydrographic surveys and site characterization.

The onshore construction phase involving site preparation, land reclamation and structural designs and installations and construction of breakwater and piers.

Operational risk areas will include onshore cargo handling, storage and loading of dry and liquid cargo, dry bulk and liquid bulk handling, fish loading and unloading, vehicle and tug operations, forklifts and cranes. Health and occupational risks will also be associated with chemical and petroleum handling and storage, management of experimental fish farm and marine park, Ship support wastewater collection and bunkering facilitation and vessel maintenance using syncrolift, supply of fuel by bunker boats etc. This will lead to exposure workers and visitors and community to dust and hazardous materials that may be present in construction materials. There will be wastes from demolitions on the site, including., asbestos and PCBs and mercury usually emanating from electrical equipment). There will also be hazards associated with the use of heavy equipment and explosives.

10.3.4.3.2. Recommended Action Plans for Health & Safety

The actions for environmental occupational safety and health is therefore guided by the fourth equator principle (EP4). The EP is an international financial industry benchmark for the identification and management of environmental and social risks associated with projects. These principles will guide the MFMR and project contractors in addressing the issues we have raised in the ESHIA study process and incorporate actions required to comply with the applicable environmental management standards. These safeguards guided the preparation of environmental impact statement (EIS) for an EIA license to be issued by EPA-SL for the fish harbor construction at Black Johnson. The environmental health and occupational safety issues identified for implementation by contractors of the fish harbor project include the following:

i. MFMR to obtain permit from EPA-SL for the importation of controlled substances containing chlorofluorocarbons and other halogenated and ozone depleting substances, refrigerants and any poisonous substances that will be used at the fish harbor project site during project design, construction phase or operational phase
ii. Ensure proper documentation by importers of controlled substances and notification of EPA-SL for use of such substances during the fish harbor project design, construction, and operation
iii. Notify EPA-SL
iv. All fishing vessels using the fish harbor or vessels and vehicles used to transport project materials to project site should comply with the provisions of Part V of the EPA-SL Act for controlled substances
v. Industries operating at the fish harbor during the project operation phase to obtain permit for the importation pf controlled substances by any industry operating at the fish harbor
vi. Display notices onsite to stop people from areas of vehicle traffic and demarcate vehicle passageways
vii. Demarcate transit routed and Minimize transfer areas for the handling of construction materials onsite, to reduce the potential for accidents with suspended loads
viii. Properly construct port areas to withstand the strength pf suspended loads and ensure that berthing areas are constructed adequately to accommodate the fishing vessels and cargo vessels calling at the port
ix. Ensure that non-technical workers do not access engine rooms of vessels, ifish processing factories, generator houses and vehicles
x. Use personal protection equipment (PPEs) including safety boots to avoid snake bite and helmets when accessing construction and operational areas of the fish harbor
xi. Use telescoping arm loaders and conveyors to minimize free falls during construction
xii. Ensure that lifting appliances of truck loaders can permit emergency escape from drivers cabin during accident
xiii. All used batteries including vehicle batteries should be disposed away from the site into landfills or appropriate waste disposal areas
xiv. Installation of solid waste treatment receptacles at the project site and development of oily sewage treatment system
xv. Installation of sound insulation doors for all office and workstations for project staff, as well as for MFMR staff buildings

xvi. Installation of garbage incineration system for wastes from processing areas and garbage bins with recycle compartments at various locations of the harbor
xvii. Provision of hearing protection aid and manual lifting aid
xviii. Effective housekeeping for Fire safety and protection from hanging and falling objects and electrical hazards
xix. Machine and welding safety through use of Head protection aid and eye protection aids
xx. Provide Safety boots and First aid treatment items
xxi. PPEs for protection from electrical hazards, machine and welding safety an
xxii. Ensure use of heavy machinery during the day to reduce noise impact on communities and use silencing equipment for noise reduction
xxiii. Provision of sanitary/welfare facilities onsite

10.3.4.4. Waste and Sewage Treatment Plans

10.3.4.4.1. Waste from Construction of Onshore Facilities

There will be waste and sewage discharge at the site during the construction of onshore facilities of the fish harbor. These construction activities will include the mobilization of construction materials including crane for loading/unloading cargo, materials for pipeline construction and construction of storage and stacking areas and the installation of underground storage tanks, construction of warehouses and silos. The construction of support facilities for the storage and supply of water, food and oil and fuel are all sources of wastes that must be managed. The re-suspension of sediment during dredging or excavation processes may be reduced by selecting an appropriate dredging method. The construction of drainage networks for stormwater, waste management and effluent treatment system can introduce liquid waste in the environment which will be harmful for drinking water .

The construction of fish harbor infrastructure, including piers and breakwater systems, harbor basins, cargo handling and including ship maintenance and repair facilities are sources of solid and liquid wastes that requires treatment before use or dumping. Dredging and disposal of dredged materials are also sources of waste at the harbor site larger vessels. Sediments, even in new port developments, may contain contaminants. The use of dredgers for dredging or berthing area, where Sediments from the seabed are pumped through trailing drag-heads into a reception tank.

Major sources of solid waste include excavation, blasting and disposal of crushed aggregates used for construction.. The construction of pier columns, pile foundations, breakwaters, harbor basins and navigation channels will involve dredging and excavation of soft sediment and underlying materials which can introduce debris into the water column end land environment. In the water, the debris will cause turbidity and affect marine organisms. The explosives emanating from construction can release nitrogen into the water and other contaminants such as metals and petroleum products. This will mix with unconsolidated sediment which can be released into the sea and affect marine life. These contaminated materials will require to be placed in a confined disposal facility to avoid introduction of heavy metals into the sea which can contaminate fish that is eaten by humans. The rubble mound breakwaters construction for the fish harbor will consist of dumping of rocks or debris of various from dump trucks, barges, or from fall pipes by barges. This will introduce solid waste including garbage and liquid waste including wastewater and efluents into the environment.

10.3.4.4.2. Control of Dust and Air Emissions

We expect that air emissions will be generated from land- and sea-based sources during the fish harbor construction work involving land reclamation and earth movement.
In addition, land-based activities may cause combustion emissions from the use of diesel engine of vehicles, ship based engine for material transport, equipment, and machinery, including trucks, excavators, barge-moving tugs, boilers during material mobilizations and construction activities. There will be fugitive dust emissions from excavation and bulldozing; movement of fill and materials by front end loaders, excavators and trucks; and re-suspension of dust from equipment and vehicle movement on harbor roadways.

Air pollution will also come from volatile organic compound (VOC) emitted from fuel storage tanks and during fuel transfer to construction machinery. We expect dust emission from construction and operational activities including handling and storage of dry bulk cargo and from vehicle traffic on unpaved roads and from vehicle exhaust pipes. Toxic aur substances emitted from vehicle or ship exhaust chambers will include sulfur dioxide (SO2), nitrogen oxides, carbon monoxide (CO), and ozone depleting green house gasses such as CO2. Particulate matter (PM) and unburned hydrocarbons may also be released from construction activities. The fish harbor project will have several industrial components for factory operations and is expected to emit up to 100,000 tons of CO2 equivalent on a yearly basis. There is currently no air treatment system at the Black John or adjacent communities. We therefore recommend the following activity plans for the mitigation of air pollution during the design, construction and operational phases of the fish harbor :

i. Ensure proper handling and storage of aggregates
ii. Ensure the use of vacuum collectors or water sprays for dust-generating construction activities at the harbour to suppress the dust.
iii. Use telescoping arms and chutes to minimize free fall of materials and eliminate the need for slingers
iv. Daily cleaning of docks, berthing areas and slipways, fish handling and cargo handling areas and vehicle packing areas and
v. Ensure use of conveyor systems for fish processing plants and cargo handling, loading and unloading of fish where possible. Ensure that hatches or fish holds of vessels are always closed after loading or unloading or Sei activity
vi. Cover all transport vehicles using the fish harbor.
vii. Ensure estimation of CO2 emissions from the activities during the construction and operational phase of the project. This should be evaluated by the EIA consultants When the annual CO2 emission exceeds 25,000 tons per year, a public disclosure of this emission should be made to key stakeholders including EPA-SL and Environment Ministry responsible for reporting Nationally determined contribution (NDCs) on GHG emissions to the UNFCC
viii. During project operation, ensure verification of performance documentation and certification for ship engine to ensure compliance with combustion emissions specifications (including NOx, SOx, and PM), within the limits provided in the regulations highlighted above for the ESMP
ix. Ensure the use of low-sulfur fuels as far as possible to ensure operations within pollution threshold

x. Reduce the propulsion power of ships while in port during the project operational phase
xi. Ensure the use of port tugs during idling periods of ship operations.
xii. Ensure the application of air quality management to minimize combustion
xiii. Design port layouts to reduce travel distances by vehicles and berthing vessels from offloading and onloading points for fish to storage establishments
xiv. Ensure the use of low emissions vehicles for port operations and hybrid locomotive tugs. Include use of electric vehicles and construction of vehicle charging points. This will improve Sierra Leone's achievement of GHG emission reduction benchmark
xv. Establish alternative energy sources including solar powered grid system for solar powered cold rooms for fish processing and lighting of harbor facilities including access roads, residents and offices, Wharfs and slipways, fish processing and fish farming demonstration areas. Solar power systems in Sierra Leone are very effective for more than 6 months in the year
xvi. Ensure that cargo transfer equipment such as cranes, forklifts and trucks are always in good working order. This will reduce air emissions.
xvii. Use effective fuel storage, loading/offloading systems including use of floating top storage system
xviii. Ensure dedicated terminal is used for vessel fueling to minimize spillage

10.3.4.4.3. Waste from Onshore Operations and Dredging

The wastes that are generated from fishing vessel repairs and maintenance will include include oils, oil emulsifiers, paints, solvents and detergents. It will contain bleach hand dissolved heavy metals. The use of antifouling paints will include paint scrapings. Wastewater will be produced from metal finishing work which will also contain cyanide, heavy metal sludge, and corrosive acids and alkalis materials. The use of cleaning agents of aqueous solutions of caustic soda, and detergent-based strippers will introduce liquid wastes into the environment and seawater. The painting of vessels and the use of steel shot as blasting agent to remove old paint form fishing trawlers will cause wastes. The use of anti-fouling paints on fish hulls will contain solvents that contain organometallic biocides to minimize the growth of marine organisms on ships hulls.. Other drydocking repair works will use sheet metals. The maintenance of fishing canoes and semi-industrial fishing vessels using outboard engines, and patrol vessels will also generate liquid wastes.

During harbour operations, maintenance dredging will be required at least once every year. This will involve the routine removal of siltation materials and sediment from the fish harbor basins and navigation channels. This activity is important to maintain depths and widths and ensure safe access for the ships as well as efficient navigation to access to access dry docking facility. . Vessel repair and maintenance will include repainting during dry docking. This will involve the use of chemical stripping agents for paint removal, which will contain pollutants such as methylene chloride, esters and terpene . Other solid wastes generated from vessels and will include plastic, paper, glass, metal, and food wastes.

The fish harbor project proposes to construct waste treatment facilities to manage the collection and storage of hazardous and non-hazardous wastes. The waste treatment facility should consist of waste reception facilities -waste bins with chambers for holding recyclables including plastic, and aluminums cans. Effluents generated by fishing vessels and other vessels using the harbor will include sewage, tank cleaning water, bilge water, and ballast water. Water effluents should be

collected and transported using trucks or pipes within the port area. We note that the treatment of sewage including liquid and solid wastes will form a major environmental and health safety component of the ESMP. A preliminary Engineering feasibility done by Shangdong Gangstong Engineering Consulting firm in 2018 proposes the installation of waste treatment system. We recommend that this should consist of the use of septic tank and piping network at the fish harbor. This sewage treatment mechanism will utilize separation chamber and a self-flow and grid system, where a sewage lift pump is connected to a biochemical distribution pool for treatment of organic pollutants. The treated waste should be further discharged in high efficiency filters for further treatment

We recommend the following waste handling and treatment during the fish harbour construction and operations, including dredging and vessel maintenance. These environmental management safeguards are in line with the World Bank Environmental Health and Safety Guidelines for harbors and terminals (World Bank Group, 2017):

i. Avoid dumping of dredged materials during land reclamation into the sea
ii. Maximize beneficial re-use options for uncontaminated dredged materials, such as for wetland creation or enhancement, habitat restoration adjacent to project site
iii. Treatment of dredged materials for use at project site as construction material
iv. Where the use of dredged materials is no longer possible, undertake comparative risk assessment to determine which final disposal option is optimal including disposal in land fill
v. Make compulsory the use of floatation devices (life jackets) by all project staff and visitors interfacing the sea areas of the project site
vi. Make compulsory, they use of marine sanitation devices (MSDs) onboard all fishing vessels and cargo vessels equipped with toilet facilities
vii. Installation of public toilet facilities with modern flush capability to be used by visitors, separate from those used by project staff installed toilets and operating on U.S. navigable waters
viii. Ensure that all buildings and factory constructed are provided with hygienic and automatic operated toilet and wash hand basin facilities with sanitary compliance
ix. Ensure that untreated sewage discharges are prohibited within three miles from shore.
x. Ensure that treated and untreated sewage discharges are prohibited by fishing vessels in the rest of the Sierra Leone River Estuary including the Whale Bay and in the Black Johnson lagoon used for fish farm and marine park experiment and demonstration
xi. MFMR to engage with contractors and fishing vessel operators to establish web based no-discharge zones (NDZs) in the exclusive economic zone of Sierra Leone fishery waters which can be shared to fishing vessel operators and flag states.
xii. Ensure that fishing vessels retain sewage effluent onboard in a holding tank of their marine sanitation devices and to secure the devices to prevent overboard discharges.

10.4. Fire Prevention during Construction & Operation

The tendency for fire outbreak during the movement of construction materials to project site and during fish harbor construction activities is high. The following action plans are recommended as precautions to avoid fire outbreak during construction and operation of the fish harbor complex:

i. Display of 'no smoking' signs at fire sensitive areas (e.g. fuel storage areas at the work camp, vehicle parking areas, energy generation plants and fuel loading platforms and pumping stations
ii. Installation of fire alarm and smoke detector alarm systems at strategic locations of the site
iii. Provide fire extinguisher for all facilities and operational areas of the project site
iv. Develop and display fire disaster response plans and extinguishers on site at various locations, in collaboration with the Sierra Leone National Fire fighting Department and EPA-SL
v. Ensure proper storage of solid and liquid wastes including flammable liquids in containers for safe disposal
vi. Ensure that the handling of flammable materials by competent persons
vii. Conduct regular fire safety training for project staff and key project stakeholders that visit the project site

10.5 Management of Explosions

Explosions may occur due to the poor handling and storage of explosive materials. We recommend the following actions for response to explosions:

i. Avoid the movement of people or vehicles into the immediate explosion areas
ii. Maintain contacts with the Fire Services of the Sierra Leone Police .
iii. Immediately notify the Fir Force Department
iv. Ensure security officers hired include one Fire Service Officer
v. Train project staff on fire response and organize fire response drilling
vi. Recruit Health and Safety personnel as part of the project team
vii. Ensure proper collection and disposal and management of waste oil

10.6. Change Management Response for ESMP Implementation

We envisage changes to occur with time that may affect project implementation, including the implementation of ESHIA recommendations including the ESMP and the Resettlet Action Plan (RAP). During our ESHIA management meeting for fish harbor at Black Johnson, our expert team of Black Eagle Sierra Leone recommended that the MFMR and main project contractors should hire a National Project Management Team (PMT), consisting of Three Environmental Monitoring Experts and a Fisheries Manager (MFMR Staff Retention), Three Harbor Engineers (Mechanical, Electrical and Civil), that will be Supervised by (1) Project Management Expert or Site 2) Environmental management Expert. These expert team will be responsible for the following:

i. The review and reporting on environmental compliance to the MFMR, project Contracting Firm and Funding Government
ii. Conduct monthly meetings to review project implementation benchmarks and environmental management plan implementation
iii. Recommend amendment of project cycle and environmental management response plans
iv. Attend national and international meetings on port and highway infrastructure developments and recommend any compelling adjustment in project execution

10.7. Management Plans for Marine Parks Along Fish Harbor

The marine park aquariums should be constructed at the Black Johnson Lagoon to entertain the public, teach Secondary School and university students and maintain the ecological systems and marine biodiversity protection in Sierra Leone. Candidate species for the aquarium should include common bottlenose dolphins (Tursiops truncatus), Killer Whales (Orcas whales and Manatees preferably in one aquarium and Marine Turtles and Sharks in another aquarium.

10.7.1. Rationale for Sierra Leone Marine Parks Along Fish Harbor

There is economic and social importance of marine eco-tourism to the local and national economy of Sierra Leone. However, there has been very little consideration of the sustainability or of increase of tourism through the establishment of a national marine park (Sei S, 2016). We note that there is an existing marine turtle conservation effort in Sierra Leone through the protection of turtle nesting beaches, turtle bycatch monitoring, awareness campaigns and some livelihoods support for coastal communities. However, very little economic benefits is currently accrued from the marine ecotourism values of sea turtles and the existing awareness raising activities in the country have not made any significant impact on the target audiences for the importance of marine parks.

In the past, most of the public awareness activities have taken place on an ad hoc basis and their effectiveness remains questionable. Marine species have not yet been utilized to provide entertainment services in Sierra Leone, mainly due to limited expertise in the welfare caring fro marine animals in captivity and the absence of training skills for marine animal intelligence development. The Marine park Aquariums along the fish harbor at Black Johnson brings an opportunity of establishing and aquarium industry in Sierra Leone. Cetacens (particularly dolphins) are known world wide for their intelligence in providing entertainment services and fetches huge economic benefits for many countries including China. The Marine aquarium industry establishment blue print will be established along the fish harbor at Black Johnson, which will add to the ambience of the coastal features of Black Johnson and contribute towards community development and revenue generation for Sierra Leone.

Although Sierra Leone benefited from snapshots of cetacean sighting surveys, tghese surveys have been adhoc and the Marine Park program provides an opportunity to understand the population dynamics of cetacean populations in the fishery waters of Sierra Leone. Additionally, has been no program for the development of Marine Park or game park for marine animals to contribute towards revenue generation from the entertainment/education that could be provided by marine megafauna. The marine park program along Fish Harbor will contribute towards three of the four major thematic areas for crosscutting issues of the Global Environment Facility (GEF's) biodiversity strategic priorities (in paragraph 7, C.21 Inf.11):

a. capacity building,
b. participation of government agencies beyond "green" agencies and
c. enhancing participation of local communities and the private sector.

We have conceived the Marine Park program to fit within the mariculture park demonstration and experimental component of the fish harbor project as it falls well within the Sierra Leone and China's strategic priorities on sustainable marine biodiversity protection and eco-tourism. It also falls within GEF's strategic priority on catalyzing sustainability of protected areas and eco-tourism. The program also fits within the marine resources management theme of Pillar 2 for the management of natural resources with sustainable management of marine resources of the Sierra Leone Governments National Medium Term Development Plans (NMTDP) and the New Direction Agenda. The Marine Park will build upon the existing marine

protected area management efforts, currently being implemented by the local fishing communities, and the community development support will further strengthen the MPA communities. Dolphinariums fetch a fortune in the aquarium business in China, where an immense expertise has been developed. Thisshould be leveraged upon through the Fish harbor chain, to unlock the wealth from the marine conservation sector.

"The First step of developing a Marine Park along the Fish harbor project is to conduct a Cetacean and other marine mammal sighting survey, preferably to form part of the fisheries stock assessment collaboration program between Sierra leone and the P.R. of China. This will be an immense opportunity to understand the population status of marine mammals in Sierra Leone" (Black Eagle, Sl. Ltd., 2022).

This will enable the understanding of the type of marine mammal species in Sierra Leone and enable leveraging the available local stocks for aquarium establishment and future captive breeding.

10.7.2. Marine Park Delineation at the Black Johnson Lagoon

The Sierra Leone marine parks (SLMPs) with Manatee and Dolphins as well as marine turtles, nurse sharks, penguins and sea lions should be , will be established to stimulate tourist attraction in Sierra Leone, drawing from experience in China and elsewhere. In order to ensure that the marine park is effectively managed, the marine areas will be delineated using harmony anchorage or other appropriate technology that will be identified during the program implementation. The Harmony anchorage system in particular is ideal in the delineation of sea zones within the SLMP, to clearly demarcate the SLMP from other marine use areas. In order to minimize impact on sea beds of vulnerable marine communities, a special steel coil will be drilled into the seabed, without cutting or crushing the dense network of roots and rhizomes of mangrove forests. In some cases, the substrate, if it is hard, will be perforated to an appropriate depth and a stainless steel rod will be fixed within as an anchor point. This technology will be ideal for the positioning of the anchorage system consisting of a hydraulic key that drills a steel coil into the seabed. Expert Scuba construction divers from China will work with Sierra Leonean Scientists in this process, to transfer knowledge to Sierra Leone. The anchor line that will be fixed to the head of the steel coil will be kept permanently taut in open water inorder to avoid damages of the seabed. At the surface, the line will be attached to a marking (delineation) buoy. Aquariums can also be constructed using tanks in an entertainment center with parvillion, to entertain viditors from time to time. This is a good business in China. See example of aquarium exhibition and display in China in Figure 53

Figure 53. Example of Dolphin Aquarium Entertainment Audience in China

The Management of the Sierra Leone Marine Park Aquariums at Black Johnson should consider the following management areas for effective management of the marine animals to provide entertainment services:

i. Ensure Animal care, welfare, and well-being, Construct Modern facilities and practices for comprehensive veterinary care
ii. Ensure effective exhibition aesthetic studies and habitat studies and consider this in planning, and design of the Marine Park Aquariums
iii. Ensure Innovative and inspirational educational programs and experience sharing with Chinese aquarium industry. This should be funded by the project to facilitate exchange visits of Sierra Leonean Scientists from MFMR
iv. Design a framework for guest engagement and effective guest service entertainment, including provisions for WASH facilities and refreshment service areas
v. Stimulate Economic development and community partnerships
vi. Ensure Professional staff development and training
vii. Ensure Sensitization and community preparedness programs for public animal safety
viii. Ensure business planning and financial management for the Marine park
ix. Innovate and Raise the bar and ensure regular advancement in operational standard for the

aquariums including

x. Provide nutritionally complete diets and Environmentally comfortable living standards for animal behavior for mental and physical health with choice and control to promote mentally and physically healthy behaviors;

xi. Ensure Psychological Wellbeing for aquarium animals- develop natural coping skills and avoid chronic stress

Summary of environmental management plans is presented in Table 29. The action plans in monitoring the environmental management issues is provided in the environmental monitoring plans which provides indicative budget for monitoring the implementation of the environmental management actions identified.

Table 29. Key Environmental Management Plans and Indicative Budget

Impact	Action/s	Equipment	Time Frame
Waste	Collection and disposal of Garbages, maintenance of waste receptacles and general waste management.	Construct Incinerator Bins and garbage receptacles Onsite sanitation crew and environmental officer.	Daily/Monthly
Security	Provision of Security for Project Site during construction and operations. Recommended to hire at least 4 police personnel to deliver rounds for a 24 hours monitoring sheme	Project Security Personnel arranged by MFMR, seconded to the project and paid allowances	24 hours/Monthly/ Annually
Water Pollution	Water quality tests such as pH, Turbidity, COD, Oils/Grease, and TSS Building of sediment traps and bearers traps Building of a berm around the fuel storage tanks and maintenance.	Samples collected and outsourced to FBC or regional Labs for analysis	Quarterly/biannually
Air Pollution	Air Quality tests such as Total Suspended Particles (TSP5)	Sample will be collected and analyzed by CA of MFMR/Project Environmental Team and reported to EPA	Monthly/Quarterly
Noise Pollution	Maintenance of generator and housing Monitoring of noise levels. Noise generated from the plant will be reduce by using silencers and damping pads	Electricity Generator and Welding equipment -Earth moving vehicles, barges and dredgers -Blasting and excavation equipment -Noise form generator systems of fish processing plants, canning factory, Installation of Noise meter — on heavy plant machinery	Quarterly/Biannually

Health and Safety	First Aid Kits Protective gear for workers Gloves, overalls, respirators, safety boots and ear piece. Training of workers in occupational health, safety and environment Warning signs within facility	To be provided by Fish harbor contractor and managed by project site Engineers	Quarterly/Monthly
Traffic	Maintenance of signs and Markers.	Traffic and work warning signs to be installed by the Project Contractors and management by the site Engineers and routinely maintained	Quarterly/Annually
Fire Equipment	Fire Extinguishers and other spill kit and explosion containment equipment.	To be procured and installed by the project. Routine maintenance required	Quarterly/Annually
Training	Training of personnel e.g. in First Aid and spill response as well as environmental Monitoring and fire safety and emergency evacuation.	Training to be provided by the project management team and funded by the project budget	Quarterly/Annually
Incidentals and Emergencies	Emmergency responses during accidents		Daily/Monthly/Quarterly/Yearly

11.0. Environmental Monitoring Plans

The monitoring parameters proposed in the ESMP should be monitored effectively in order to meet the objectives of the ESMP. The parameters to be monitored should include the following:

- Public safety and healt
- Fire prevention system
- Pollution prevention
- Vegetation management
- Noise
- Erosion
- Waste management
- Air Quality
- Water Quality
- Accidents and dangerous occurrences
- Socio economic/cultural issuesTraining and development

11.1. Air Quality Analysis

Parameters for air quality to be monitored on monthly basis, in spite of measures to be carried out to suppress dust uptake by air currents, shall include:

- Total Suspended Particulates (TSP)
- PM10

The EPA-SL should be provided reports on the monitoring of the various pollution elements on a quarterly basis, to provide them information to keep track of the environmental compliance of the project relating to the ESMP and baseline data monitoring.

11.2. Water Quality Analysis

The following should form part of the parameters to consider in the water quality analysis:

- BOD
- pH
- DO
- Turbidity
- Total suspended solids

Our assessment already acquired baseline data which shows contamination with E. Coli and Fecal coliforms with values more than 50 (n/100ml) above the WHO limits of zero Escherichia coli and Coliform bacteria counts. Additional seawater samples and fish samples will be collected from the site and analyzed at accredited laboratory overseas, to confirm the baseline data. The project management team, supervised by the MFMR Competent Authority for Fish and Fishery Products is particularly required to effectively implement environmental monitoring program, to monitor the various areas proposed in the ESMP. This should include adapting the monitoring program to ongoing environmental monitoring programs by the CA

of MFMR, to develop a sampling framework for sampling/measuring and analysis of environmental parameters.

11.2.1. Method for Water Quality Analyses

This should generally be in line with the framework of water quality analysis set up by the Competent Authority (CA) of the Ministry of Fisheries and marine Resources. Government of Sierra Leone established the Competent Authority for fish and Fishery Products in the Ministry of Fisheries and marine Resources in 2020 that provides for these mandates. The environmental monitoring scheme should consider measurement of temperature *in situ* with a portable temperature probe. Turbidity, pH and colour determinations may also be measured *in situ*. Methods of analysis should be based on those outlined in "**Standard Methods for the Examination of Water and Wastewater" (APHA-AWWA-WEF 1998).** The parameters and the methods normally used for analysis are summarized in Table 30 below.

Sampling sites shall be determined based on existing sampling framework of the Competent Authority for fish and fishery products of MFMR.

Table 30. Method of analysis of selected parameters

Parameters	Method	APHA Method Number
Colour	Visual comparison method	2120 B
pH	Direct measurement with a pH meter	-
Turbidity	Direct measurement with a turbidity meter Filtration and drying at 180ºC in an oven	-
Total Dissolved Solids, TDS	Filtration and drying at 105º C in an oven Winkler's method with Azide modification	2540 C
Suspended Solids, SS	Determination of DO before and after 5 days incubation at 20ºC	2540 D
Dissolved Oxygen, DO		4500-0.C
Biological Oxygen Demand, (BOD)		4500-0.C

11.3. Training and Development

To ensure the successful implementation of all the environmental management programmes, a training programme is recommended for the project's Environmental Management Team and key personnel of the contractor. The programme will cover the creation of environmental awareness and occupational safety and health issues. The main issues of concern will be:

11.4. Environmental Awareness

The areas earmarked for environmental awareness creation include:

- Proper usage and definitions of basic environmental terminologies;
- Sierra Leone EIA Procedures, and Provisions of EPA Act, 2008;
- Environmental Laws, Regulations and Environmental Compliance in Sierra Leone;

- General environmental policies;
- Introduction to environmental management planning;
- Environmental impact assessment;
- Mitigation measures
- Monitoring plans;
- Environmental audit;
- ESIA case studies.

The posting of "Warning Signs" and information dissemination programs must be implemented to ensure overall community safety throughout the project cycle. There should be an information, Education and Community (IEC) awareness program to improve the understanding of the community members about project related risks and activities that will endanger their lives . Their individual activities including uncontrolled bush burning, climbing of towers, especially by children as well as the need to respect warning signs and all rules governing the construction and operation of the fish harbour.

11.5. Records Keeping of Port Visitation and Daily Construction

The project contractor and project site managers must ensure the documentation of visitors calling at the site, including their time of arrival and exit from the site during construction. This must be ,maintained suring the operational period. All daily activities at the project site and those undertaken during operational phase should be documented. All accidents occurring during construction and operation of the fish harbor should be documented in the **Black Johnson Fish Harbor Construction and Operational Logbook. This must cotain logs of the following information:**

i. Date of mishap;
ii. Name(s) of employees involved;
iii. Sex and Age;
iv. Usual Employment;
v. Precise occupation at the time of mishap;
vi. How mishap was caused;
vii. Period of disablement.

11.6. Fire and Machinery Monitoring and Control Register

A fire monitoring and control register must be maintained throughout the project construction and operational phases, to include the following information:

i. Description of fire warning system;
ii. Date of test or examination.
iii. Particulars of defects found;
iv. Particulars of action taken and date.
v. Date of last examination of machinery
vi. Type of machinery (including electricity generators, vehicle, barges, dredgers, earth movers, vessels etc)
vii. Date of last examination of machinery, working conditions of machinery; Machine defects identified and corrective measures taken or to be taken.

viii. Name, designation and signature of monitoring officer
ix. Endorsement signature of site Engineer

A summary of environmental monitoring plan is presented in Table 31

Table 31. Summary of Environmental Monitoring Plans for Fish Harbor Project

Proposed Mitigation Areas	Parameters to Monitor	Location	Monitoring/Measurement Activities/Equipment	Cost (US$)	Project Phase/ Frequency/Duration	Total Budget (US$)	Remarks
Waste Management	Waste and garbage	Black Johnson Project Site	-Construct Incinerator Bins and garbage receptacles and waste treatment plant and provide maintenance and replacements	100,000	Construction and Operation/Annually/3 years	**300,000**	Budget To be Finalized by MFMR/Chinese Government/Contractors
			Recruit 4 Environmental Monitoring Officers (MFMR Staff Retention Monthly Allowances)	4000	Construction and Operation Phase/Monthly/3 years	**144,000**	Budget To be Finalized by MFMR/Chinese Government/Contractors
Security of Project Site and Construction materials	Provision of Security	.	Recruit 4 Project Security personnel (OSD/SLP) and erect Security outpost onsite, to provide 24hrs security to and manage any explosives and emergencies (3 OSD/SLP Officers Retained)	1,600	Construction and Operation Phase/Monthly/3 years	**57,600**	Budget To be Finalized by MFMR/Chinese Government/Contractors
	Water and Fish Contamination and Pollution		Fuel Station with Mini Supermarket/ Terminal/Fuel Storage Tanks and Protection Barrs/Maintenance	200,000	Construction and Operation Phase/Yearly/3 years	600,000	Budget To be Finalized by MFMR/Chinese Government/Contractors
			Recruit 4 Fuel Station Attendants	1600	Construction and Operation Phase/Monthly/3 years	57,600	Budget To be Finalized by MFMR/Chinese Government/Contractors
	Occupational Safety Monitoring		Recruit 3 National Consulting Engineers (Mechanical, Electrical and Civil Engineers) to	3,000	Construction and Operation Phase/Monthly/3 years	108,000	Budget To be Finalized by MFMR/Chinese Government/Contractors

			work with Chinese Engineers for site supervision, including maintenance of installations and standard operation supervision				
			Analytical Testing Lab for Water Quality and Fish Quality Testing and Environment Monitoring for Contaminants. Initial tests at accredited lab in West Africa. Tests for E-coli, Salmonella, Coliforms, Heavy metals, AMR, pH, Turbidity, COD, PCBs Oils/Grease, and TSS Treatment, Bio Toxins	200,000	Construction and Operation Phase/Monthly/3 years	600,000	Budget To be Finalized by MFMR/Chinese Government/Contractors.
	Air Pollution/GHG Emission		Air Quality tests including Total Suspended Particles (TSP5). To be monitored by Project management Team and CA of MFMR	500	Construction & operation Phase/Monthly/ years	60,000	Budget To be Finalized by MFMR/Chinese Government/Contractors
	Noise Pollution and		Maintenance of Electricity Plant Generators-Grid Using Noise Silencers and damping pads.	5,000	Construction & Operation Phase/Quarterly/3 years		Budget To be Finalized by MFMR/Chinese Government/Contractors
			-Training of workers on occupational health, safety, and environment.	20,000	Construction & Operational Phase/Quarterly/3 years	80,000	Budget To be Finalized by MFMR/Chinese Government/Contractors

			Display warning signs onsite within facility. -Provide First Aid Kits and Protective gear for workers Gloves, overalls, respirators, safety boots and earpiece. -Install Sign posts of the project location and at Strategy area on Peninsular Road				
			Provide and install firefighting equipment (E.g. Extinguishers) on site and in all staff vehicles and at vehicle maintenance and vessel repair workshop -Training of project personnel on Fire Fighting and prevention of fire outbreak	5,000	Construction & Operational Phase/Quarterly/3 years	45,000	Budget To be Finalized by MFMR/Chinese Government/Contractors
	<u>Water Quality</u> Of Aquariums, Mariculture Tanks and BJ Lagoon and Whale		Sampling to be part of the CA environmental sampling Scheme, supported by the fish harbor project. Samples tested at Accredited Labs	10,000	Construction and Operation Phase on Quarterly Basis for 3 years	120,000	Budget to be finalized by MFMR/Chinese Government

	Bays (BODs) pH Oil and grease Total E. coli, Salmonella, Fecal coliforms, Total Coliforms, suspended solids Conductivit Noise Noise levels shall be measured in communities close to the line.						

11.7. Environmental Monitoring Reporting

The results and recommendations, including change management emanating from the environmental monitoring should be documented by the project management team and the Competent Authority for fish and Fishery Products and reported to the Director of Fisheries and Project Manager. All reports should be sent to the Director , EPA and Minister. They will provide opportunity for the implementation of effective mitigation measures or . The Project Management Department will hold monthly management meetings to evaluate reports on environmental monitoring and the environmental management benchmarks. The Environmental Management consultants will report through the Site Engineer and Project Management Director on all environmental activities for inclusion in the monthly reports. The reports should also be submitted to the Grievance Redress Management Team for evaluation any any seeming grievances emanating from the non-implementation of the environmental monitoring. The Grievance redress mechanisms (GRM) framework is presented in section 10 of this report and shall form a key management component of the implementation of the ESMP

12. Community Development Action Plan (CDAP) and Resettlement Action Plans

This section provides details of the issues identified for community development actyions during the various stakeholder engagements. The community development issues and actions proposed by the community people at Black Johnson and surrounding communities is presented below:

12.1. Stakeholders Engagement for CDAP, RAPs and GRMs

12.1.1. Environment Protection Agency of Sierra Leone (EPA-SL)

The EPA was engaged throughout the ESHIA process, including the ground truthing exercise to verify project site and conflicting issues related to the fish harbor. They were also engaged on the ESHIA proposal development by the client institution (MFMR) and in the preparation of the terms of reference for the ESHIA. The input of EPA has been invaluable, in particular in advising on the framework of the ESHIA including community engagement to identify community development actions. The EPA advised on relevant consultations with stakeholders in order to address all concerns. The Agency was part of the process of ground breaking and initial scoping visits and their advice has been included in the engagement process to agree the actions for community development, compensation and resettlement fo the communities. Ensuring that the community are not worst off as a result of the implementation of the fish harbor project. The recommendation of EPA on inception report enhanced the preparation of this final report containing the CDAP and resettlement framework, including grievance redress mechanisms (GRMs).

12.1.2. Ministry of Environment (MoE)

The Ministry of Environment has been key stakeholders at the conceiving stage of the fish harbor project and feasibility visits for the land selection at Black Johnson. The MoE participated in the Engineering feasibility studies with the Chinese Consulting Firm (Shandong Gangtong) nfor their field studies and data collection for the engineering design framework of the fish harbor(See report of the Engineering Feasibility Attached.). The Ag. Director of Environment, Mr. Lahai Keitta has been particularly useful in the provision of environmental expertise and policy characteristics required for the fish harbour construction at Black Johnson.

12.1.3. Ministry of Lands, Housing and Country Planning

The MLHCP is core counterpart of the fish harbor project, representing Government's interest in land acquisition and providing policy and technical expertise in the acquisition of lands situated at the foreshore owned by Government and those owned by the private people of Black Johnson Community. Licensed surveyors have been involved in the land acquisition process, including

land verification to ensure that grievances are minimized, and the community is fully compensated for their lands affected by the project. This process of engagement lead to the verification of land ownership for 16 land owning families with more than 80% now fully compensated. The involvement of the MLHCP has also been useful in the identification of alternative lands as additional compensation to resettle the landowning families. Mr. Alhaji Rabieu Savage has particularly been useful in the land verification exercise and facilitation of compensation and resettlement possibilities, to provide proper understanding to the landowning families concerning the processes of compulsory acquisition of land by Government for the provision of public goods and services

12.1.4. Ministry of Justice (MOJ)

A legal Council representing Government's Interest had been designated to the MFMR by the Ministry of Justice for the fish harbor project and other fisheries management related matters. The Legal Council who is part of the Compensation Committee for the Black Johnson Project and has been instrumental in providing legal services to enhance the understanding of the landowners and Black Johnson Community on their rights in the acquisition of land by Government for development projects. In particular, in explaining the foreshore act in several stakeholder meetings, to increase the understanding of the MFMR, landowners and other interest groups concerning the provisions of the foreshore act that gives the right to Government over lands situated at the foreshore, less than or equal to 150m from the highest water mark or rivers, lakes and lagoons. The Legal Council has also been useful in the provision of legal advice for the acquisition of the land, including the processes leading to the signing of warrant of acquisition tby the President of Sierra Leone, as provided by law, after all the processes for claims and land verifications were met.

12.1.5. Member of Parliament for Constituency , Hon. Kadie Davies

Hon. Kadie Davies who represents the interest of Black Johnson Community at the House of Parliament of the Sierra Leone Government has been engaged in stakeholder meetings where the Legal Council from the MOJ had explained the situations in land acquisition where community people dwell at the foreshore land owned by Government. That prior to signing of warrant by President for acquisition of the land. In one of the briefings, the Legal Council representing Government had explained to the honourable that over 70 documents of claim were submitted to the Compensation Committee for the Fish Harbor Project at MFMR and the pattern for land allocation was studied. He noted in that meeting that some people had signed survey plans, others title deed and others with plans not signed. He noted that the land was signed by the Director of Survey on 19th of May 2019. Any submission with survey plans signed after this date will not be accepted. Search was made at Roxy Building for legality and also at the court of landowners are in court. There will be a need to await the verdict of the court prior to compensation. He noted that the Head Man, the Women's Leader and many others were always with the site verification team. The Legal Council also noted that people may be compensated twice for the same piece of land if there is no verification.. For conflicting claims, it was clarified to the Member of Parliament that on the 31st of march 2022, land owners were called to a meeting as the Gooding's and the Kaiwans are making conflicting claims. The matter was referred to the court to verify. The Legal Council had clarified the land verification process to include the following:

Category A: land claims(Title deeds and survey plans signed), **Category B land claims** (Land Plans Signed but no title deeds and Category C land Claims (**Land Plans not signed**). In the compensation framework explained to the Member of Parliament for which she requested explanation during stakeholder engagement, the Legal Council explained that 11.6 town lot is equal to one acre was the approach used for estimation of ownership. It has been further clarified that for some of the landowners having their property on the beach, Cap 149 of Foreshore Act

specifies ownership of lands on beaches and creeks and rivers belonging to Government. Another survey plan for acreages minus those falling withing the Foreshore Act were recorded as authentic, for which compensation have been provided. The Legal Council had also informed the Member of Parliament about meetings held to give priority to Sierra Leoneans as potential investors for the investment along the harbour chain for ancillary facility. Our further engagement with the MFMR revealed that eash of the land owning families will be provided additional four (4) town lots of land at alternative sites as part of the resettlement actions, to compliment the financial compensation. Each of the one town was costed at Le8 million old Leones, which is considered in the resettlement plan costings presented in section 11 of this report. Efforts should be made by the project client (MFMR) to ensure that this additional resettlement obligation is met fully for the land-owning families.

12.1.6. Engagement with Community Leaders and Community Members

The community leaders of Black Johnson Community and Community members of Black Johnson and associated communities were held to ensure their active participation in identification of key issues for community development plans and resettlement actions. Gate keepers (opinion leaders) including the village headman, youth leaders, women leaders and fishermen and fish processors, teachers, pastors and school pupils have been engaged extensively through Focus Group Discussions and Key informant interviews. During these engagements, several issues were identified for community development to be addressed by the project as part of the cooperate social responsibilities.

12.2. Community Development Action Plans (CDAP)

During various community engagements using Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) at Black Johnson and surrounding communities of Big water, York and John Obey, the various community elders identified the following issues. *For the CDAP:*

- **Employment opportunities**: Most young people in the communities of the Fish harbor project are unemployed. Fishermen are without fishing gears to conduct fishing. Therefore, the community development actions of fishing input support, mariculture and the marine park was identified as a key sources of employment for the young population of the Black Johnson community. The community also perceive the fish harbor project to provide employment for the youths. The need for fishing nets and outboard engines for fishermen was emphasized as a means to stop them mining sand from the beaches of John Obey and York for sale to housing developers. They also requested for solar powered cold rooms and fish smoke ovens to be provided for the Black Johnson Community to improve their participation in value added fish trade

- **Education and Social Services:** Black Johnson villages has no School. School pupils have to travel long distances to attend schools at nearby villages of York . The building of Primary and Secondary School at the Black Johnson Village was identified as a major community development that will improve the education of the communities around the fish harbor. The construction of vocational centers to build the capacity of young people in metal works and their involvement in the metal works and aluminums work schemes and other construction works along the fish harborur was emphasized. Some youths are drivers and expressed willingness to serve as drivers during the construction and operation of the project, The youths also called for support for the refurbishment of their community center and possible provision of football field where they can develop their potential in Soccer. All sports such as swimming, tennis and athletics game promotion were also

identified. The provision of adult literacy scheme was also identified as part of the education service provision by the project.

- **Provision of alternative lands and building materials** *for Landowners affected by the project*

- **Provision of Electricity:** This was identified as one of the most important community development issues for the Black Johnson and associated communities. The MFMR through the Fish harbor project should contact the Ministry of Energy and the Electricity Distribution and supply Agency (EDSA) to work out feasibility for an urgent connection of the Black Johnson Community to the National power grid by partnering through existing power supply projects for the Freetown Peninsular Axis.

- **Pipe Borne Water Facility**: Black Johnson community has only one water well (borehole) serving the entire community. There is a river stream running from the Whale River Bridge that passes through the community and project site which serves the community for laundry and also for drinking. The community requested additional water wells or pipe borne water . The opportunity exists to use the stream water and ground water and pipe it to provide source of drinking water. This water source can also be used during the construction and operation of the fish harbor. The provision of pipe borne water connected to the national grid of Sierra Leone water Company in Freetown is strongly recommended. The ongoing Water Project for the Western Rural District for communities along Freetown Peninsular should be contacted for possible extension of the project to cover the Black johnson Community. The MFMR through the fish harbor project should contact the Sierra Leone Water Company (SALWACO)n to consider possibilities of connection of the Black Johnson Community to the national water supply system. This should be catalyzed by direct funding from the fish harbor project. There is also the opportunity of water supply piping through the natural dam at John Obey and Black Johnson. Possibilities for water supply from the John Obey natural dam and the falling water from the hills at Black Johnson must be assessed for possible supply of water to improve livelihoods of communities along the fish harbour.

- **Microcredit scheme to promote trading**: The community members requested for microcredits to empower them to be able to effectively participate in the fishing investment along the fish harbur. They requested for credit schemes with repayments through community bank. Calling for a community Bank to be constructed at the Black Johnson Community through which micro-credi schemes can be rolled out by the fish harbor project. Most of the livelihood's activities of the communities along the fish harbor site include the harvesting of forest woods and sand mining for construction of homes and the burning of coal. Fishing Gardening are also among their livelihood sources. They consider the provision of microcredits to enable the reduction of forest harvests and sand mining, thereby leading to environmental sustainability. Youthful fishermen and women fish processors along the Black Johnson communities world require to be actively involved in fishing using the appropriate fishing gears in order to enhance their capacity to benefit from the fish harbour project. They considered that the provision of microcredit scheme's will enable them procure fishing nets and outboard engines to improve their participation in fishing. This will reduce their dependent on nearby mangrove forests and the Western Area Peninsular Forest reserves which will help in protecting the environment and the fish harbor complex.

- **Alternative farm land**: The community also requested for alternative lands for gardening and farming to improve their livelihoods. They also requested for seedlings to enable them do gardening. The seedlings requested include potatoes seedings and vegetables, pepper etc. to enable them embark in crop production to improve their livelihoods

- **Community Health Services:** The community identified community health clinic to be provided for Black Johnson village that will serve associated communities. We recommend the project to include the establishment and effective implementation of a reliable health and safety policy that will adequately address health and safety requirements of the Black Johnson Community, the project staff and associated communities . As a quick fix, the project should leverage on the mobile clinic opportunity provided by the Ministry of Health and Sanitation, for a regular visitation of the Mobile Clinic at least twice every month, to serve the Black Johnson community and project staff during the project construction phase, while the construction of a permanent health center for the community is rolled out by the project. The augmentation of the mobilization of the mobile clinic on forth nightly to serve the project community has been costed in the CDAP

12.2.2. Mode of Implementation of CDAP

Prior to implementation of the CDAP, we recommend that the implementation of the CDAPs be subjected to project cycle-planning that will involve management meetings between the MFMR fish harbour project committees, the Chinese Government providing the funds, the the Black Johnson Community, landowners and the ESHIA Team and EPA-SL, to deliberate on priorities of the CDAP that can be implemented during the course of project construction phase. The other activities that can be differed after completion of the first phase of the project should also be identified and costs agreed. The costs of the CDAPs are indicative costs that will be only confirmed after these meetings are concluded. This process should involve the active participation of local community of Black Johnson, the Civil Society and the affected landowners. We recommend the establishment of a fish harbor project steering committee (SC) to be charged with the responsibility for the implementation of the CDAP. Other specialists and interest groups such as line ministries, Civil Society Organization leaders, ESHIA Team and EPA-Sl should be part of the Steering Committee. This should be discussed during the validation of the ESHIA report and disclosure of the ESHIA and feasibility Engineering Studies by the ESHIA Consultants and the Chinese Expert Team and representatives of the Chinese Government. Summary of the CDAP and indicative costs is provided in Table 32.

Table 32. Summary of Community Development Action Plans

Community Development Area	CDAPs	Indicative Cost (US $)	Time line
Alternative Employment to prevent forest degradation, cold burning and sand mining	fishing gears, fishing boat, Solar powered cold room, fish Smoke houses	100,000	3 years.
Education and Social Services	Construct primary and secondary schools. And Vocational Training Center. Provide equipment for metal works and aluminum. Support adult education, football field and sports	100,000	3 Years. TBD by MFMR and Donor
Alternative lands for farming, and Gardening	Provide alternative lands for farmers and gardeners and for landowners affected. Land for Community Farm	20,000	3 years. TBD by MFMR and Donor

Drinking Water Facility	Pipe Borne Water -linking BJ to Guma, Water Wells, Natural dam piping	50,000	3 Yeas. TBD by MFMR and Donor
Microcredit through Community Banking	Loans provided to communities of BJ, Big water, York and John Obey to support Fish trade and other trade	200,000	TBD by MFMR and Donor
HealthServices	Community Clinic, Mobile Clinic mobilization support	100,000	3 Yrs. TBD
Agriculture Support	Seeds for gardening. E,g. Pepper seeds, Yams, Plantain, vegetables	20,000	3 Yrs. TBD
Electricity	Connect BJ to National Grid	100,000	TBD

13. Grievance Redress Mechanisms (GRMs) for Fish Harbor Project

The fish harbor project at Black Johnson is a Category A project which requires the project client (MFMR) to establish effective grievance redress mechanisms (GRMs). The GRMs will be used by the affected persons (Aps) of project communities and Grievance Redress Committee (GRC), including Contractors to receive and facilitate resolution of grievances. These grievances are associated with the fish harbor construction impacts on environment, health and social activities detailed in the ESMP. GRMS are required to address the risks and impacts of the project by resolving concerns from Aps from time to time through consultations and engagements. The GRMs will minimize court proceedings and protecte the interest of communities that may not have access to legal representation and saves time for addressing grievances. The GRMs provided in this ESHIA report were identified during engagement with Black Johnson communities and stakeholders consultation meetings.

The GRMs consist of processes for resolution of grievances raised by affected persons (Aps) to be resolved by institutions using guidelines and processes within effective time lines.. We have provided a conceptual model and a summary of procedures for receiving and dealing with complaints from Aps. The GRMs follows the Equator Principle (AP) required for the fish harbor cosntruction which have high financing demand. The current status of land compensation through the establishment of Compensation Committee (CC) by the MFMR and the establishment of an ESHIA committee for administrative and technical backstopping to the ESHIA Consultants is also presented.

13.1. Current Status of GRMS Established by MFMR

The fish harbor project already have immense publicity and the MFMR have followed the due process for the acquisition of land. After the inception meeting for the ESHIA studies, our consultations with the MFMR revealed that the MFMR had already established a **Compensation Committee (CC)** for the Fish harbor project concession land at Black Johnson. The MFMR Compensation Committee comprises of the following:

i. Ministry of Lands, Housing and Country Planning, represented by a Consulting Surveyor
ii. The Ministry of Justice, represented by a State Council
iii. Black Johnson Community Leaders
iv. MFMR Administration and Fish Harbour Project Committee
v. Civil Society Organizations

The Compensation Committee engages with landowners to facilitate their claim over their parcels of land for compensation. A Legal Counsel representing the interest of Givernment plays key role in ensuring that landowners understand the legal processes involved in the land acquisition by Government for the fish harbor project and the limits of the rights of land owners over coastal lands located in the Foreshore. In one of the stakeholder's meetings summoned by the CC, an

update was presented on the status of land acquisition and compensation in order to improve the understanding of stakeholder and to resolve any conflict of interest of grievances. Key stakeholder Institutions including the Ministry of Environment, the EPA-SL , the Anti-Corruption Commission , Civil Society and the Ministry of Tourism were present for the briefing meeting

The key role of the CC in the compensation of the land owners for the 252 acres of land and addressing grievances include the following:

i. Transparency in the administration of land acquisition by Government for construction of the Fish Harbour at Black Johnson. Civil Society organizations have been key players representing the interest of Landowners and assisting them in negotiations with MFMR for acceptable compensation package
ii. Ensure that land acquisition by Government followed the due process of the law, pursuance to Section 2i of the Constitution of Sierra Leone which provides for compulsory acquisition of land for public sector development
iii. Putting up notice with allowance of long-time window to allow landowners to submit document of claim to the CC for ownership of the parcels of land at Black Johnson. Ba
iv. The CC comprises of qualified persons for verification of land ownership, including Licensed Surveyor of MLCP and a Barrister of Law representing the interest of Government. The State Council provided accurate advice for land acquisition and compensation, including situations where landowners lose claims based on provisions of the law. E.g. the Fore Shore Act which declares ownership of all lands situated at the foreshore extending to about 150m belonging to the State
v. MFMR was provided legal advice to follow due process leading to the signing of Warrant by HE the President of Sierra Leone for Compulsory Acquisition
vi. Making flexible, the claim of land ownership by creating three categories of claim: Category A representing people with Title Deeds and Signed Survey Plans signed, Category B, representing people without Title Deeds but with signed survey plans and category C allowing people with unsigned survey plans but have indemnity from the Town Chief/ Village Headman
vii. Landowners represented by Community Leaders including the Black Johnson Town Chief and Village Head man and Civil Society
viii. Agreement with landowners for financial compensation and the issuance of warrant for Compulsory acquisition of 252 acres of land at Black Johnson for the construction of fish harbour
ix. The Hon. Minister of Fisheries and Marine Resources Chairs the CC, giving the Committee the required political will to perform its function
x. Parcels of land claims were surveyed by the Licensed Surveyor to verify ownership
xi. Over one-year period was allowed for claim of ownership by land owners which ended in May 2019
xii. Land claims verified by the Competent Office of Registrar General of Sierra Leone. Out of 70 documents submitted, 35 people had Title Deeds, but 19 people qualified for ownership compensation
xiii. Site demarcation done during ground Truthing with EPA-SL to verify conflicting interests with land boundaries.
xiv. The only existing grievance is made by business people who are making claims for lands situated in the foreshore, where they do not have right of ownership
xv. Resolved grievance for the value of land compensation to be less than the actual value for beach lands, since Government will be providing electricity, water facility and other facilities to develop the Black Johnson community

xvi. All affected persons (AP) by the fish harbor project are engaged to participate in the project irrespective of gender, literacy level or language barrier. There is no discrimination

xvii. Affected Persons are treated with dignity throughout the land acquisition process

xviii. The engagement process by MFMR and transparency has reduced grievances for land ownership and compensation have been provided successfully for land owners and the Concession land areas has been demarcated

13.2. Recommended Grievance Redress Mechanisms for Fish Harbor Project

We recommend an ongoing documentation of grievance and assessment of the nature of grievances by a Grievance Redress Committee (GRC) to be constituted by the MFMR (Figure 54). The GRC should comprise of the existing Compensation Committee and should include the MFMR, MLCP, MOJ /Community Leaders and project Contractors and Civil Society. The Black Johnson (B.J) landowners and community leaders should also be represented in the GRC and must participate in grievance assessment through grievance management meetings that should be summoned by the MFMR.

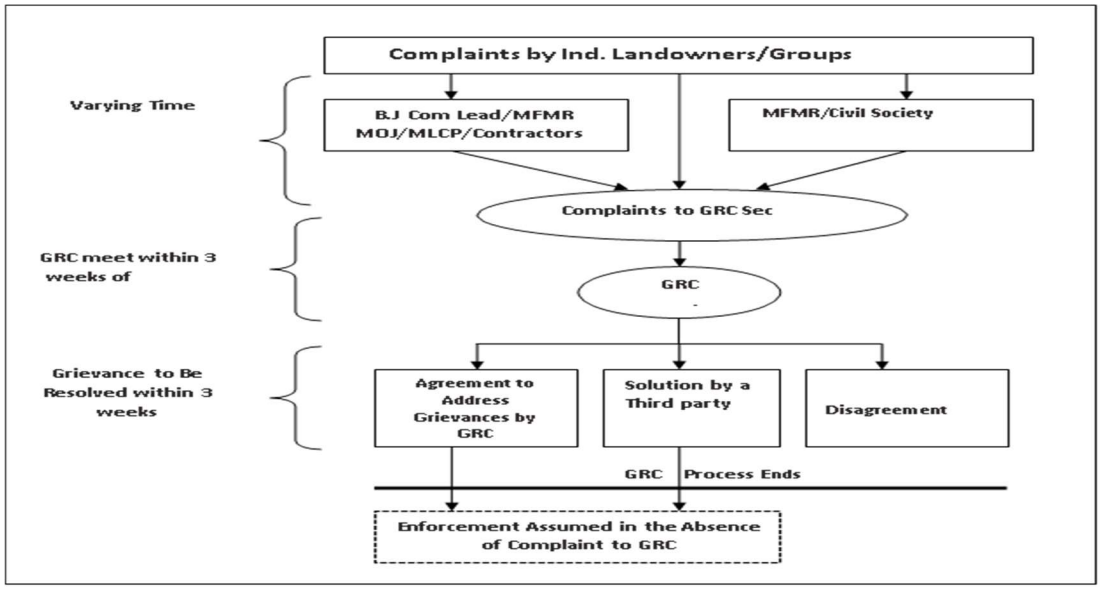


Figure 54. Conceptual Model for GRMs for Fish Harbor Project

The procedures for grievance redress should be supplemented with time frames for grievance handling. Such time frame should not exceed 3 weeks. All members of the Fish harbor project management team should serve as members of the GRC and other stakeholders co-opted must be fully experienced and competent personnel who can win the respect and confidence of the affected persons. It is also important to maintain a gender balance within the GRC. The following should comprise the key criteria for the appointment of members of the GRC :

i. Knowledge of the fish harbor project and its objectives

ii. Technical knowledge and expertise in coastal infrastructure development and environmental assessment

iii. The full understanding of the social, economic, and cultural environments and the dynamics of the communities

iv. Must possess the capacity to understand the grievance issues by the Aps and be able to solve resolve them

v. Must have a Gender consideration to cut gender barrier that may prevent hearing grievance.

vi. The GRC must have a realistic budget to cover the costs of meetings and community engagements to document grievances throughout the life cycle of the fish harbor project

vii. The GRC budget must also conduct awareness campaigns on the benefits of the fish harbor project, throughout the design, construction and operational phases of the project.

viii. Capacity-building should include training on infrastructure and support services, field inspections, meetings, documentation, and supplies.

ix. Develop resettlement action plan (RAP) that clearly defines the roles of the various institutions

x. Institutions that should be set up to deal with different types of grievances.

xi. These roles for institutions should be effective at various levels to ensure that complainants can be addressed at the community level or at higher level of the GRC (e.g. Ministers of Government). The Environmental Management Plan (EMP) should clearly define the process of grievance redress for conflicting issues associated with implementation of EMP

xii. To refer unsolved cases for grievances to independent agencies for their technical assessment and advise for resolution. The Grievance redress mechanism process for Fish Harbor Construction at Black Johnson is presented in Figure 55. The summary of measures for grievance redress is presented in Table. 33.

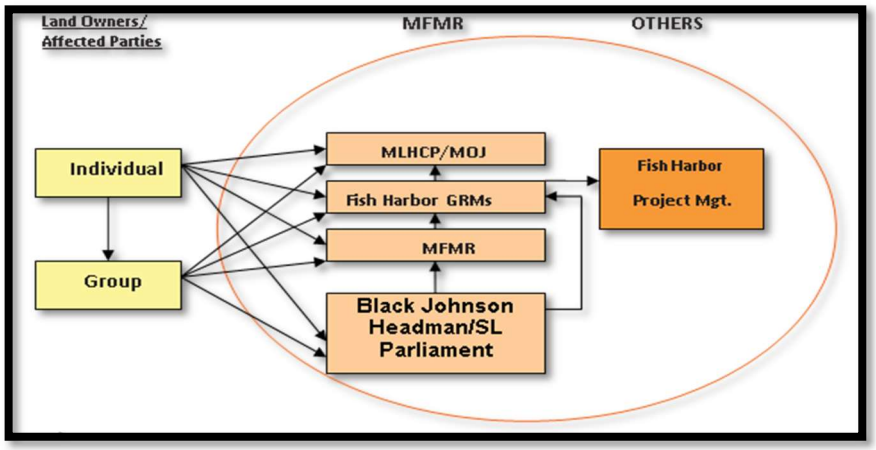


Figure 55. Flow diagram for grievance redress for fish Harbor project

Table 33. Summary of Grievance Redress Measures

Type of Grievance	Responsible Parties/	Grievance Redress Measures	Cost (US$)	Time Frame/ Comment
Damage to house walls and roofs due to blasting, vibration, and heavy vehicle movement Damage to access roads, culverts, and canals of communities	GRC/Contractor Engineers/ESHIA Team	Provide alternative land Conduct post crack surveys Conduct Vibration Tests during Construction Assess Damage and suggest redress		
	Project Site Manager/Site Engineer	Monitoring the overall grievance redress processes by contractors, engineers Assess the progress of public complaints Conduct Training of Staff Report Grievances to GRC for redress		
	GRC	Approving the resettlement implementation plan including GRMs		
	GRC	Decide additional compensation for APs		
	EPA-SL/MFMR/ESHIA Team	Regulating and monitoring the compliance to ESMP through project cycle Meetings with APs to assess impacts Setting standards and times for blasting at construction site and decide waste dumping sites		

	GRC/Contractors/ESHIA Team	Addressing appeals from APs on grievances related to land acquisition and compensation		
		Addressing appeals from APs on grievances from landowners on land claims		
		Complying with the EMP and adopting appropriate measures to mitigate adverse social impacts to APs		
		Maintain databases on grievances Monitoring the progress of grievance and report to GRC Chair (Minister, MFMR)		
Obstructions to access roads of communities		Issuing assurance letters to APs (by contractors and/or RDA for reconstruction or repair after completing the road construction work) —————— Providing alternate access roads — Getting relevant agencies to construct or improve drainage systems, roads, culverts, anicuts, and wells		
Damage to private property Decrease in Aquifer (water table) level of streams, pollution of public water wells due to blasting and Damage to economic trees	**GRC**	Payment of compensation for damage and loss of livelihood		
	GRC	Assisting the APs in land acquisition and compensation processes including relocation to new sites		

		Maintaining good relations with APs, responding to their concerns, and providing assistance to them as required Identifying all resettlement impacts before, during, and after construction; and taking steps to mitigate them Participating in GRCs as an ex-officio member Functioning or serving as lowest level receiver of grievances		
		Deciding any additional compensation for Aps		
Dumping of solid wastes/Threats to protected areas and cultural heritage/Resettlement and compensation with alternative land/ Disputes for ownership rights/Land boundary disputes	GRC/ESHIA Team/Contractors/BJ Community Chiefs	Assisting the APs in land acquisition and compensation processes including their relocation to new sites Maintaining good relationship with Aps in responding to their concerns, Assessment of resettlement Impacts resettlement impacts during Design, construction and Decommissioning		
Dust, air and noise pollution	GRC/EPA-SL/ESHIA Team/Contractors/MFMR Internal Auditor/MFMR Accountant	Internal auditing of resettlement compensation payments through participation in Grievance meetings Prepare list of APs in need of additional assistance and report to Chair of GRC		

14. Resettlement Action Plan for Fish Harbor Project

14.1. Resettlement Analysis

This section evaluates the scale of the proposed fish harbor project and nature of land ownership displacements at Black Johnson and associated communities. It presents the legal framework and implications for land acquisition and land tenure in the Western Rural District and Black Johnson, for industrial fish harbor development and resettlement needs. The existing actions taken by the project Client (MFMR) towards resettlement are also presented. The need to resettle all affected persons by the project is important for the prevention of grievances that may undermine the successful implementation of the project. Recommendations to address these resettlement needs are provided as resettlement action plans for implementation during project planning phase and any emerging issues in the course of project construction and operational phases

14.1.1. Land Tenure and Socioeconomic Settings of Black Johnson

Land tenure in Sierra Leone is based on duality of ownership, where the land in the Western Area which was originally settled by the Creoles is held under the English concept of freehold interests. This was promulgated by the English Common Law which is currently in force. The lands in the Western Area including Freetown were acquired through negotiation with the natives by the English and handed over to the settlers. Land in the rest of the country (i.e. the Provinces) is held under communal ownership defined by customary tenure, where land is supposed to be controlled by traditional rulers who administer it on behalf of their communities in accordance with existing customary norms of practice.

Sierra Leone's statutory land tenure system in the Western Area is based on written laws enacted by Parliament, regulating ownership of land, and promulgates that land can be held by individuals, agencies or organizations under freehold system after the the payment of a 'fee simple[1]. This legal regime relies on the doctrines of equity. Here, any individual who wishes to acquire land will negotiate payment arrangement with the landowners who are usually Government or private owners, agencies or communities. This legal system also provides for 'crown lands' in the Western Area, designated as public lands that belong to Government and includes all lands that have been unoccupied for over12 years[2]. These crown lands also include all lands belonging to the state claimed under treaties and international conventions, including the law of the sea convention (UNCLOS) and the national laws of the Foreshore Act that designates all shores of Sierra Leone, beaches, lagoons, rivers, bays, creeks, estuaries, and sea areas to be claimed under state sovereignty[3]. This follows by Government proclamation published in the Gazette, declare any lands formed by the reclamation of any part of the foreshore about 150ft from the mean high water level from the sea or any tidal rivers, creek or channel to be State Land, and discharged from all public and private rights, which may have existed or been claimed over such foreshore prior to reclamation by Government. Section 5(1-4) of the **Foreshore Act, cap 149** provides for compensation of occupants of the foreshore based on considerations not to make them worst off, in situations where the occupants had legitimately acquired the foreshore in the public interests and now about to be utilized by Government for development purposes.

The 11 years civil war in Sierra Leone which ended in 2002 saw influx of people from the provinces of Rural Sierra Leone to the Urban areas which has affected land tenure and made land rights malleable in both the Western Area and customary settings (Sei, S., 2018)[4]. The impasse of these settlements affected most of the coastal areas including the coastal localities of Western Rural Peninsular, where many people found an opportunity to inhabit wharves for livelihoods. Many of the displaced people and rural urban migrants had developed the foreshore, mainly for hotelling to attract tourists and for residence, with little understanding of the laws guiding the foreshore. At Black Johnson community, while most of the legitimate landowners, mainly the Creoles moved to urban Freetown for residence and others live overseas, long years of caretaking and settlement on the lands and its associated foreshore created multiple claims over landownerships. This warranted the Ministry pf Lands and Country Planning to apply the

[1] · MLCPE (2016). National Land Policy-Sierra Leone

[2] Unoccupied Lands Ordinance, 1911 (Cap 117)

[3] Public Lands Ordinance, 1898 (Cap 117); Crown Lands Ordinance, 1960 (Act. No 19 of 1960), Foreshore Act, Cap149

[4] Sheku Sei (2018). Socio-economic studies for equitable governance of customary land tenure in Sierra Leone. Report prepared for FAO under Governance of Tenure Project, GCP/ SIL/049/IRE, funded by the Republic of Ireland

doctrine of 'First in Law'' where claimants with land deeds older in time are given legitimate rights over land parcels.

The prices for parcels of land are usually based on the size and interest requested (whether freehold or lease). Once agreed, the land can be surveyed by registered private or Government Surveyors and site plans produced after payment of fees agreed. The site plan which is verified by the Government Ministry of Lands is consequently approved and registered. Deed of conveyances of ownership is developed by a Solicitor for registration with the Government deed registry of the Registrar General's Department. Freehold interest may not be acquired by strangers who do not possess citizenship by birth or by naturalization[5]. In addition, non-citizens are not allowed to acquire land interests under lease for more than 21 years. For an exception to this rule, an approval license must be obtained from a Board that comprises the Lands and Country Planning Minister, the Ministers of Trade, Finance, Economic Development and the Attorney General and Minister of Justice.

14.1.2. Demographic, Socioeconomic and Cultural Settings of Black Johnson

Black Johnson is in the York Rural Ward in the Western Rural District along the Western Peninsular of Freetown. Black Johnson is flanked by York and Big-water on the North-Western Part and John Obey Beach on the South Western Part, served by coastal beaches with the Whale Bay prominence of the Atlantic Ocean, Separated by the Black Johnson River (Figure 56).

Figure 56. Black Johnson in York Rural Ward of Western Rural District

This Ward of York has a population of 170,019 (SSL, 2021 Mid-Term Census), and occupies an area of 241.3 km^2 Black Johnson village itself has a population of about 7,000 people. The population density of York Rural Ward is is 704.6/km^2, with 4.6% annual population growth observed over 7 years (2015 to 2021) (Statistics Sierra Leone, 2021).

The Whale Bay which is the major seacoast of Black Johnson is also used by Big Water Village, York Village and John Obey, and was once known as the Mammy River. It was called the Mammy River because it is believed that during the slave trade era, the Queen of York often visited the Whale Bay to get fresh air. Many years later, a huge whale was discovered dead around the 'Mammy River' which warranted naming the river after the Whale. Whales were sighted in the Whale Bay over 50 years ago, which lead to the establishment of a Whale Watching Station at York Village. However, in recent years, humpback whales from the Banana Island are found stranded on beaches such as the Lumley Beach in Freetown when they breach. A protected forest, the Western Area Peninsular Forest overlooks the Black Johnson which provides additional value for the project location that would unlock future economic benefits for Sierra Leone.

The major economic activities of Black Johnsons and associated communities is fishing, wood cutting

[5] Section 3, The Non-citizens (Interests in Land) Act, 1966 (No. 30 of 1966).

and cold burning, Petty trading, Sand Mining, Agriculture and gardening and animal husbandry. Sand mining had been the main cause of coastal erosion at Black Johnson beach and other beaches along the Whale Bay and Sierra Leone River estuary. The nearby John Obey Beach is particularly now popular for sand mining, which provides future threat for the life of the fish harbour. We have proposed in the resettlement action plan and community development action plan, a Government policy that will stop sand mining at John Obey which is closed to the fish harbor, and alternative livelihood schemes to incentivize the youths to engage in other livelihoods activities, to save the beaches along Black Johnson from Sand mining and coastal erosion. This will prevent future failure of the fish harbour.

14.1.3. Project Scale and Land areas affected

The Engineering feasibility study report for the project proposes an industrial fish harbor development at Black Johnson covering land area of 252 acres mostly owned by private people (Shangdon Gantong Engineering Consulting., 2018). An additional 37-acre land will be reclaimed from the sea area of the Whale Bay. The scale of construction of the harbor will consist of long-term development and First Stage Development. The long-term development comprises of the following the following:

i. Wharf capacity for 15 berths of 938m long, Bulk Cargo and Container Berth of 900m Long
ii. Total Breakwater of 745m Long berthing 20,000 tons of bulk cargo, and 100,000 tons container ships
iii. Ship building and repair platform: Shipyard with 2000 ton and 5,000 tons slipway. Three berths West of shipyard, 278m long occupying 36.5-acre land area
iv. Fish processing park and supporting areas including fish processing Workshop, freshwater treatment plant, sewage treatment plant, bonded warehouse, Entrepôt Trade warehouse, Chinese Office Building, MFMR Building, Canteen, Dormitory, Generator Room and Vehicle Parking lot covering 68.7 acres. Oil storage Tank occupying 1.63-acre land
v. Mariculture and Marine Park Demonstration and Experimental area, which include hatchery and fingerlings workshop and sedimentation tanks, water storage tank and outdoor hatchery and bait pond. We propose a Dolphin Aquarium (Dolphinarium), Sharks, Stingrays and Turtles Bay, and considerations for a demonstration Manatee Cove, all covering area of 79 acres
vi. Fish Market, covering 37 acres, Aquatic product trading hall and parking lot for vehicles
vii. Residential service area. This is proposed as a low cost residential housing on the southern aide where the MFMR Staff and other staff can live.
viii. Reserved development area that will be used for future development including considerations for Government Hotel Service or developments related to the harbour

14.1.4. First Phase Construction Scale

The project proposes a first phase with 9 fishing berths with total length of 913m, fish production areas and fish processing and dormitories at the land extent towards Black Johnson Village. The first stage will consist of the following construction and land areas:

i. There will be a harbor jetty with 9 berths taking a total length of 913m and coastline of 635m.
ii. Ship repair berth of 278m with ship repair plant, water supply, drainage, firefighting system, and power supply system
iii. Breakwater system of 100

The total land area acquired by the project is 252 acres and sea area will be around 30 acres.

Preparation of Reports on Resettlement

14.2. Resettlement Funds

The resettlement funds were provided by Government of Sierra Leone as part of the counterpart funding to the project Grant. The fund is directed towards cash compensation to landowning families that qualified for compensation. A total of 22 landowning families qualified for compensation for the land acquired by Government for Construction of Fish Harbor at Black Johnson, along Western Area Peninsular of Freetown. In addition, each landowning family will be provided Two Town Lots by MLHCP on behalf of Government, as alternative land, to resettle along the Western Area Peninsular. Each Town lot is valued at NLe30,000. A total of NLe 14,634,240 was provided by MFMR/GoSL for cash compensation. An alternative land of 2 town lots has bee allocated for each compensated landowning family, valued at NLe 1,320,000, as resettlement consideration. This also accounts for the effects of Foreshore Act that dispossessed them of land. Another 4 town lots each has been agreed to be allocated to each family of illegal accupants affected by the Foreshore Act. This totals up tp 32 town lots) valued at NLe 960,000, as considerations to ensure that the AP's of Black Johnson are not worst-off as a result of the Fish harbour project . The overall resettlement funds is 16,914,240.

14.3. Project Site Alternatives to Reduce Resettlement Costs

During the planning and design stage of the project, the site selection was done after feasibility studies inorder to reduce resettlement costs, in particular, considerations for avoiding densely populated coastal areas was prudent. The feasibility studies for site selection as detailed in the ESHIA report considered the following:

i. Residential development of the site and population density
ii. Site topography and required earth movement and reclamation to obtain deepert waters
iii. Reduction of the extent of foreshore withdrawal and infrastructure displacement. Black Johnson has very little infrastructure development for both housing and hoteling
iv. Promotion of stakeholders engagement and information sharing at the project planning stage including site selection.
v. Producing a documentary on project engagement and stakeholders views and professional feedbacks on stakeholder's myths and misunderstandings
vi. Formation of a Compensation Committee and Environmental, Social and Health Assessment Committee, to evaluate compensation and resettlement needs of the communities and affected persons (APs) of the fish harbour project

The actua rate of land loss at the Black Johnson project site is very low, considering that a large portion of land is collectively owned by landowning families, most of who do not reside at the Black Johnson village; hence the land had not been subjected to intensive construction. Most of the landowners are resident in the Capital City of Freetown and many other live overseas, leaving the land to be protected by caretakers. Agricultural practices on the land is also very low as it is not the main source of income by communities.

14.4. Temporary Land Occupation

The impact of temporary land occupation during the project construction is negligible as most of the existing occupants on the project site are caretakers of the land owning families that have already been compensated for the acquisition of the lands. In addition, very minimal space will be temporarily occupied by Security Personnel and project staff, with large reserved areas of over 37 acres which can be used as stockyards and temporary stores for construction materials, This will not require compensation as the Sierra Leone Police and the Fire Service Officers can be seconded on the project to provide security under payment arrangements for only monthly allowances, while their salaries are paid by Government. These secondment arrangements will be rolled out by the MFMR using existing Sierra Leone Government Policies. In addition Gratuities or employment benefits will be paid to Personnel temporarily hired by the project, including

temporal site occupant security personnel.

14.5. Affected Persons (APs) and Verification of Landownership

The process of acquisition of 252 acres of land, mostly private land at Black Johnson followed the due process of the law. The land acquisition qualifies under Section 21 of the 1961 Constitution of Sierra Leone which provided for compulsory acquisition of land for infrastructural development that provides public goods and services. The land has been acquired with approval by House of Parliament of Sierra leone and the signing of Warrant by HE the President of Sierra Leone, which confers ownership of the land by the Ministry of Fisheries and Marine Resources (MFMR). The land has been delineated with beacons and verifications indicates that about 19 landowning families legally qualify for land ownership. A total of of 70 people submitted document but only 35 of those documents had title deeds of the land. The ownership categories of the land verification included the following:

i. Category A: people with title deed and survey plans signed
ii. People with title deeds and unssigned survey plans
iii. People with survey plans not signed but have indemnity from the Chief of Black Johnson Community

The restriction reckoned during the verification exercise was that any document that came after May 2019 after surveying the property will not be entitled to Compensation. All land documents received went through the office of Administrator and Registrar General, who verified the validity and legality of documents, while the Attorney General's Office and the Court retained the powers for granting verdicts for any multiple ownerships claims under litigation.

The Compensation Committee for the Fish harbour project considered in their verification exercise that property will only become unoccupied where no one will lay claim to it . After several visits, searches and documentation checks, it was discovered that some of the land documents were registered, while others were not. There were instances where land claims were wrong. Situations where On their Site Plan is Black Johnson but their coordinates did not fall on Black Johnson. E.G. Jalloh Jam site plans of land documents indicated Black Johnson locality, but after plotting the coordinates fell in other communities.

There were also situations where land documents were refused as they were submitted after the stipulated deadlines, as announced in the stipulation of time periods for submission of documents. For example, some land documents stipulates that they were surveyed on 27th of May 2019. However, it was verified that the property was actually surveyed and signed by the Director of Surveys and Lands on 25th May 2019. A technical situation where the land already became property of Ministry of Fisheries and Marine Resources after 25th of May 2019 affected people in Category C ownership class. This group did not qualify for financial compensation. However, they have been considered for Government resettlement Concession land, with 4 town lots to be allocated to every landowning family affected by the Foreshore Act (their lands situated at the foreshore, 150ft from the highest mean sea level). The process granted over six months extra above the stipulated period announced, providing grace period for the public to submit their claims. The process also had to ensure that the interest of Government is protected. The people whose site plans and survey plans under category A were submitted after the deadline were rejected.There is the situation where under Category C, no one is qualified for compensation. The affidavit is not signed by the Chief of Black Johnsons. It was not surprising that people will claim lands that do not actually belong to them, a situation that was expected as a result of increasing land grabbing along the coast, where beach lands are generally sought after.

14.5. Considerations for Vulnerable Groups

During the process of land verification, the project considered vulnerable groups who do not qualify for compensation. This included people affected by the Foreshore, most of whom do not qualify for lands affected by foreshore Act. The Project also aims to protect communities located along the coast, including the Black Johnson Community usually affected by flooding during the rainy season. The Fish harbour project will promote the local content policy by giving priority to communities to participate at various levels of the project to earn income, including:

i. Giving priority to the local people for the provision of local construction materials, thereby offering jobopportunities to local residents and Sierra Leoneans
ii. Providing unskilled jobs first available to the AP's, including women and the poor
iii. Providing training and capacity building for local residents of Black Johnson and associated communities to strengthen their involvement in the project construction works and in the operation of the fish harbour project, including the Marine park and mariculture program

14.6. Household income and expenditure Analysis

During the site consultations, about 20 households with 80 persons of the Black Johnson, York, Big Water, John Obey, River No.2 , communities were interviewed and analysis showed an average per capita annual income of about Le 9,000,000 (US$ 500) per year, obtainable mainly from crop cultivation, petty trading, sand mining and cold burning and animal husbandry.

For youths engaged in fishing, a profitability analysis reveals that fishers are currently fishing at a loss as their capacity to reach lucrative fishing grounds have diminished, particularly when the nearby coastal waters of Whale Bay and Sierra Leone River Estuary and other river systems of Yawri Bay has been declared as Marine Protected Areas.

14.7. Artisanal Fishing Investment Analysis

From the information collected during the FGDs and KIIs, we analyzed a perceptive five years fishery investment profile for artisanal fishing along the Western Peninsular, and our results shows that fishermen are fishing at a loss for standard 3-5 fishing canoes and fishing gears of gillnets, including bottom set gillnets targeting snappers and drift nets, using NPV discounting algorithm:

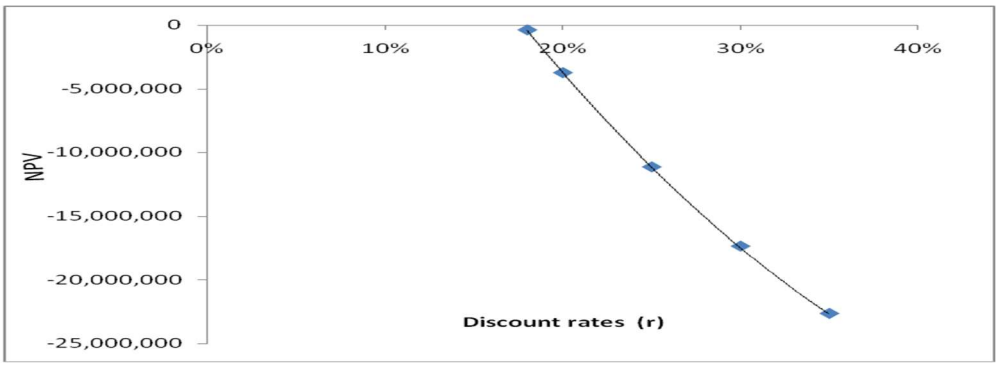
$$NPV = -C_0 + C_n/(1+r)^n = -C_0 + C_1/(1+r)^1 + C_2/(1+r)^2 + \ldots + C_n/(1+r)^n$$

There are indications that long term investment period is required for fishermen to breakeven and make profit. The cash inflows and cash outflows for the artisanal fishing investment analysis for standard 3-5 fishing canoe, using 2017 as base year, for six years investment profile is presented in Table 34.

Table 34. Cash flows & IRR for Fishing Investment Along Western Peninsular

Investments	Cash out flows (000)	Cash inflows ('000)	N(years)	PV (000)	(r)
Tripartite share (crew)	19, 000		2017 (yr 0)	-76,468	
Petrol	9, 000	23,732	2018 (yr 1)	-374.147	18%
Engine Oil	1, 320	24,090.5	2019 (Yr 2)	-3,731.8	20%
Cargo Manifest	48	24,450.5	2020 (Yr 3)	-11,135.6	25%
Engine Maintenance	1, 500	24,810.5	2021 (Yr 4)	-1,7362.9	30%
Net Maintenance	1, 800	25, 170.5	2022 (Yr 5	-22,649.6	35%
Boat Maintenance	800				
Engine Cost	15,000				
Cost of Fishing Net	20,000				
Cost of boat (std 5-10)	8,000				

Income (catch +tripattite share, owner)			**72,00,000**		



The fish harbor construction at Black Johnson will unlock wealth from industrial fisheries and improve value added fish processing along the Western Peninsular coastal villages who are currently unable to make profit from artisanal fishing. The possibility of offshore fishing for artisanal fisheries sector through the manufacturing of fiber glass fishing boats with canopies and refrigerated facility means that fishermen would be empowered to spend more days fishing at lucrative fishing grounds, outside the inshore exclusion zone where juvenile fish are often caught with low profitability. This will reduce pressure on juvenile fish stocks. The manufacture of fishing nets using Chinese technology is also expected to improve fisheries investment for the artisanal fisheries sector.

14.8. Compensation and Resettlement of APs

14.8.1. Objectives of Compensation and Resettlement

The main objective of compensation and resettlement of persons affected by the fish harbor project is to ensure that the project intervention do not left them worst off. Although the compensation for parcels of land is not commensurate with existing land market prices for coastal lands, a reasonable compensation framework was agreed after negotiations with land owning families for cash payment. An additional consideration for resettlement of people disposed of their land has been considered at alternative lands situated around John Obey, where plots of Government lands have been identified. The financial compensation is meant to ensure that incomes of landowners can be subsidized. Historically, most of the land parcels were acquired by landowners below the compensation rates reckoned, despite not been equivalent to private market values at existing market prices. The compensation will improve the livelihoods of landowners and allow them to engage in investments elsewhere.

14.8.2. Resettlement Arrangements

14.8.2.1. Establishment of Compensation and Resettlement Costs

An agreement was reached between the MFMR and landowning families for a financial compensation based on Categories of Land Ownership. Category A landowners who are AP's are those with title deeds and signed land plans. Le8,000,000 (Eight Million) Old leones per one town lot for parcels of concessional lands situated at Black Johnson for the fish harbor that are not affected by foreshore Act. An additional four town lots per land owning family was agreed for all landowning families that qualified for compensation. There have also been considerations for a class of people who do not qualify for compensation as they are affected by the Foreshore Act, inhabiting lands situates 150ft from the mean high-water mark which belongs to the state. The total financial compensation is dependent upon the area of land owned by each family. A summary of agreed compensation and resettlement costs and the scale of compensation is presented in Table 35.

Table 35. Summary of Resettlement Action Plans and Costs

Resettlement category	Agreed Benchmarks				
Category A Landowners					
Affected Persons (APs) (Land Owning Families)	Acreage	Acreage/Town lot	Total Town Lots	Cost/Town lot (NLe)	Total Cost (NLe)
1	19.979	0.0861	232.04	8,000	1,856,353.078
2	0.3446	0.0861	4.00	8,000	32,018.583
3	0.6921	0.0861	8.04	8,000	64,306.620
4	1.7017	0.0861	19.76	8,000	158,113.821
5	2.0493	0.0861	23.80	8,000	190,411.150
6	4.9266	0.0861	57.22	8,000	457,760
7	1.7016	0.0861	19.76	8,000	158,104.530
8	1.9989	0.0861	23.22	8,000	185,728.223
9	6.5865	0.0861	76.50	8,000	611,986.063
10	10.8305	0.0861	125.79	8,000	1,006,320
Category B Landowners					
11	0.4513	0.0861	5.24	8,000	26,207.898
12	1.9247	0.0861	22.35	8,000	117,771.196
13	0.7049	0.0861	8.19	8,000	40,934.959
14	0.4512	0.0861	5.24	8,000	26,202.091
15	1.2216	0.0861	14.19	8,000	113,520
16	4.5333	0.0861	52.65	8,000	421,200
17	4.4272	0.0861	51.42	8,000	411,360
18	0.6764	0.0861	7.86	8,000	62,880
19	39.8	0.0861	462.25	8,000	3,698,000
20	25.5	0.0861	296.17	8,000	5,034.89
21	27 (2 family Disputed land)	0.0861	313.59	8,000	2,508,720
22	4 (Late Submission)	0.0861	58.74	8,000	469,920
Total Compensation (A)	157.5014	0.0861	1,829.28	8,000	14,634,240
Alternative Land of 2 town lots for resettlement of landowning families and for Effects of Foreshore Act Foreshore Act @NLe30000 per lot (B)					1,320,000
Grand Total Cost (Cash Compensation & Resettlement Land) (NLe) (A+B)					15,954,240
Resettlement Land for Illegal Occupants Affected by Foreshore (8 Families so far) (C)					
APs			Total Town Lots/ AP	Cost/Town lot (NLe)	Total Cost (NLe)
1			4	30,000	120,000
2			4	30,000	120,000
3			4	30,000	120,000
4			4	30,000	120,000
5			4	30,000	120,000
6			4	30,000	120,000
7			4	30,000	120,000
8			4	30,000	120,000
Total (C)			32		960,000
Grand Total Cost (All Resettlement) (A+B+C) (NLe)					16,914,240
Grand Total Resettlement (US$)					903,779.23

About 21% of the 252 acres of Land acquired will be compensated. Over 80% of the qualified landowning families in Categories A and B ownership have already been compensated. We note that over 60% of the land at Black Johnson is affected by the Foreshore Act, which belongs to

Government, due to the presence of rivers, streams, lagoons and bays at various reaches of the lands. The Whale River flows through the land and empties into the Black Johnson Lagoon, which is flanked at the foreshore by the Whale Bay. Deliberations are ongoing for the consideration of additional financial compensations for landowning families who did not present their land papers on time. The resettlement budget will be updated during the Public Disclosure of the ESHIA Report, at which time final decisions would have been reached for final compensation.

Deliberations are also underway to consider more AP's for resettlement for Foreshore impacts once final deliberations have been reached. Some controversies exist for 2 landowning families with hotel structures located at the Foreshore (Figure 57). They include:

i) Yankai Resort at Big Water Village, owned by the Dumbuya Family, with over 70% of facility at the Foreshore, located at less than 150ft from the mean high-water mark of the Whale bay and the Black Johnson Lagoon
ii) Titto's Ecolodge at Black Johnson, owned by the Titto Family, located at the Foreshore, less than 150ft from the mean high-water mark of the Whale Bay

Figure 57. Yankai Village in may 2018 (Left) (MFMR, 2018)[6] & Resort in 2022 (Right)

In May 2018 when the feasibility team of the fish harbor Project visited Yankai resort Land, the owner of the land had just commenced land clearing and constructing hots on the land. This land was already under competing claims from both the Dumbuya family and the Gooding Family and the matter was with the MLCP for verification while case was filed by Mr. Gooding at the High Court. There is currently no court judgement on the ownership of the land at Yankai Resort. One of the claimants, the Dumbuya family has already developed hotel and restaurant on the land, despite an initial advise from the fish harbor feasibility team that the land was mainly a harbor site. As it stands, no legal compensation can be made for a land that is under competing claims from two claimants. The MFMR and the MLHCP are deliberating on this matter with a view of the best considerations for resettlement in order not to make the owner worst off. However, a legal judgement from the court may be required if any legal compensation is to ne made.

We note that Yankai resort is situated at a very strategic area that will serve as the seafront for the fish harbor facing the Whale Bay and the other part of the land facing the Black Johnson Lagoon is ideal for the Mariculture and Marine Park demonstration and experimental development area of the fish harvbor. On the other hand, Tiotto's ecolodge do not qualify for compensation as the land document presented by Mr. Titto does not verify that he owns land at Black Johnson. Titto's Ecolodge is also situated at an area of the Foreshore that belongs to the Stete. The Compensation Committee of MFMR is also considering a final decision that will not leave the owner of Titto's Ecolodge worst off.

[6] Photo Credit: Ibrahim Turay (2018). Deputy Minister, MFMR

14.8.2.2. Disbursement, Management Framework for Resettlement

The funds used for resettlement and compensation of APs for the fish harbor project at Black Johnson is provided by the Government of Sierra Leone as a Counterpart funding to the Project Grant provided by the P.R. of China. The funds have been committed by the Ministry of Finance (MOF) to the MFMR and disbursements of the fund addresses the ESHIA studies, demarcation of the project site and compensation and resettlement matters related to the project.

The resettlement funds are disbursed strictly based on the agreed compensation framework with the landowning families. There is internal controls at the MFMR where there is a Project Focal Point, an Accountant and Internal Auditor. A monitoring and Evaluation team of MFMR also monitors the delivery of the resettlement commitments and the delivery of the ESHIA studies.

14.8.2.3. Organizational Structure of Compensation Committee

The compensation committee comprise of various institutions to ensure checks and balances, including the following:

i) Ministry of Lands, Housing and Country Planning (MLHCP)
ii) Ministry of Finance (MOF)
iii) Ministry of Fisheries and Marine Resources
iv) Ministry of Justice (MOJ)
v) Black Johnson Community Leaders
vi) Ministry of Information and Communication
vii) Landowning Families
viii) Directing, coordinating and

14.8.2.4. Principles for Progress Coordination between Resettlement and Project Construction

According to the implementation schedule of the Project, construction will commence in March 2014, and the construction period will be two years. The resettlement schedule will be linked up with the construction schedule of the Project;the main part of resettlement will begin in the second half of 2013 and end at the endof 2013. The basic principles of scheduling are as follows:

i) Resettlement should be completed at least one month prior to thecommencement of construction;
ii) Sufficient time must be allowed for resettlement before the commencement of construction.

14.8.2.5. Resettlement Milestone for Fish Harbor at Black Johnson

The resettlement process must be concluded prior to the commencement of construction of the fish harbor at Black Johnson. We recommend the following steps to be taken to ensure that the resettlement is rolled out prior to the commencement of the project:

i) All compensation fees must be paid prior to commencement of construction work at the project site
ii) The alternative resettlement parcels of land must be allocated to landowning families prior to their displacement and commencement of construction work to avoid grievances

14.8.2.6. Resettlement Timeline

We recommend that the resettlement process must be within specified timeline, in particular as the construction work for the project is scheduled to commence in December 2022. The timeline is a range which should be permissible, to avoid delays of resettlement and prevent grievances that may affect project implementation (Table 36).

Table. 36. Resettlement Implementation Timeline

No.	Resettlement activity	Commencement	Finish
1	Finalize RAP and agree on final terms for resettlement	December 2022	February 2022
2	Public Disclosure of Draft ESHIA Report and finalization of RAP	December 2022	December 2022
3	Disclosure of the RAP on MFMR and EPA Website	January 2022	February 2022
4	Complete Implementation of RAP	February 2022	March 2022

14.8.2.7. Appeal Mechanisms by AP's for Resettlement Benefits

It is envisaged that there will be grievances emanating from AP's for resettlement concerns. For these grievances, we recommend an appeal mechanism where AP's will have the opportunity for hearing of their grievances prior to the commencement of construction work at the project site. The following is recommended as the appeal process to ensure that most AP's are happy with the RAP agreed. The AP's will not borne any costs in their appeal processes.

Step 1: All AP's dissatisfied with the RAP can file an oral or written appeal with the village Headman of Black Johnson or Town Chief who will convey grievances to the MFMR Compensation Committee. Discussions are held by the Compensation Committee and the Black Johnson Community Leaders to verify

↓

Step 2: All Ap's dissatisfied with initial decision of the Compensation Committee and seek redress from the Attorney general's Office of the ministry of Justice of Sierra Leone within the timelines stipulated for delivery

14.8.2.8. Monitoring and Evaluation of the RAP

The MFMR project Management Office for the Fish Harbor project will ensure effective monitoring of the RAP to ensure that it is fully implementation within the stipulated timeline, which will be validated during the disclosure of the draft ESHIA report . The Focal Point of the Project, the MFMR Senior Management and internal control systems of the internal audit unit and Accounts and Procurement Office should form part of the M&E Team to ensure full implementation of the RAP. The following forms should be used by the Focal Point supervising the M&E team to ensure that the RAP us fully monitored

Name of AP:___,_____Address of AP_____

Date of completion of RAP and Compensation: MM/DD/YY

Item	Category of Ownership Verified	Acreage/ Town Lot	Compensation Received	Outstanding	Comment
Compensation for Landownership at Black Johnson					
Resettlement to Alternative Land					
	Type of Training				
Training Program Attended			**Comment for Training and Employment Sought (Qualified/Unqualified)**		
Employment Sought	Type of Employment Sought	Expertise for Employment Sought			

Reported by:_____Signature (person responsible):_____Official seal:

_,_____

Township,_____District (County)Cut-off date: MM/DD/YY

Date of completion: MM/DD/YY

Affected entity	Description[5]	Unit/ qty.	Required investment (yuan)	Compensation received (yuan)	Adjusted compensation	Percentage of compensation
Village 1						
Village 2						
Collective						
Displaced household						
Entity						

Reported by:___Signature (person responsible):__ Official seal

.

14.8.2.9. Resettlement satisfaction survey to be undertaken by ESHIA Team

This survey will form part of the disclosure of the ESHIA report and will be implemented until the completion of the final ESHIA report . This will evaluate the level of satisfaction among landowners and other APs for the RAP and compensation scheme for the fish harbor project at Black Johnson. The questionnaire (Table 37) should be administered for other APs who will not be present at the disclosure of the draft ESHIA report. Representatives of landowning families can also complete the questionnaire by contacting their interest groups.

Table 37. Black Johnson Fish Harbor Project (Phase 1) RAP Satisfaction Survey Form

No.	Question	Answer (Chose One)	Result (% affirmative Response)			
			①	②	③	Remarks
1)	How did you hear about your land been acquired by Government for Fish Harbor Project?	Government Announcement over radio Announcement over TV and Newspaper Community Stakeholders Meeting by MFMR 5) Meeting held by Black Johnson Chief and Headman 5) Rumors 6) Never heard about the Fish Harbor Project				
2)	Are you satisfiedwith the RAP by MFMR?	①Very satisfied ②Somewhat satisfied ③ No Answer ④Dissatisfied ⑤Verydissatisfied				
3)	Are you aware of the Foreshore Act where all lands of Foreshore situated at 150ft from high water mark is Government land?	①Yes ②Somewhat ③No				

15.0. Decommissioning

We anticipate that the Fish Harbour and associated assets will be operated for several years and the circumstances under which they would be decommissioned is difficult to envisage. In particular the life of this development project for fish harbor is estimated initially at 1000 years and the expansion component and maintenance means that the aim of the [project is to serve Sierra leone in perpetuity. However, In the event when decommissioning becomes necessary and it is carried out, the following are recommended:

i) All defected equipment should be salvaged for re-use or sale;
ii) New equipment should be be installed
iii) Perpetual closure of the fish harbour
iv) Provide adequate notice to staff, suppliers, and regulatory agencies in accordance with the Laws of Sierra Leone
v) Ensure payment of benefit to employees including insurance benefits
vi) Government to Pay all fees owned to contractors
vii) Decommission all movable plant and machinery
viii) Remove all machinery and equipment from the project site
ix) Demolish all buildings and structure
x) Consider alternative investment for public sector development
xi) Sell land to private sector for alternative investmen

15.1. Environmental Impact Statement (EIS) for Fish Harbor Construction

This Environmental and Social Impact Report has identified potential impacts on the physical,

biological and socio-economic/cultural environments, occupational safety, health and welfare of the employees as well as the host community of the Black Johnson community. Mitigative and potential remedial measures have also been outlined. These will be actively pursued in order to minimize or, if possible, eliminate the identified negative impacts. The Fish Harbor at Black Johnson is a Category A project with considerable environmental impact on the community and ecosystems which can be mitigated. Mitigation measures put in place will minimize impacts identified so as to make them pose no serious threats to the continued sustainability of the environment and welfare of the communities. This ESIA Report has identified the impacts, provided mitigative measures, and an environmental management plan. Other impacts will be minimal or temporary. The benefits to be derived from the Fish Harbor Construction are immense, especially considering the demand for aggregates in Sierra Leone. Black Eagle Sierra Leone believes that this ESHIA has sufficiently dealt with the significant issues on the ground and that the mitigation measures for environmental, social and health management suffices for the issuance of an environmental license to commence the construction work.

The process for compulsory acquisition of land for the harbor project followed the due process of the law. It included satisfactory stakeholders' consultation and issue identification. The engagement process included the development of project management committees comprising of the Public Relations (PR) Committee; Compensation Committee (CC) and Environmental, Social and Health Impact Assessment (ESHIA) Committee. The PR Committee which was led by the Ministry of Information and Communication facilitated community and nation-wide sensitization on the harbor project with the key deliverable of a documentary on the fish harbor and its ancillary investment opportunities. This documentary showcased Sierra Leone for investment opportunities during the 2020 Dubai EXPO. The CC comprised of Ministries of Fisheries, Lands, Environment, Justice, and Landowning Families which oversaw the due process of land acquisition. The proposed land has been surveyed, endorsed by Parliament and approved by the President through issuance of a warrant for possession. The land now belongs to the MFMR. Compensation of landowning families is ongoing with additional considerations for alternative parcels of land to be allocated to every verified member of land-owning families as part of the resettlement action plan (RAP) . The engineering design for the main seafront of the harbour should encompass the deeper parts of the Black Johnson Lagoon and the Whale Bay.

The Yantai Resort at Big Water situated at the foreshore of the Whale Bay and Black Johnson Lagoon should be reclaimed for seafront development and breakwater construction. This area is already under severe coastal erosion, situated at low elevation coastal zone (LECZ), less than 5m above sea level. Leaving this facility near the seafront of the harbor will create inclination and slowdown sediment transport due to siltation buildup. As part of the location of this facility violates the foreshore act, a resettlement package for the owner of the facility should be negotiated urgently by the MFMR. A portion of the land of Yantai Resort is already within the acquired 252-acre concession land for the Harbor. Therefore, the only option for the owner of Yantai Resort is to reach a negotiated settlement with MFMR based on consideration. Any legal challenge on their part will fall through. The Ecolodge Resort by reclaiming the lagoon and the and banks deposited by the Bay. The considerations for lagoon aquaculture as part of the industrial fish harbor will require identification of additional culture sites in remaining Lagoon adjacent to the proposed site and the proper selection of culture species. We propose an Integrated Marine Park and Mariculture Station with a well-constructed aquariums (at least two) where social animals including orcas (Killer Whales), bottlenose dolphins and manatees can be trained in captivity to provide social functions. Dolphins are lovely animals and very intelligent and playful and charismatic. Cetaceans and can be trained in captivity to provide entertainment for people. Aquariums are lucrative business in China with well-developed expertise which could be transferred into Sierra Leone. Aquarium simulates and creates a living environment and conditions of aquatic life similar to natural. The marine animals in captivity will be taken care of by professionals, making them breed and grow up. This advantage is considered to be a unique potential for income generation for communities and additional revenue generation for Government.

The marine park at the Fish Harbor will gradually become an experimental and demonstration place for the breeding of aquatic organisms and for exhibition. It is good for science education, resource protection and scientific research. Students at Secondary Schools and Universities will obtain practical training on conservation and animal welfare management from the Marine Park. Apart from the daily exhibition, the aquariums of the SLMP will perform functions of endangered aquatic animal protection hub and regulate aquarium expansion in Sierra Leone in the future. Killer Whales (Orchinus orca), Common Bottlenose Dolphins (Tursiops truncatus), West African Manatees are found in the waters of Gulf of Guinea, with common bottlenose Dolphins, Manatees, Hump Back Whales are common in Sierra Leone Waters. The humpback Whales (Megaptera novaeangliae) is particularly known to breach in shallow coastal waters of Sierra Leone and get stranded on beaches when they breach.

We note that salinity is the most important environmental variable in the lagoon that will affect aquaculture development. Existing salinity of the lagoon is around 35ppt. Coastal erosion, eutrophication and pollution are additional limiting factors for a lagoon aquaculture development that will need to be addressed. The fish harbor construction at Black Johnson is a viable project with impacts that can be effectively mitigated if the measures recommended for the ESMP, CMP, EMP, CDAP, RAPs and GRMs are fully implemented. The issuance of EIA license for the project is strongly recommended realizing the economic benefits the project will provide for Sierra Leone. The capacity of the project and available expertise of the donor country in port development provides a good proxy for the full implementation of the ESMP, CDAP and RAPs for the project.

Signed:

Stefan Kruger,
Project Director,
Black Eagle,
November, 2022

Appendix 1: Management Correspondences from Client, MFMR

MINISTRY OF FISHERIES AND MARINE RESOURCES
OFFICE OF THE PERMANENT SECRETARY
7TH FLOOR, YOUYI BUILDING

REF: MFMR/BE16/61/01

FROM: The Permanent Secretary, Ministry of Fisheries and Marine Resources

TO : (See Below)

13th June, 2022

Copy: Hon. Minister, MFMR
Deputy Minister, MFMR
Director of Fisheries

INVITATION TO ATTEND THE INCEPTION MEETING FOR THE ENVIRONMENTAL SOCIAL HEALTH IMPACT ASSESSMENT STUDIES (ESHIA) FOR THE CONSTRUCTION OF A FISH HARBOUR COMPLEX AT BLACK JOHNSON

As you may be aware, this Ministry has hired the services of an independent consulting and Port Engineering Firm - ***Black Eagle SL Limited*** for the Environmental Social Health Impact Assessment (ESHIA) Studies for the construction of a Fish Harbour complex at Black Johnson. The team of the consulting firm has already commenced the ESHIA studies and will be presenting the scope of the work during the Inception meeting. The inception meeting will be followed by a Scoping visit to the project site on Thursday 16th June 2022.

As a key stakeholder and collaborating institution for the project implementation, you will be contacted by the team of the Consulting Firm from time to time for the necessary data collection through key informant interviews, focus group discussions and other community engagement mode. Your active participation in the discussions of the scope of the ESHIA and its association with your interest in the Black Johnson community and Whale Bay area will be highly appreciated.

As a strategic partner in this endeavor, I wish to invite you to an inception meeting in respect of the ESHIA studies for the construction of an Industrial Fish Harbor Complex at Black Johnson in the Conference Room of MFMR on Wednesday 15th June, 2022 at 11:00am.

I look forward to your participation and invaluable contribution to this crucial discourse.

Mohamed Jalloh
For: Permanent Secretary

Addressed To:
Hon. Minister of Environment
Hon. Minister of Lands, Housing and Country Planning
The Permanent Secretary, Ministry of Environment
The Permanent Secretary, Ministry of Information and Communication
The Inspector-General of Police, SLP
Executive Director, Environmental Protection Agency, Sierra Leone (EPA-SL)
The Director of Surveys and Lands, Ministry of Lands, Housing and Country Planning
Mr. Sao Lamin, Civil Society Organization
The Village Headman, Black Johnson Village
The PRO, Black Johnson Village

Appendix 2.

Description of the Consulting Services

The Consulting Firm (Black Eagle, Sierra Leone Limited) is required to conduct full ESHIA study and produce report for the design and construction of the proposed industrial fish harbor complex at Black Johnson Village and Whale Bay Area, based on two alternatives: a) The design of harbor and export terminal on pillars to avoid the loss of aquatic habitat within the Whale Bay and minimize disturbance to the natural mixing of waters (Rock Mud bunded landfill or (b)Sheet-pile bunded landfill through the reclamation of the area by a pile of rubble and quarry material to eliminate unsustainable mining of rock elsewhere. The studies should be carried out based on the detailed proposal submitted by the Consulting Firm to the MFMR. This should also strictly follow the detailed deliverables for the assignment as presented in the Request for Proposal (RFP) issued by the Client which comprises of the following elements:

1. Characterization of the project site to collect baseline data
2. Inshore bathymetric survey
3. Risk Assessment including water quality and sediment analysis
4. Air quality and noise pollution assessment
5. Climate modeling and characterization of meteorological situation
6. Vehicle and Traffic Studies
7. Socioeconomic and health impact studies

The ESHIA studies should be provided for a proposed industrial fish harbor that entails the following:

i. A berthing and transshipment area for up to 15 fishing vessels at a time
ii. A Ship building and repair area suitable for a Syncrolift Docking System
iii. Fisheries product processing area.
iv. Area for construction of Sierra Leone Competent Laboratory for fishery products
v. Fisheries experimental and demonstration area, including fishing gear repair station
vi. Aquatic product trading area-Industrial fish market
vii. Residential services area, including office space –'Sierra Leone Marine Resources House' and Social Housing construction for up to 300- two bedroom fenced apartments
viii. Reserved Development area for future port expansion or hotel Development

The fish harbor complex will conform to the standards required for the export of possessed fish to USA, EU, UK Asia, Africa and other countries. This will enhance sustainable management of Sierra Leone fish resources through the centralization of all fishing activities including fish landing, handling, processing and export. The Consulting Firm is therefore expected to conduct the ESHIA studies and produce report that includes Environmental and Social Management Plan (ESMP) that include construction management plan (CMP), Environmental Impact Statement (EIS), required mitigation measures for environmental, social and health impacts and Resettlement Acton Plan (RAP), commensurate with the provisions under the EPA act 2008 as amended in 2010, and other relevant regulations. The studies should include:

- Assessment of site suitability for the development of a fisheries harbour and export terminal at Black Johnson
- establishment of baseline conditions for the project area with respect to the biophysical, socio economic, health and environment.
- Identification and assessment of potential socio-economic and health impacts of proposed project activities on the livelihood patterns including impacts on cultural properties, social infrastructure, natural resources and values of communities in the Black Johnson area of the project.
- Development of cost effective mitigation measures for significant impacts of the project during design, construction and operational phases and any future decommissioning
- To recommend prudent measures during design, construction, commissioning, operations and decommissioning to avoid and ameliorate adverse effects and increase beneficial impacts.
- Identification of existing environmental regulations related to harbor development in Sierra Leone and provision of advise on standards, consents and targets.

- Preparation of detailed ESHIA report that presents clear and concise information on the environment, social and health impacts of the project.
- To work MFMR facilitate the process of obtaining the necessary ESHIA the applicable permits/License or approval is obtained from EPA-SL for the harbor construction. The Technical reports produced by the Consulting Firm should comprise of an inception report, a Draft Report and a Final report approved by the MFMR and in line with the EPA-SL requirements, which should contain recommendations on mitigation measures to reduce impacts of the development project on the environment, health and socioeconomic activities in Black Johnson area. The final report should incorporate comments and suggestions from the client and the Environment Protection Agency Sierra Leone after disclosure and validation of the report with relevant stakeholders including project beneficiaries and the Black Johnson Community].

Reporting Requirements

Three (3) reports are to be submitted to the EPA-SL as follows:
The Project Screening report -The Project is screened against applicable environmental laws to determine the nature and scope of the ESIA Study. This should form part of the ESHIA study inception report

The Scoping report including details of the terms of reference and baseline studies, scale, focus and methodology and development of the management plans; defining the project's environmental and social boundary. This should also form part of the ESHIA study inception report

The ESHIA report should include detailed analysis of the potential environmental and social impacts, supported by objective and defendable scientific studies. The report should contain recommendations to mitigate identified negative impacts, and to enhance positive impacts (including recommendations) of the project development, a set of Management Plans should also be produced as an outcome of the ESIA. This Report presents the findings and outcomes of the ESHIA in the broader and detailed terms. Three reports are expected to be submitted by the consulting firm as follows:

An Inception report should be produced within two weeks to one month after contract effective date, providing details of work plan/timelines, review of prior work done on the sites of interest, reports of preliminary discussions with stakeholders like EPA_SL, SLRA, SLPA, SLMA and communities adjacent to the sites of interest and the scoping and screening reports submitted to EPA-SL.

Technical reports
(Draft and final), containing data/results of the detailed studies in the TOR of the RFP, and in line with the approaches and methodology detailed in the proposal submitted by the Consulting Firm (Black Eagle-Sierra Leone Limited) in different sections of the report submitted by month 3.

Appendix 3. Focus Group Discussion Questionnaire for CDAP

Focus Group Discussion (FGD) Guiding Questions for Community Development Action Plan (CDAP) For Black Johnson Community

ESHIA Studies for The Development of an Industrial Fish Harbour Complex at Black Johnson, Along Freetown Peninsular

1.0 Description of Approach

These Focus Group Discussion (FGD) guiding questions have been developed by Black Eagle, SL Ltd. to provide insightful understanding of complex issues and situations for the environmental, social, economic and health conditions of the Black Johnson Community in order to establish community development action plans (CDAP) for the Black Johnson people. The focus group questions will serve as teasers and provides an opportunity for people to express their views, to hear the opinions of others and to collectively develop resolutions to the problems affecting the livelihoods of the people of Black Johnson community.

This will provide technical and anecdotal information that can be debated, and which can lead to creative problem-solving and broad community support under the CDAP as cooperate social responsibility for the Harbour Project. Focus groups are based on open communication and critical deliberation, they can lead to improved community relations, trust and a sense of ownership in the process and outcome. The Black Johnson Community led by the village Headman Mr. Kakpindi have summoned a meeting by themselves on 17th June 2022 to discuss the problems affecting their community and how this will be impacted by the proposed harbour construction. Key among their agenda is the compensation of landowners of the Black Johnson Community whose lands will be affected by the Harbour Construction. Important Caveat of the Sierra Leone Land Laws is the Foreshore Act which specifies that all land that lie about 150 ft away from the Highest High-water mark belongs to Government. In addition, all lands conforming to the need for development projects can be acquired by Government under **Compulsory Acquisition**, with consideration for compensation of landowners. This means that, landowners will not have the choice to impose charges on their parcels of land, but to negotiate with Government. The FGD by Black Eagle consulting firm will provide meaningful input into the development of the CDAP.

2.0 FGD Guiding Questions

The following will serve as guiding FGD questions during the community meeting:

1) **Community Schools (English or Arabic or Both)**: Do you have primary or secondary Schools in your community? If yes, how far are the schools from the Black Johnson Village? If no, will you require a school in your community

2) **Community Health Centres/Clinics or Hospitals**: Do you have health facilities in your community? If yes, how many of them and can you tell us an estimated number of nurses and Doctors or Community Health Officers? If no, will you require Health Centre?

3) **Secret Society, Culture, Religion and Protected areas**: Do you practice secret society in

your community? If yes, which ones and which area of the Black Johnson Land are the Society Bush. If no, will you require one

Do you have any monument areas or marine protected areas or protected forests? If yes, are they located in the Black Johnson Area of the proposed Harbour? If no, will you require one. Please tell us about the type of resources you are protecting in the protected forests. Do you have Mosques or Churches, are they located in the land for the proposed Harbour? How many mosques or churches are there? If non, will you require any?

4) **WASH Facilities**: Do you have toilet of water wells in your community? If no, what is the source of drinking water and where do the people use as toilets. If you have no toilets or water facility, will you require any? How many will you require?

5) **Climate Change Impacts**: We learnt that your community gets affected by flooding every year and prevent you from accessing your lands? If yes, what do you think are the main cause of the flooding? What can you suggest for mitigation of this flooding to protect your community? Can you adapt to the flooding events, what would be the ways you can possibly live with the flooding without adverse effects on your livelihoods?

6) Are people among you who think they will lose their houses and or property because of the Harbour Construction? How many of you and what properties do you expect to lose?

7) What are your expectations if any, for possible resettlement or compensation for the loss of homes, lands, and property as a result of the harbour work?

8) What other needs would you want the Harbour Project to provide for your community, in addition to the Compensation of landowners and the issues highlighted so far?

9) If you were to prioritize the issues you have highlighted, what will be the first five priorities?

Black Eagle SL Limited
29 Signal Hill, Freetown,
Sierra Leone
West Africa

Reg. 000830
Incorporation: 000220
TIN: 1054143-2

Appendix 4. Key Informant Interview Questionnaire for CDAP

KEY INFORMANT INTERVIEW QUESTIONNAIRE:
Stakeholders Engagement for Community Development Action Plan
ESHIA STUDIES FOR THE DEVELOPMENT OF AN INDUSTRIAL FISH HARBOUR COMPLEX AT BLACK JOHNSON, ALONG FREETOWN PENINSULAR

1.0 SALUTATION

I am_____, from Black Eagle Consulting Firm, conducting the environmental, social and health impact assessment (ESHIA) studies for the construction of Fish harbour on 252-acre land of Black Johnson community, along Freetown Peninsular. As an important community leader, you have been selected for an interview on what you think will be the impact of the project on the community and what key actions can be taken by the project and Government as community development actions for the Black Johnson community. We will research on the opinions provided by you and others. The information that you shall provide for this interview will be kept strictly confidential. There is no borden on you to write answers to the questions we will ask you. We will write down your answers as notes and you identify will be kept confidential.

Respondents Name _____

Name of the Institution/Company/Community _____

Designation/Profession _____

Mobile/Telephone _____**Email** _____

Institution/Company Address _____ **Date of Interview** _____

2.0 KII Approach:

2.1. Target Respondents:

About 15-25 community decision makers including Village Headmen, Deputy Headmen, Town Chiefs, Imams, Pastor, Community Health Practitioners, Community School Teachers, Youth Leaders, Women's Leaders, Civil Society Organization, NAMATI

This Key Informant Interview (KII) questionnaire has been developed by Black Eagle, SL Ltd. to provide insightful understanding of complex issues bordering on livelihoods, health, and socioeconomic impact of proposed harbour project on the Black Johnson Community, in order to establish community development action plans (CDAP) for the people of Black Johnson and associated communities including John Obey, York Village and Big Water. The KII questionnaire provides an opportunity for people to express their views, to hear the opinions of others and to collectively develop resolutions to the

problems affecting the livelihoods of the people of Black Johnson community.

This will provide technical and anecdotal information that can be debated, and which can lead to creative problem-solving and broad community support under the CDAP as cooperate social responsibility for the Harbour Project. Under the Sierra Leone Laws, the Foreshores Ordinance (Cap 149) specifies that all land that lie 150 ft., away from the High-Water mark belongs to Government of Sierra Leone, and provides for Reclamations and to Validation for Leases or Grants of Foreshores and the Erection of Wharves thereon. The foreshore Act has therefore affected land ownership at Black Johnson and may make some landowning g families disposed of rights over some portions of their land and they will only be compensated for the land not affected by the provisions of the Foreshore Act.

In addition, all lands conforming to the need for development projects can be acquired by Government under **Compulsory Acquisition**, with considerations for compensation of landowners or relocation. This means that landowners will not have the choice to impose charges for their parcels of land, but rather to negotiate with Government for consideration of compensation. The KII questionnaire by Black Eagle consulting firm provides an opportunity of people of Black Johnson Community including landowning families affected to provide meaningful input into the development of the CDAP. The following are key questions for the

3.0 Key Informant Interview Questions:

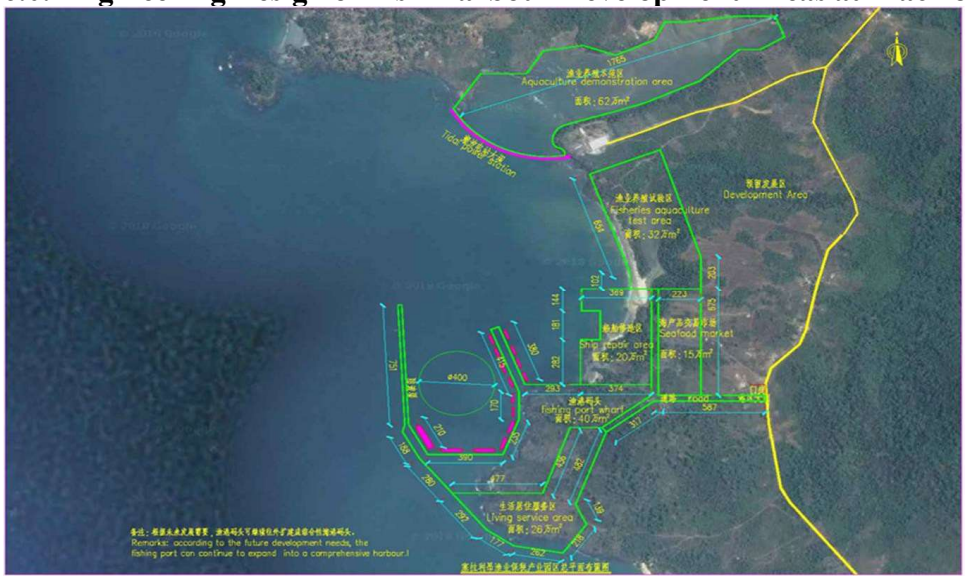
1. If you were to choose between having the harbour Project at Black Johnson and having it somewhere else what will be your choice. What are some of your reasons for your choice?
2. Do you have any idea whether Black Johnson Community has Schools, Clinics, Drinking Water Supply or Toilet Facilities? If Yes, please tell us the number of these amenities present in Black Johnson Community or in your own community (if different from Black Johnson)
3. What are the major economic activities for the people of Black Johnson Community? (Cold burning, farming, fishing, sand mining, stone mining, building construction, carpentry etc?. Which activities do you consider as alternative livelihoods activities and which of these activities are you engaged in?
4. Please name the most 10 important community support you would recommend for the Black Johnson Community
5. Are you aware of the existence of any Secret Society practice at Black Johnson Community? If Yes, which ones.
6. Are there any reserved land for burial purposes in Black Johnson Community? If yes, is this land part of the proposed land for the fish harbour project?
7. If there were no secret society and Bush reserved for the dead in Black Johnson Community, can you recommend these among community development Actions as cooperate social responsibilities for the harbour project
8. Are you aware of any economic trees on the proposed land of Black Johnson Community? If yes, which are the most important economic trees
9. Will you consider compensation for economic trees among community development actions for the harbour project?
10. Please tell us about the most important animals and plants that you think will be affected by the construction of the harbour at Black Johnson. If you were asked to choose between the harbour and the animals and plants that will be destroyed, what will be your answer
11. What can you suggest as key measures to minimize the problems on your community that will be caused by the construction of the harbour at Black Johnson?
12. Please tell us the problems you experience as a result of heavy rains and swelling of the Black Johnson River and the Whale Bay during the rainy season.
13. Do you often get flooding from these problems? How long does the flooding last and what are the problems caused from flooding?
14. Are you afraid of losing your land, house or other property because of the Harbour Construction?

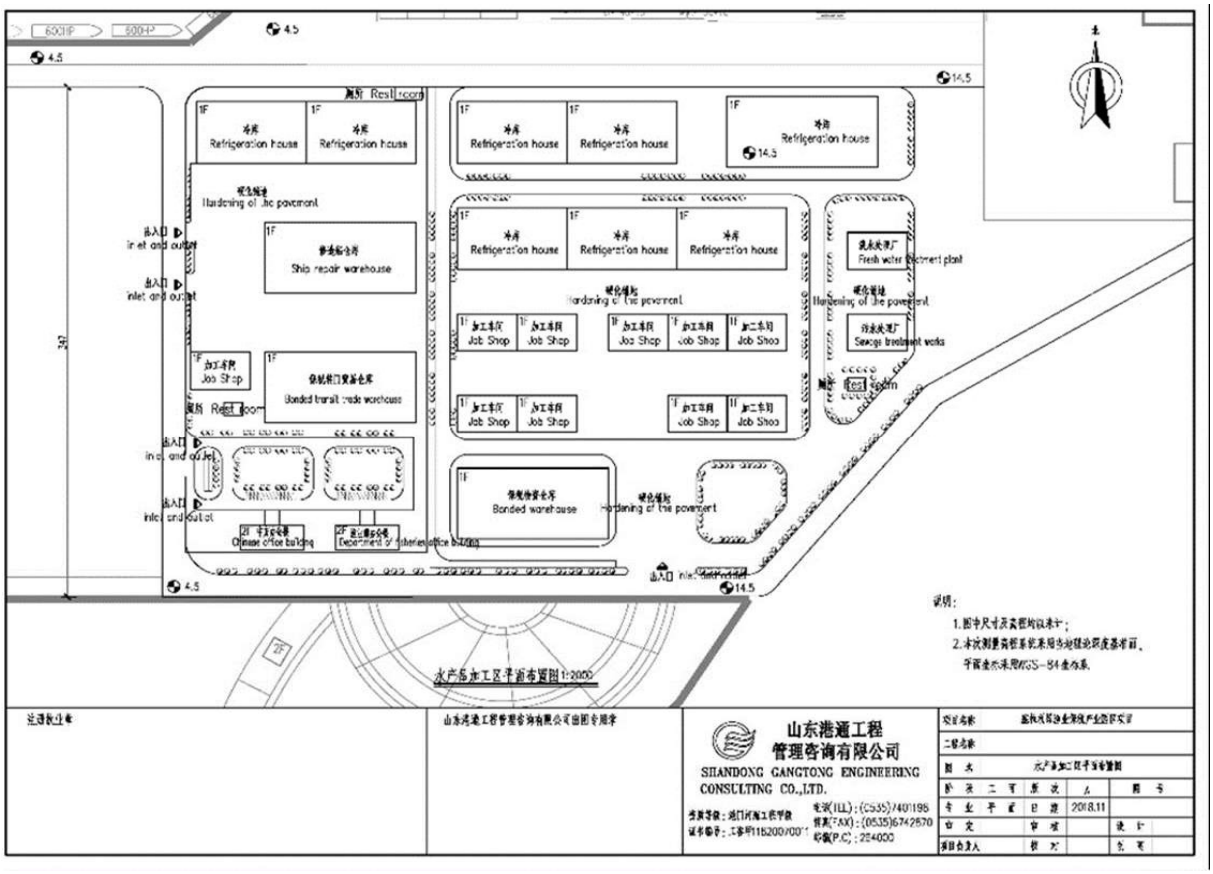
15. What are your expectations if any, for possible resettlement or compensation for the loss of homes, lands, and property as a result of the harbour work?
16. What other needs would you want the Harbour Project to provide for your community, in addition to the Compensation of landowners and the issues highlighted so far?
17. If you were to prioritize the issues you have highlighted so far for community actions by the harbour project, what will be the first five priority areas

……

Appendix 6. Design of Fish Harbour at Black Johnson (Shangdong Gangstong Engineering Consulting (2018)

6.0. Engineering Design of Fish Harbour Development Areas at Black Johnson




Refrigeration house
Hardening of the pavement
Ship repair warehouse
Job Shop
Bonded transit trade warehouse
Bonded warehouse
Chinese office building
Department of fisheries office building
Fresh water treatment plant
Sewage treatment works
Rest room
水产品加工区平面布置图 1:2000
山东港通工程
管理咨询有限公司
SHANDONG GANGTONG ENGINEERING
CONSULTING CO.,LTD.

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