Environmental & Social Management Plan (ESMP)

Mano River Union Road Development and Transport Facilitation Programme (MRU/RDTFP) Phase-III

Paving of Putuken - John Davis Town Road Corridor (50Km) River Gee and Grand Gedeh Counties

MINISTRY OF PUBLIC WORKS

THE GOVERNMENT OF LIBERIA

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LIST OF ACRONYMS

AfDB ....African Development Bank
Db ....Decibel
E&S ....Environmental and Social
EPA ....Environmental Protection Agency
EPML ....Environmental Protection and Management Law of Liberia
ESIA ....Environmental and Social Impact Assessment
ESMP ....Environmental and Social Management Plan
FDA ....Forestry Development Authority
FTHRP ....Fish Town-Harper Road Project
GOL.....Government of Liberia
GRM ....Grievance Redress Mechanism
HIV/AIDS..... ....Human Immunodeficiency Virus
ISS..... Integrated Safeguards System
km..... ....kilometer
LEC.....Liberia Electricity Corporation
LLA.....Liberia Land Authority
m^3 ....Cubic meter
MC..... Monitoring Consultant
MGCSP..... Ministry of Gender Child and Social Protection
MME.....Ministry of Mines & Energy
MOJ..... Ministry of Justice
MoL ....Ministry of Labour
MPW ....Ministry of Public Works
MRU/RDTFP ....Mano River Union Road Development & Transport Facilitation Programme
NOx..... ....Nitrogen oxides
OSs .....Operational Safeguards
PAPs.....Project Affected Persons
PIU ....Project Implementation Unit
PM ....Particulate Matters
PPE ....Personal Protective Equipment
RAP .....Resettlement Action Plan
ROW .....Right of Way

1.0 INTRODUCTION

1.1 Background

The Government of Liberia (GOL) has identified road infrastructure development as one of the key areas of its development agenda. The country's road network is in deplorable condition and needs urgent attention in order to drive economic activities around the country. It is believed that of the estimated 10,538Km of public roads in Liberia, only a minute portion about 7% (734 Km) are paved. In this regard, the Governments of Liberia is in talk with the African Development Bank (AfDB) to construct portion of the 510Km of Ganta to Harper road that linked three south-eastern counties (Grand Gedeh, River Gee, and Maryland counties) with an estimated population of one (1) million (25% of Liberia's population). The three counties also link Liberia to Ivory Coast via the Cavalla Customs in Maryland County which forms part of the Mano River Union Road Development and Transport Facilitation Programme as well as the Trans-African Highway. The proposed road project (Putuken to John Davis Town (50Km)) which is part of LOT-3 (Zwedru to Fish Town in Grand Gedeh and River Gee counties) is a continuation of the 510Km road development from Ganta, Nimba County, to Harper, Maryland County. The entire 510Km road corridor was portioned into two (2) Sections. Section 1 is the road from Ganta to Zwedru, while Section 2 is the road from Zwedru to Harper and Harper Junction to Cavalla Custom in Mary Land County. Section 2 under which this report covered, was further phased into three (3) LOTS. The Government of Liberia has approached the AfDB for funding for a 50Km section of LOT-3 between Putuken to John Davis Town for which this ESMP has been developed.

1.3 The Purpose and Objectives of the ESMP

This stand-alone ESMP has been developed to fulfill the requirements of the AfDB Integrated Safeguards System (ISS). The ISS requires Category 1 projects to develop stand-alone ESMP in addition to project Environmental and Social Impact Assessment report. The specific objectives of the ESMP are as follows:

(i) to inform would-be contractor's environmental and social mitigation cost

(ii) to establish clear procedures and methodologies for the environmental and social screening, planning, review, approval and implementation of the project's components;

(iii) to specify appropriate roles and responsibilities for implementing and monitoring mitigation measures;

(iv) to determine the training, capacity building and technical assistance needed to successfully implement the provisions of the ESMP and other related plans;

(v) to establish detailed itemized cost requires for ESMP implementation; and

(vi) to provide practical information on resources, including sources of funding, for implementing the ESMP.

2.0 PROJECT DESCRIPTION

2.1 Project Development

The overall objective of the third Phase of the Programme (as was the case with the ongoing two phases) is to boost the post-conflict economic recovery of the three countries in the MRU region by improving road infrastructure and promoting intra-community and regional trade.

Specifically, the Programme seeks to improve transport conditions on the two road sections and bridge in order to reduce transport costs, facilitate the free movement of persons and goods between the two countries and improve the living conditions and wellbeing of programme area communities.

The expected outcomes include: (a) reduced transport costs and travel time; (b) enhanced potential for agriculture thereby contributing to food security and alleviating poverty among communities on the corridors; (c) improved road safety and social wellbeing and (d) improved regional trade and integration.

2.2 Project Components

The project has four components including the following: (i) Road development and mitigation of negative environmental impacts, (ii) Social Infrastructure and Institutional support measures, (iii) Transport and Trade facilitation, and (iv) Programme management

2.3 Project Location

The Ganta – Harper road network runs from North-eastern Liberia to South-eastern Liberia. Section 2 – Zwedru – Harper runs entirely in the south-eastern part of Liberia. This section has been divided into three (3) lots. This ESIA covers Lot 3 for the section beginning from Putuken to John Davis Town (50Km) situated in Chedepo and Putu districts in River Gee and Grand Gedeh counties, respectively

The existing laterite road is a primary two-lane highway, which traverses mostly rural communities and is located between River Gee and Grand Gedeh counties and extends over a length of 50 Km between the towns of Putuken and John Davis Town. The entire Putuken to John

Davis Town corridor is unpaved and has been engineered to good riding comfort due to regular maintenance work by MPW although some parts of the road remained in a very deplorable condition and inaccessible mostly during the rainy season. The carriageway is narrow due to overgrown vegetation. The project road has about three major junctions: Jedepo Junction/Combat Gate near Kilepo , Putu Pennokon Junction/Sapo Check Point, and CVI Junction, John Davis Town. Major towns on the project road include, Putuken, Kilepo , Putu Pennokon, Boley Town, Farley Town, Gbejolobo Town, Petrokon or Tiama Town, Panrrow Town and John Davis Town. Road passing through these towns is unprotected by drains to carry runoff from the carriageway. The horizontal and vertical alignments mostly follow the existing rolling terrain with occasional steep vertical grades within the corridor. The elevation at site varies between 35 and 300 meters above sea level. Approximately there are about 22 towns and villages along the proposed corridor and 31 streams/creeks that would require culverts installation in line with the design specification. The project road section has lane configuration from single lane to two lanes. Location map of the project and general is map of the South-eastern Corridor are shown in Figures 1 and 2, respectively.

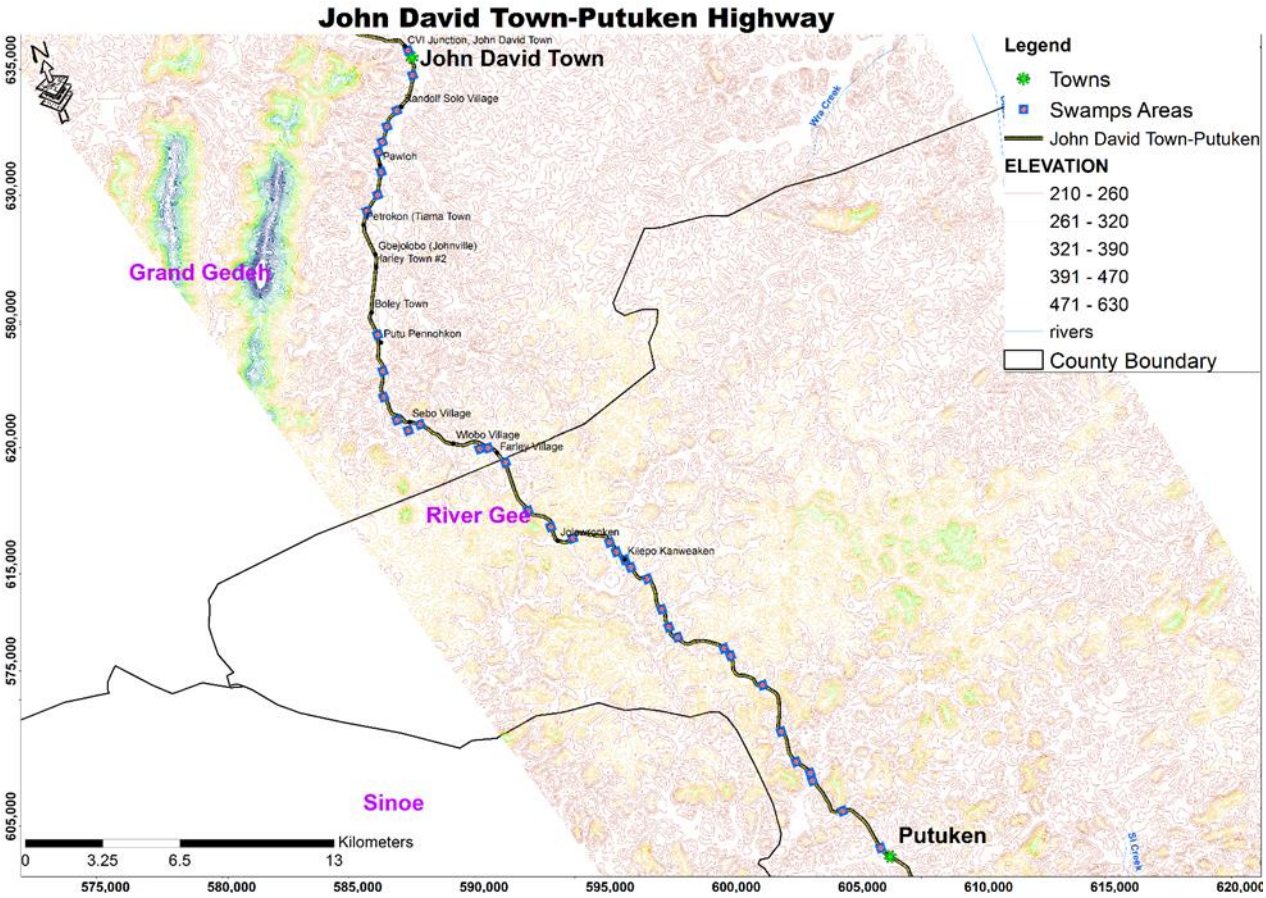

Figure 1 Project Location Map

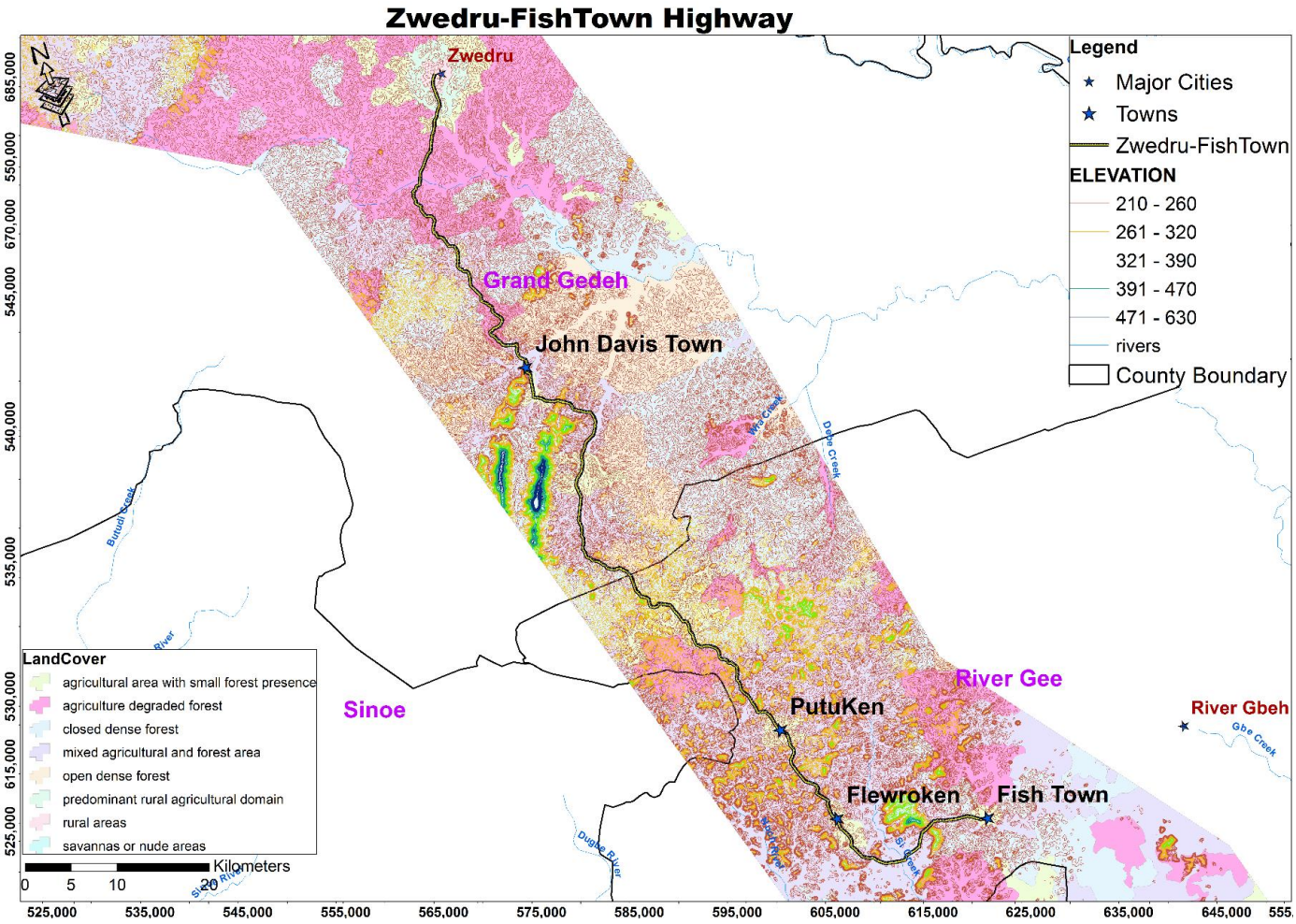

Figure 2 Location Map of Southeastern Corridor

3.0 LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 National Legislative Framework

3.1.1 The 1986 Constitution of Liberia

The 1986 Constitution of the Republic of Liberia, specifically Article 7, sets the basis for legal and institutional framework for the protection and management of the environment in Liberia. It provides for public participation of all citizens in the protection and management of the environment and natural resources in Liberia. The Environment Protection Agency (EPA) of the Republic of Liberia was established on November 26, 2002 by an Act of the Liberia National Legislature under the Executive Branch of Government to function as an autonomous body with the principal authority for the protection and management of the environment in Liberia. The Constitution sets the basis for the formulation of several environmental regulations, policies, and laws that are relevant to this project. The relevant regulations, policies, laws, and guidelines are discussed below.

3.1.2 The Environmental Protection Agency Act (2002)

The Environmental Protection Agency of Liberia was created by this Act. The Act was approved (enacted) in 2002 and published in 2003. Section 5 of the Act designates the EPA as the principal Liberian authority for environmental management which shall co-ordinate, monitor, supervise, and consult with relevant stakeholders on all the activities for environmental protection and the sustainable use of natural resources. Section 6 (b) of the Act stipulates that the EPA should propose environmental policies and strategies to the Policy Council and ensure the integration of environmental concerns in the overall national planning.

3.1.3 The Environmental Protection and Management Law (EPML) of Liberia

The EPML is the principal piece of legislation covering environmental protection and management in Liberia in parallel to the EPA Act. The Act provides the legal framework for the sustainable development, management and protection of the environment by the EPA in partnership with relevant ministries, autonomous agencies and organizations. It also stresses inter-sectoral coordination while allowing for sector specific statutes. The Environment Protection and Management Law (EPML, 2003b) defines the specific requirements for performing an ESIA and other measures required to protect the environment in Liberia.

Section 6 of the EPML requires an ESIA license or permit for the commencement of projects that have the potential to impact the environment. An ESIA is required for some specific types of projects as defined in Annex I of the EPML, while the need for an ESIA for other projects may be determined on a case-by-case basis after review of project brief by the EPA. The small-scale infrastructure development aspects of this project will require the project to acquire environmental permit prior to the commencement of activities in that category. The flowchart below provides the environmental screening process of the EPA, while the Table 1 provides summary of relevant EIA regulations, policies, and guidelines.

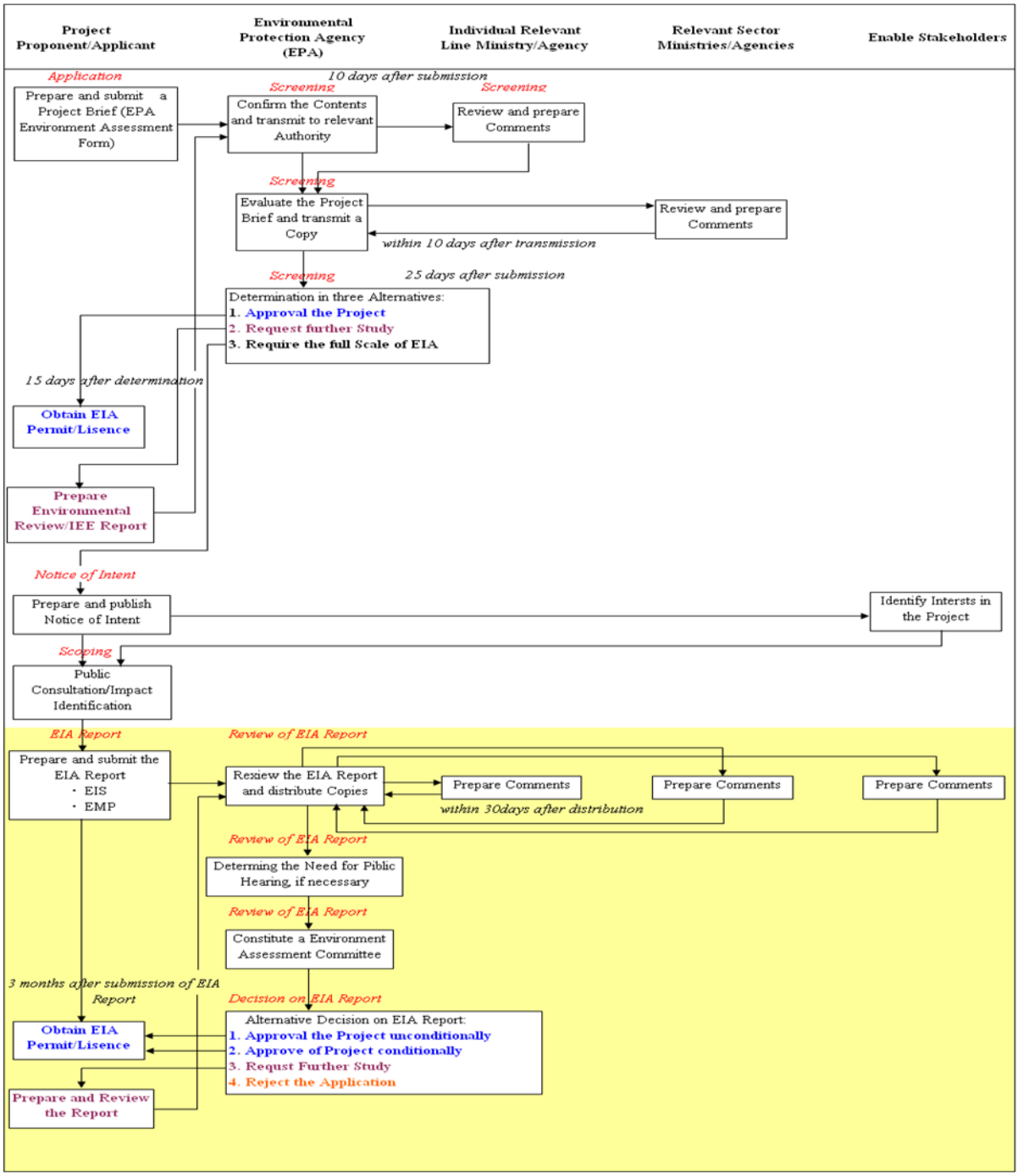

Figure 3 EIA Process in Liberia

Table 1 Relevant Environmental and Social Regulations, Policies, Guidelines

Title	Year	Description
National Environmental Policy	2003	The policy provides a systematic and logical framework by which to address environmental issues. Section 4.7 of the policy calls for an ESIA on all major developmental, socioeconomic and land use activities in any form that may have adverse effects/impacts on the environment to one degree or another.
Environmental & Social Impact Assessment (ESIA) Procedural Guidelines	2017	The ESIA Procedural Guidelines provides administrative procedures for the preparation of ESIA to ensure effective environmental governance.
National Biodiversity Strategy and Action Plan	2004	The policy implements the United Nations (UN) Convention on Biological Diversity, of which Liberia is a member, on the national level.
National Forestry Policy	2006	The policy describes the main directions for the future of forestry development in Liberia, and updates earlier polices so they take into account the new Forestry Reform Law.
National Forest Management Strategy	2007	The strategy summarizes the FDA's approach to managing the national forest endowment. It includes objectives, goals, and management actions in pursuit of the overall aim to "conserve and sustainably manage all forest areas so that they will continue to produce a complete range of goods and services for the benefit of all Liberians and contribute to poverty alleviation in the nation" (FDA 2007, 4).
National Health Policy and National Health Plan[1]	2007	The document is a framework for health sector reforms in Liberia. The goal of the policy is to make health care delivery

[1] Liberia Ministry of Health and Social Welfare. 2007. National Health Policy and National Health Plan. Accessed from the ILO website: http://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---ilo_aids/documents/legaldocument/wcms_126728.pdf

		services throughout the country effective and efficient, thereby enhancing the quality of life of the population.
National Gender Policy	2009	The Policy is intended to eradicate and eliminate all gender related problems in Liberia.
Land Right Policy	2013	The policy provides recommendations for land rights in Liberia, centered on four basic types of rights: Public Land, Government Land, Customary Land and Private Land. The policy also fosters equal protection of all relative to all land matters. The policy recognizes that since the founding of Liberia, the lands of customary communities have been less secure than private lands. This must end such that land under customary practice and norms are given protection equal to that of private lands i.e. the land right of men and women.

3.2 The African Development Bank Safeguards Requirements

All the five Operational Safeguards have been triggered by the project. The project is Categorized as Category 1 under the ISS. This is also in line with the national environmental impact assessment requirements which requires a full ESIA for this project as the AfDB. Based on the project category, the ISS requires a full environmental and social impact assessment to be conducted. A stand-alone Environmental and Social Management Plan (ESMP) is also required. A full Resettlement Action Plan (RAP) has been developed as required.

3.3 National Administrative Framework

Environmental and social governance in Liberia is divided between the EPA and some other ministries and national authorities on the national level, and the Environmental and Social Committees, on the local level.

At the national level, the Environmental Protection Agency (EPA) of Liberia is the main agency and principal authority for environmental management. In addition to the EPA, other institutions involved in environmental protection and management include the Ministry of Mines and Energy (MME), the Ministry of Agriculture (MoA), the Forestry Development Authority (FDA) and the Liberia Land Authority (LLA). Other institutions, including the Ministry

of Gender, Children and Social Protection (MGCSP), the Ministry of Justice (MoJ), and the Ministry of Labor (MoL) have various social protection responsibilities.

At the local level (county and district level), the EPA Act authorizes the establishment of County and District Environmental Committees and directs the National Environmental Policy Council to provide guidelines for their establishment. Each County Committee is composed of county and district officials, traditional leaders, private citizens, and two local representatives to the national legislature. The Committee is staffed by a County Environment Officer, hired by the EPA, but responsible to the County Committee.

The District Environment Committees are to be established by and report to the relevant County Environment Committee. They are charged with promoting environmental awareness and mobilizing the public to manage and monitor activities within the district to ensure that they do not have any significant impact on the environment. The District Committees are composed of district officials, mayors, chiefs, and private citizens and are staffed by a District Environment Officer hired by the EPA.

In addition to assisting the County and District Committees in the fulfillment of their responsibilities, the County and District Environment Officers are responsible for compiling reports to the EPA, promoting environmental awareness, and conducting public hearings on environmental impact assessment in the County and the District.

The EPA Act also provides for the establishment of an Environmental Court and the appointment of Environmental Inspectors to ensure the enforcement of environmental requirements and standards developed by the EPA.

4.0 BRIEF DESCRIPTION OF BASELINE CONDITIONS

4.1 The Existing Bio-Physical Environment

The Putuken to John Davis Town road runs across the forested landscape of the Liberian hinterland. The terrain is gently undulating, consisting of the weathered lateritic peneplain of Southeast Liberia. This has few rock outcrops, but deep, strongly weathered soils. The soils are ferralsols (latosols or laterites), rich in iron and aluminium, generally quite infertile and highly erodible where they are disturbed or vegetation is removed. The landscape is highly dissected by small creeks, and larger streams and rivers, which drain into the Cavalla River.
As for the whole of Liberia, the climate is humid tropical with pronounced wet and dry seasons, running from May to October and November to April respectively. The average annual rainfall is in the range of 1700 to 1800 mm. June, July and September are usually the wettest months, and December and January the driest.

The road corridor runs through an area that was previously fully forested. This forms part of the Upper Guinea evergreen hardwood tropical rainforest that originally ran right across West Africa, but which now has some of its main relics in Liberia. It is very species diverse, with over 2200 vascular plants. There are no protected areas or other conservation sites in the vicinity of the project location, and the habitats all appear to be modified. All of the forest near the road is now either disturbed and degraded by shifting cultivation or logging, or has been replaced by active shifting cultivation, sedentary lowland rice cultivation, or tree plantations.

There is frequently a blurred distinction between forest and agriculture in this landscape, partly because the prevailing shifting cultivation system moves land from forest to farm for a short period, followed by a long fallow period during which the abandoned land becomes bush until forest re-establishes itself to some extent. Farming households also depend on the remaining forest for a wide range of non-timber forest products and bushmeat. In addition, many tree plantations are under-managed, so that they are difficult to distinguish from secondary forest.

The broad biodiversity of the forest plants is complemented by a significant animal biodiversity. This is clearly depleted from what would be found in primary forest, but is still likely to be considerable in some areas. There are no large mammals in the road corridor, but the forests, bush and riverine areas, and even the active farmland and plantations, provide

modified habitats that still support large numbers of small mammals, reptiles, amphibians, birds and insects.

Since most of the road passes through rural areas, and with relatively low traffic levels, air quality seems to be good during the wet season. Dust is known to be a significant nuisance during the dry season, and will become worse during construction before being almost eliminated on the road itself as a result of the paved surface.

Ambient noise is currently also at acceptable levels, though it can exceed national standards for short periods locally. Examples of this identified during ESIA preparation were heavy machines operating, some agricultural activities and a celebration.

4.2 The Existing Socio-Economic Environment

The project proponent ensured that a Socio-Economic Survey (SES) was conducted of the Project Affected Persons (PAPs), who are the owners and tenants of structures within the right of way of the area – Putuken Town to John Davis Town (50 Km), River Gee and Grand Gedeh Counties. However, as the project proponent has already conducted RAP for Lot 1 and 2, this assessment, even though branded as "Putuken Town, River Gee and Grand Gedeh Counties", begins just outside of the urban demarcation of Putuken.

Economic development has been held back by the condition of the road, which inhibits traffic and raises transport costs in the wet season. Farmers cannot sell produce easily as buyers cannot get to them and investment in tree crops is limited as transport difficulties mean it is not economically worthwhile harvesting the trees. Most farms are subsistence and grow mostly rice and cassava crops for home consumption. Income and expenditure data were not collected, but indicators of wealth were. Wealthier families tend to own vehicles, have generators and often have a non-agricultural business interest. The majority of wealthier households are located in the cities and larger towns.

The illiteracy rate – never having attended school, unable to read and write, and aged over 15 years – is higher (14 percent) than the national average (12 percent) but the data show that at least five years of education is achieved by most, that drop-out rates are low and that the numbers of children out of school are at low levels. Liberia has had a tremendous push towards improving the quality of and extending school networks into rural areas, and this is evident in the distribution of schools in the project area of influence. Most graduates identified in the survey are living in Zwedru.

4 PROJECT ALTERNATIVES

4.1 Basic Rationale

This ESIA study sought to consider possible alternatives to the proposed project. These alternatives included among other considerations the "No Project Alternative", the Alternative Locations and the Alternative Designs.

4.2 Alternative Mode of Transportation

There are no alternatives to this road that fulfil the functions of providing relatively fast, cheap land transportation. Air, rail, and water transport are unlikely to either complement or substitute for roads or highways in this region. There is no railroad link in or near the project area. Hence, rail is not considered as an option. There are no water bodies that can be used as a mode of transportation in the project area. Streams or river in and near the project area are neither connected nor navigable. The only possible means is air transport but, this is a rather expensive alternative and cannot be used as an alternative to the road.

4.3 Do Nothing Option or "No Project" Option

This alternative implies that the selected road corridor in River Gee and Grand Gedeh counties will not be improved and that it would be left in its present state characterized by several defects and related impacts. The project is expected to generate enormous benefits for both the local and national economies. The potential benefits hugely outweigh the potential negative risks and impacts. Therefore, this option cannot be pursued and the project has to go ahead.

4.4 Engineering Intervention Option

This option assumes that engineering measures will be provided to correct the problems highlighted to improve the safety, health and social conditions of the local communities. In considering the various alternative solutions to the present state of the roads, the project aims of making accessible the Southeast region of Liberia to increase productivity, reducing transportation costs for the agricultural target centers and improving critical social services, and road safety, have been considered.

4.5 Route Alignment Alternatives

Factors such as engineering design standards and best practice, road safety, farming activities, existing and future mining activities, existing and future services, i.e., power lines, pipelines, and existing and future town developments were considered. Landowner needs were also considered, all within the norms of engineering, practicality and financial viability. All parties including project affected persons have agreed on the position of the alignment and the road reserve will be proclaimed and landowners and PAP will be paid compensation

4.6 Material Acquisition

Construction material - borrow materials (laterite gravel), sand and rock deposits identified are all within an average haulage distance less than 3km offsets from the existing road alignments. Acquisition of these materials will be established with the contractor and the MLME and with the consent of land owners. Impacts of transport of materials to site will not be significant as the distances are short and the road corridor is not very populated.

4.7 Route

Overall, the route from Putuken - John Davis Town Road Corridor is relatively passing through a number of rural towns. However, it has few straight sections because of the undulating terrain and the need to cross the numerous stream lines at advantageous points. As it is, the road will need some improvement in horizontal and vertical alignments for safe and comfortable ride. However, it is not intended to realign more than short sections, and to utilize the existing alignment to the greatest extent possible. By this means the project will avoid the need for significant additional land take.

4.8 The Preferred Alternative

The advantages to be derived from the road improvement alternative far outweigh the disadvantages of the “Do Nothing Option”. Although there are environmental implications associated with the improvement alternative, appropriate mitigation measures would be implemented to control them, thus justifying the case for implementing the project. Even though the initial cost of the paved road improvement program would be high, the accrued benefits to be derived from this option socially, environmentally, and economically, far supersede all other options. For reasons of life-cycle cost, safety, better, safer driving,

environment, traffic volumes, and citizen interest, in the operational phase, an asphaltic concrete pavement surface consistent with the rest of the FTHRP corridor is recommended.

5.0 ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

5.1 Positive Impacts

5.1.1 Employment Opportunities

The project will create employment opportunities both directly or indirectly during construction and operational phases. Socio-economic study infers that there are a lot of local human resources. Therefore, most people will be employed as semi-skilled and casual workers. Few skilled workers will be available. It is anticipated that approximately 200 people will be employed directly and indirectly during the project period.

5.1.2 Improved Local Socio-economy

The communities acknowledged that the project road will contribute to the growth and development of the local economies of the two (2) counties; business at the major towns along the road and the following socio-economic benefits:

- Increased business opportunities at the market centers due to the presence of the project workforce during construction;
- Employment of locals during the construction phase of the project; and
- Strengthening of local economy through the establishment of micro-enterprises such as bulking points, catering services etc.

5.1.3 Ease of Road Transport in the Project Area

Construction of the proposed road will improve transport and communication in River Gee and Maryland Counties area because of improved road surface. After construction, the road will improve transportation of goods, commodities and services to and from the project area. This is a large positive impact.

5.1.4 Improved Living Standards

The implementation of the project will result in the improvement of the living conditions of population living along the road and the two counties in general, thus contributing to poverty reduction. The communities felt that the journey time will be shortened and there will be improved access to markets to sell their produce. Both the male and female gender felt that the upgrading of the road will result in efficient traffic flow with savings in both time and cost, thus there will be improved communication, which at present is a big problem.

5.1.5 Increased Security

The area where the road traverses is neighbouring an area largely peaceful. However, incidents of theft do occur along the way due to the scarce road users at present. Better road usage with frequent passers-by would result in an improvement of security. The upgraded road will also increase easier movement by security personnel. Any improvement in security from the current levels would be a major benefit to the communities.

5.1.6 Education

Better road communication would open up the area for development, which would also lead to building of more schools and other advance institutions of learning. This would eventually lead to improvement of education institutions in the area. Any improvement in educational attainment from the current levels would be a major benefit to the communities.

5.1.7 Improved National Transport

The main mode of transportation in the area is road transport, which is used for transportation of passengers and goods to the various town centers along the project area. There are no other affordable options for transport in the project area. With improved road conditions, it is expected that there will be improved transport within the region. This is likely to benefit the local and regional economy in the short term and the national economy in the long term. There will also be easier access to the essential services offered in the neighbouring towns and cities.

5.1.8 Road Safety

Road projects can lead to reduction in accidents when they involve significant improvements in vertical and horizontal alignments, improved carriageway width, junction layout or greater separation of pedestrians, non-motorized traffic and motor vehicles. The proposed project design will contribute to improving road safety and the comfort of road users in several ways:

1. Sight distance and visibility especially at approaches to bridges will be improved;
2. Road signs (both warning and directional) and road markings have been included in the design; and
3. Adequate shoulders have been designed throughout its length.

5.1.9 Empowerment of Women

Women play an important role in agriculture and general economy of the project area. However, the existing road makes it hard for women to access markets for their products due to the high transport costs as public transport operators are few and as a result the fares are high. The poor state of the road leads to use of old motorcycles, converted cars, buses and trucks. These vehicles are very uncomfortable, gender insensitive and often overloaded as there is no space for comfort. It is even worse for women who are pregnant. Due to poor state of the road, it takes very long for women to reach trading centers and hospitals. This will however change with the construction of the proposed road, thus empowering women in the counties.

5.1.10 Improved Drainage

The proposed road is expected to improve drainage infrastructure and general discharge of storm water from the road/carriageway which will reduce soil erosion in the project area. This will be a major gain to the present road condition as there are signs of serious erosion in several places.

5.1.11 Improved Access to Services

Majority of the inhabitants of the project area have difficulty in accessing markets, schools, hospitals, government offices and other amenities. This is due to high transport costs, longer travel time, low economic growth and poor/lack of services due to the poor road network in the area. This will be eliminated with the construction of the road.

5.1.12 Reversal of Rural Urban Migration

Most of the people in the project area have shunned investing in the area and mass exit of human resources especially the youth in search of opportunities and services in urban areas. The road will enhance access to services, markets and stimulate economic activities in the area, thus reducing and reversing rural urban migration which has become a major planning concern in the country.

5.2 Potential Risks and Negative Impacts

5.2.1 Impact on Topography

The part section of road between Putuken and John Davis Town passes through few hilly areas with majority of the land covered is swampy land. During widening of the existing corridor there would be cutting of slopes and filling which would change topography at some parts of these sections of the road. Earthwork for this would alter the existing topography, although the impact of the same would be negligible. In addition, the project road is passing through a terrain prone to earth flows/mass movement erosion and landslides due to the geological nature of the terrain. Protection measures need to be taken through construction, which might alter the topography at a localized level.

5.2.2 Impacts on Surface Water Drainage

Several streams cross the project road. Apart from these, there are various small drains, and water pans draining the areas along the project section. In the hilly section, there are various valley drainage lines, which cross the project road. Minor impacts are anticipated on the surface water drainage in the area during the construction phase due to the diversion of waterway. Precautions need to be taken during the construction work of culverts and bridges across these streams such that the flow in these water bodies is not obstructed, thus affecting the cross drainage. In addition, any embankment work in low lying areas shall have provisions for cross drainage for natural drains to ensure that flow is not affected during the construction phase.

5.2.3 Impact on Climate

The proposed project is likely to improve the existing road and no changes in climatic conditions are anticipated. Moreover, landscaping is envisaged in the area along the entire length of the road, which will help in improving the overall microclimate of the area. The improvement works envisaged in the existing road does not have any significant microclimatic impacts.

5.2.4 Impacts on Soil Environment

5.2.4.1 Mass Movement - Erosion

It was observed along the existing road that mass movement erosion is a common phenomenon. Most of these soil movements are small, but the areas affected by mass movements are usually completely destroyed and rendered non-productive for further agricultural use. Such areas need considerable efforts and investments for reclamation. The loss of fertile land, even if the area is very small, is always a serious drawback for farmers**.** Among other land use causes, surface runoff entering into these cracks could then cause rapid over-saturation of the surface layers leading to wet earth flow and subsequent slumping of the up-slope part of the crack, thus forming an initial erosion scar. Because of the evenly distributed rainfall, the soil remains saturated over long periods. Less permeable under layers restrain deep percolation, encouraging lateral water movement and lead to temporary waterlogged conditions. These will cause plastic or even liquid-state conditions encouraging wet earth flow. This tendency will be greatest on steep slopes and may explain why all erosion scars observed in the area are located on convex slope sections.

5.2.4.2 Impact on Top Soil

The impact on soil due to the project will be in terms of topsoil erosion. Strengthening and widening of the existing road will not cause significant soil erosion. Soil pollution would take place to a negligible extent due to spillage of construction material, oil, fuel, grease and asphalt around the construction yards. Care will be taken to minimize spillages of construction materials.

Loss of productive soil, during the construction stage, is envisaged at locations of workers' camps, stockyards, storage, etc. if these are located on fertile areas. The contractor should ensure that no productive areas are used for these purposes and avoid adverse impact. In any case, though it would be a direct impact, it would be reversible and insignificant in nature. The soils in the road alignment are of loam to clay loam soils being capable of producing high yields. Soils both within and outside the road corridors may be negatively impacted due to the proposed project.

The loss of productive topsoil due to road construction is a direct adverse long-term impact. Since a major portion of the proposed road is on the existing alignment and do not utilize

agriculture land, there will be minimum permanent loss of agriculture soil and land due to the road construction. In addition to this, there will be temporary impact on productive soil at diversions, and labour camp due to leasing of land for construction period. Hence, the impact on soil during construction phase has to be controlled by strictly implementing the ESMP suggested for the project. During the operation phase of the proposed project roads, no impact on the productive top soil is envisaged.

5.2.4.3 Soil Erosion

The soil in the study area varies from loam to clay loam soils. Therefore, the potential for erosion varies along the alignments. Soil erosion will be aggravated if the vegetation is removed from the sides since roots are known to hold soil together. This will however be for a temporary duration until the compensatory afforestation and roadside turfing have matured. It will not be possible to widen the existing road without removing small trees and therefore erosion will be unavoidable. Mitigation measures such as turfing of road embankment slopes with shrubs and grasses will take care of soil erosion in to a considerable extent. In borrow pits, the depth of the pits should be regulated so that the sides of the excavation will have a slope not steeper than 1 vertical to 4 horizontal from the edge of the final section of bank. The device for checking soil erosion includes the formulation of sediment basins, slope drains etc. Cutting of trees in phases will minimize the impact.

No soil erosion is envisaged when the road is in operation as all the slopes and embankments of the project road shall be stabilized through turfing and pitching.

5.2.4.4 Contamination of Soil

Contamination of soil during construction stage is primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur in hot-mix plants from leakage or spillage of asphalt or bitumen. Refuse and solid waste from labour camps can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.

However, by following mitigative measures such as maintenance of vehicles and machines and fuel refilling in a confined area, contamination of soil can be avoided to a great extent. The provision for oil interception chamber is suggested in the ESMP for treating the waste water generated from vehicle washing, refilling and maintenance areas. Fuel storage and refilling sites should be kept away from cross drainage structures and important water bodies. All spoils shall be disposed of as desired and the site shall be fully cleaned before handing over. These measures are expected to minimize the impact on soil contamination.

During the operation stage, soil pollution due to accidental vehicle spills or leaks is a low probability but potentially disastrous to the receiving environment, if they occur. These impacts can be long term and irreversible depending upon the extent of spill. The nearest cities should have fire fight facilities in order to meet the risks during the operation phase of the highways.

5.2.5 Impacts on Water Resources Environment

5.2.5.1 Impact on Surface Water Quality

The proposed road corridors are not expected to alter the existing water quality on a permanent basis. There are various water bodies, along the corridors including rivers, backwaters, and streams. Some impacts are anticipated on the water quality of these water bodies during the construction phase. Silt load in the streams at the culvert and bridge locations may increase during construction and the spillage of hazardous chemicals during accidents may pollute the waters thereby, affecting the ecosystem. The issue of blocking of cross drainage should be taken care throughout the project stretch. Care needs to be taken during the construction of culverts and bridges. In case of any water supply system at the downstream of the bridge location, prior information should be made to the concerned towns and villages and the construction activities should avoid discharge of any hazardous chemicals in to water system.

Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers' camps and from spillage in vehicle parking and/or fuel and lubricant storage areas. However, mitigation measures such as construction works close to the streams and other water bodies shall be avoided, especially during wet seasons.

Disposal of waste arising from the project activities should be done by approved waste disposal agents and collecting and storing of bituminous wastes and taking it to approved disposal sites will minimize the impact.

During the operation phase, the possibility of degradation of water quality is very remote. The impact on the surface water quality during operation can be expected due to accidental spillage. However, the probability of such accidents is minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are taken care of in the design stage.

5.2.5.2 Impact on Ground Water Quality

No activities of the project construction or operation are expected to have any impact on the ground water quality of the region and hence the impacts on the ground water quality are not anticipated.

5.2.6 Impacts on Air Environment

Vehicular emissions are one of the major sources of air quality impacts of highway projects. As the project envisages improvement of road conditions for smooth traffic flow, the project will have beneficial impact on air quality of the region during its operation. However, when viewed with respect to the existing ambient air quality or with respect to compliance of ambient air quality standards during the post upgrading phase of the road stretch, due to the increase in the traffic volume, the impact on air quality along the project roads is likely to be minor. Impacts on air quality during the construction phase of the project will be considerable as the amount of work involved in improvement of the road is significant, but any possible impacts will be temporary. However, provision of adequate air pollution control equipment, like dust filters and measures like dust suppression by water sprinkling and planting of green belt may further help to significantly reduce the impact.

Emission of CO_2 and NO_x due to the combustion of diesel will be a principal cause of air pollution during the construction phase. After improvement of the existing road, the traffic is expected to move smoothly at higher designed speeds, which will assure lower emissions of gaseous pollutants, further improving air quality in the region and hence not expected to affect the air quality adversely. However, the extent of these impacts, at any given time will depend upon the rate of vehicular emission within a given stretch of the road; and the

prevailing weather conditions. The impacts will have strong temporal dependence as both of these factors vary with time. The temporal dependence would have climatic, seasonal, as well as long-term components.

5.2.7 Impacts on Ambient Noise Level

During the construction phase of the road, the major sources of noise pollution are vehicles transporting the construction material to the construction yard and the noise generating activities at the yard itself. Mixing, casting and material movement are primary noise generating activities in the yard and will be uniformly distributed over the entire construction period. Construction activities are anticipated to produce noise levels in the range of 80 - 95 dB (A). The construction equipment will have high noise levels, which can affect the personnel operating the machines.

5.2.8 Impacts on Fauna, Flora and Ecological Environment

5.2.8.1 Impacts on Fauna

The increased activities of vehicle movement disturb the sensitive movements of fauna. The impacts are expected to be more severe during the times of accidents of vehicles carrying hazardous chemicals. In the absence of proper accident management mechanisms, such accidents will be very hazardous to flora and fauna of the region. Some sections of the proposed upgrading of the road to asphalt standard are near forest areas. From the site visits and discussion with officials, it is inferred that there are no noticeable habitats or wild or endangered animal habitats along close vicinity of the project road. This can be inferred due to the presence of farmlands and human settlements along existing roads. But upgrading of the road will result in increased human activities along the project area. Further, noise due to construction machineries and increased vehicular movement for raw material transportation for road construction will disturb the fauna along the area during construction phase. Due care should be taken in the construction stage that human activities should be completely restricted to the proposed road corridors such that there should not be any human ingress in to forest areas for poaching of animals / any other natural features.

5.2.8.1 Impact on Ecological Resources

The road passes near forest areas. These areas are rich in bio-diversity as presented in base line environmental profile of the project road. The envisaged borrow pits and land acquisition

in the project road will bring about hill cutting and tree cutting. This may result irreversible and long-term impact on the flora and fauna of the project area if properly planned.

5.2.9 Impacts on Human Use Values

5.2.9.1 Land Acquisition

The proposed upgrading of the project road will involve land acquisition and demolition of road side structures. A detailed analysis of the impacts of land acquisition and structures in the project area are part of a RAP already undertaken. The project area runs through peri-urban areas and hence the impact of land acquisition is expected to have significant effect on livelihood and economic activities of the project area. The client should therefore ensure that the Resettlement Action Plan prepared for the project area is implemented to mitigate / minimize this impact.

5.2.9.2 Construction of Site / Camp Buildings

This activity will involve construction of buildings for office, construction camps and habitation during the construction phase. This may result in clearing of vegetation and pose sanitary & health problems in the construction camps. Due care should be taken to maintain hygienic conditions at site by providing proper drinking water and sanitation facilities. However, the impact due to such activities is reversible and short term.

6.0 MITIGATION MEASURES

6.1 Impact Analysis Matrix

Before providing mitigation measures for potential impacts, impact analysis matrix has been used to determine the significance of each impact. To establish the significance of an impact, magnitude and sensitivity are looked at in combination to evaluate whether an impact is significant, and to what degree. A simple matrix, presented below, is used to assign a significance class for each input in the form of an identified potential impact.

Table 2: Impact Significance Matrix

	Significance of impact	Sensitivity		
		Low	Moderate	High
Magnitude of impact	**Negative impacts**			
	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major
	Positive impacts			
	Positive	Minor	Moderate	Major

Mitigation Measures

Once the significance of a given impact has been characterized using the above matrix, the next step was to evaluate the mitigation measures that are required. In keeping with the standard mitigation hierarchy adopted by the EPML 2002, the priority in mitigation is to apply mitigation measures to the source of impact. This first step is to see if ways can be found to ***avoid*** causing the impact altogether (for example by re-routing a road to avoid a wetland). A second, less good option, is to find ways to ***prevent*** the impact from occurring (such as developing strict working rules to separate workers from machines, thereby preventing injuries). A third option, less good again, is to ***reduce*** the magnitude of the impact from the associated project activity (such as vegetating bare earth surfaces to reduce erosion). ***Restoration*** of damage to the environment will be necessary if prevention proves not to be effective, and also to resolve the residual damage caused after reduction of an impact. In some cases, restoration can be a valid mitigation option in its own right (for example, the replacement of vegetation that had to be removed to provide access to a resource). If none

of these options are possible or are not likely to be fully effective on their own, then ***compensation*** measures may be a resort. These would be to address the resultant effect to the resource or receptor, or to reduce the significance of the effect once all reasonably practicable mitigation options have been applied to reduce the impact magnitude. In some cases, compensation is the only option, such as when a house has to be removed because it is in the road right of way.

Assessment of Impacts

The register matrix in table below (Table 3) shows the actual assessment of the identified social and environmental impacts identified as likely to occur as a result of the design and construction of the upgraded Putuken – John Davis Town Corridor. The matrix forms the basis of the impacts and risks that are included in the mitigation plan in Table 4 below.

Table 3 Matrix for Establishing Impact Significance

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
A. POSITIVE IMPACTS									
Improved supply of transport services	Indirect	Regional	Long-term	N.A.	Positive	High	**Major**	N.A.	N.A.
Reduced transport costs	Indirect	Regional	Long-term	N.A.	Positive	High	**Major**	N.A.	N.A.
Reduced travel time	Indirect	Regional	Long-term	N.A.	Positive	High	**Major**	N.A.	N.A.
Reduced dust nuisance from unpaved highway	Direct	Towns in road corridor	Long-term	N.A.	Positive	Medium	Moderate	N.A.	N.A.
Reduced sediment in roadside watercourses	Direct	Regional	Long-term	N.A.	Positive	Medium	Moderate	N.A.	N.A.
Employment opportunities during construction	Direct	Road corridor	Project duration	N.A.	Positive	Medium	Moderate	N.A.	N.A.

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
Improved opportunities for business with greater movements of people and goods, and reduced transport costs	Induced	Towns in road corridor	Long-term	N.A.	Positive	Medium	Moderate	N.A.	N.A.
Improved access to social services, including health and educational facilities	Induced	Regional	Long-term	N.A.	Positive	Medium	Moderate	N.A.	N.A.
Improved opportunities to access agricultural markets	Induced	Regional	Long-term	N.A.	Positive	Medium	Moderate	N.A.	N.A.
B. NEGATIVE IMPACTS									
1. Overall Impacts									
1.1 General environmental damage in the form of degraded land, lowered quality of living, reduced quality of resources, etc., mainly in the affected rural communities along the road.	Direct, Indirect	Road corridor	Permanent	Constant	Medium	Medium	Moderate	Prevention and restoration	Negligible

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
1.2 Limited awareness or respect about the importance and value of the environment among labour force leads to an excessive amount of damage to resources or disruption of people's livelihoods in the roadside	Direct	Towns in road corridor	Project duration	Constant	Medium	Medium	Moderate	Prevention	Negligible
2. Environmental Health and Safety Impacts									
2.1 Injuries occur to the public, especially children, during works.	Direct	Road corridor	Project duration	Frequent	Small	Medium	Minor	Prevention	Negligible
2.2 Injuries occur to the public from exposure to hazardous substances (e.g. cement, diesel) in the affected communities along the road.	Direct	Road corridor	Project duration	Frequent	Small	Medium	Minor	Prevention	Negligible
2.3 Infectious and contagious diseases are spread amongst the communities near the road.	Indirect	Towns in road corridor	Project duration	Constant, but worse seasonally	Medium	Medium	Moderate	Prevention	Negligible

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
2.4 Sexual exploitation and gender-based violence increase in local communities, particularly the rural towns due to the influx of temporary laborers	Indirect	Towns in road corridor	Project duration	Constant	Medium	Medium	Moderate	Prevention	Negligible
3. Occupational Health and Safety Impacts									
3.1 Workers are unaware of the dangers from the sites (roadline, quarries, batching plants etc.) they are working in, leading to high rates of injury.	Direct	All active work sites	Project duration	Constant	Medium	Medium	Moderate	Prevention	Negligible
3.2 Injuries due to inadequate provision of safety equipment	Direct	All active work sites	Project duration	Constant	Medium	Medium	Moderate	Avoidance	Negligible
4. Community Impacts									
4.1 Incoming workers do not respect local communities, leading to social disruption, particularly in the rural towns.	Indirect	Towns in road corridor	Project duration	Frequent	Small	Medium	Minor	Prevention	Negligible

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
4.2 Houses are lost in the road right of way.	Direct	Road corridor	Permanent	One-off	Large	High	**Major**	Compensation	Minor
4.3 Loss of land use and business sites in the road right of way, particularly in the three cities.	Direct	Road corridor	Permanent	One-off	Medium	Medium	Moderate	Compensation	Negligible
4.4 Cultivated land and crops are disturbed or destroyed, mainly in the rural areas along the road and in the locations chosen for quarries, borrow areas, camps, batching plants, etc.	Direct	Road corridor	Long-term	Constant, but worse seasonally	Medium	Low	Minor	Avoidance or reduction	Negligible
4.5 Local people's livelihoods are adversely affected by project activities.	Direct, Indirect	Road corridor	Short-term	Constant	Small	Medium	Minor	Avoidance or compensation	Negligible
4.6 Cumulative losses are incurred by social groups unable to respond to change.	Indirect	Road corridor	Long-term	Constant	Medium	Medium	Moderate	Prevention	Minor
5. Traffic Impacts									

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
5.1 Use of public roads by project vehicles increases the accident rate and generates nuisance levels of dust:	Direct	Mainly the road corridor and surroundings	Project duration	Constant	Medium	Medium	Moderate	Reduction	Minor
5.2 Increased traffic on public roads, running at faster speeds, leading to more accidents and more serious accidents:	Induced	Regional	Long-term	Constant	Medium	Medium	Moderate	Prevention	Minor
6. Cultural Heritage Impacts									
6.1 Cultural sites are damaged**, a**nywhere that new land is cleared, such as for diversions, camps, quarries and borrow areas.	Direct	Road corridor	Permanent	Occasional	Medium	Medium	Moderate	Avoidance	Negligible
7. Hazardous Materials									

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
7.1 Pollution to air, soil or water and danger (illness or injury) from the delivery and handling of hazardous materials (including bitumen, mixed asphalt, fuels, lubricants and cement) at project camps, workshops, plants and construction sites.	Direct	Most work sites	Project duration	Constant	Large	Medium	**Major**	Prevention and restoration	Negligible
7.2 Pollution to air, soil or water and danger (illness or injury) from fuel and oil storage at project stores and workshops.	Direct	Most work sites	Project duration	Constant	Large	Medium	**Major**	Prevention and restoration	Negligible
7.3 Pollution to air, soil or water and danger (illness or injury) from refuelling operations at project camps, workshops, plants and construction sites.	Direct	Most work sites	Project duration	Constant	Large	Medium	**Major**	Prevention and restoration	Negligible

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
7.4 Pollution to air, soil or water and danger (illness or injury) from concrete and asphalt batching plants	Direct	Batching plant sites	Project duration	Constant	Large	Medium	**Major**	Prevention and restoration	Negligible
8. Construction Materials									
8.1 Damage to the land (degradation, loss of soil and cover, reduced productivity) from borrow pits and quarries	Direct	Material sources	Long-term	Constant	Large	Medium	**Major**	Reduction and restoration	Minor
8.2 Disturbance (noise, dust and traffic accidents) and danger of injuries from quarry operation – general	Direct	Material sources	Project duration	Constant	Medium	Medium	Moderate	Prevention and restoration	Negligible
8.3 Disturbance (noise and dust) and danger (serious injury or death) from quarry operation – explosives and blasting	Direct	Material sources	Project duration	Constant	Medium	Large	**Major**	Prevention	Negligible
9. Impacts of Waste Materials									

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
9.1 Pollution of soil or water and ill-health from waste generation and management at camps and construction sites.	Direct, Indirect	Most work sites	Project duration	Constant	Medium	Medium	Moderate	Reduction and restoration	Negligible
9.2 Pollution of soil or water and ill-health from waste disposal at camps.	Direct, Indirect	Most work sites	Project duration	Constant	Medium	Medium	Moderate	Reduction and restoration	Negligible
9.3 Pollution of soil or water from poor sanitation at work sites – camps and construction sites.	Direct	Most work sites	Project duration	Constant	Medium	Medium	Moderate	Prevention	Negligible
9.4 Pollution of soil or water from site camps and stores.	Direct, Indirect	Most work sites	Project duration	Constant	Medium	Medium	Moderate	Prevention and restoration	Negligible
10. Soil Loss									
10.1 Erosion and physical damage of soils and earthworks – all construction sites, camps and ancillary infrastructure areas.	Direct	Road corridor and most work sites	Permanent	Constant, but worse seasonally	Large	Large	**Major**	Prevention and restoration	Minor

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
11. Pollution of Water									
11.1 Damage to water resources by pollution with sediment or chemicals in runoff in any of the 11 major creeks and many, minor creeks crossed by the road, or nearby wetlands and water supply boreholes.	Direct	Regional	Long-term	Constant, but worse seasonally	Large	Large	**Major**	Prevention and reduction	Minor
11.2 Pollution by entrained sediment from poor drainage systems entering any of the 11 major creeks and many, minor creeks crossed by the road, or nearby wetlands and water supply boreholes.	Direct	Regional	Long-term	Seasonal	Large	Large	**Major**	Prevention	Minor
12. Air Pollution									

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
12.1 Dust from construction sites and access tracks to ancillary infrastructure affects local communities and crops	Direct	Road corridor and most work sites	Project duration	Seasonal	Medium	Medium	Moderate	Reduction	Minor
12.2 Exhaust fumes affect local communities close to the road and all project ancillary infrastructure.	Direct	Road corridor and most work sites	Project duration	Constant	Small	Medium	Minor	Reduction	Negligible
13. Biodiversity Impacts									
13.1 Vegetation other than invasive species (i.e. both natural plants and farm plants) is damaged or destroyed unnecessarily – beyond the agreed boundaries, particularly natural plants in the forested sections	Direct	Road corridor and most work sites	Long-term	Constant	Medium	Medium	Moderate	Prevention and restoration	Minor

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
13.2 Increased but poorly controlled exploitation of forest resources, including NTFPs, as a result of improved road access, particularly natural plants in the forested sections.	Induced	Road corridor	Long-term	Constant	Small	Medium	Minor	Prevention	Negligible
13.3 Wild animals other than very common or non-native pest species are killed, particularly in the forested sections	Indirect	Road corridor	Long-term	Constant	Medium	Medium	Moderate	Prevention	Minor
14. Noise and Vibration Impacts									
14.1 Noise disturbance at excessive levels from construction activities, quarries, borrow areas and batching plants.	Direct	Towns in road corridor	Project duration	Constant	Medium	Medium	Moderate	Reduction	Minor

Impact/Risk	Causality	Extent and scale	Duration	Frequency	Magnitude	Sensitivity	Significance	Mitigation strategy (actions defined in ESMP)	Residual significance after mitigation
14.2 Vibration disturbance causes stress and damage to buildings, either from trucks and machines on construction sites and access tracks, or from quarry operations.	Direct	Towns in road corridor	Project duration	Frequent	Small	Medium	Minor	Prevention and reduction	Negligible

The impacts identified in the during the ESIA process are presented in the Table below along with the appropriate mitigation measures, the mitigation costs and the residual impacts that may still occur after mitigation measures are applied or because of the mitigation measures themselves.

Table 4 Impact Mitigation Plan, including estimated cost and responsibilities

environmental impact	Mitigation measures	Residual environmental impact	Responsible	Resources required or approximate costs
	1. General environmental Protection			
1.1 **General environmental damage in the form of degraded land, lowered quality of living, reduced quality of resources, etc.,**	• **Avoid damage to any part of the environment (soil, plants, animals, human resources and settlements) as far as possible.** • **If damage cannot be avoided, then mitigate or compensate for the damage.** • **Avoid any work beyond the agreed boundaries of the work sites.** • **Agree on mitigation or compensation arrangements before starting any work.** • **Do not hide any damage or pollution. In the event of an accident, it is better to consult the EPA and agree on a mitigation plan than to risk prosecution under the law.**	**Negligible**	**MPW/PIU/Contractor**	**Not applicable: this category should be covered by the design process and by responsible contract management.**
1.2 **Limited awareness or respect about the importance and value of the environment among labour force leads to an excessive amount of damage to resources or disruption of people's**	• **Ensure that the site supervisors brief all workers at the start of every job, and at the beginning of each week, on the main environmental messages.** • **Ensure that all professional and technical staff respect the environment and understand why they must.** • **Do not allow staff and workers to neglect environmental issues. This may lead to offences under the Environment**	**Negligible**	**MPW/PIU/Contractor**	**Appropriately prepared and targeted training materials on environmental and social awareness for managers, site supervisory staff, machine operators, drivers and workers. These will include the environmental and social components of the weekly and daily site toolbox talks.**

livelihoods in the roadside areas of the affected communities	**Protection and Management Law.** • **Do not ignore blatant disregard for environmental and social issues by professional and technical staff.**			**3 person months of a national consultant to create these materials and conduct initial trainings. Subsequent cascaded trainings and toolbox talks to be undertaken by the Contractor and MPW.**
	2. Environmental Health and Safety			
2.1 **Injuries occur to the public, especially children, during works in the affected communities along the road.**	• **Ensure full separation of the public from working sites.** • **Fence off working areas so that people cannot be injured by things dropped on them or falling into excavations.** • **Maintain a clean site so that dangerous articles are not left lying around near the work site, especially at night.**	**Negligible**	**Contractor**	**3 x community safety awareness days per community (affected) by a national NGO providing community theatre.**
2.2 **Injuries occur to the public from exposure to hazardous substances (e.g. cement, diesel) in the affected communities along the road.**	• **Ensure full separation of the public from storage facilities.** • **Enforce the exclusion of non-project personnel from all sites with hazardous substances.**	**Negligible**	**Contractor**	**Not applicable. Awareness of the importance of implementing exclusion will be included in awareness trainings. Costs are then implicit in contract implementation.**
2.3 **Infectious and contagious diseases are spread amongst the affected communities near the road.**	• **Ensure that non-local workers are accommodated in sound, dry buildings, with good ventilation and clean water supplies, and with good cleanliness and sanitation arrangements.** • **Provide bed nets to all non-local workers.** • **Monitor and control the habitats of malaria vectors.** • **Provide awareness trainings to workers**	**Negligible**	**Contractor**	**Health training as part of toolbox talks (see above).**

	and nearby communities, on the prevention of contagion and infection from diseases such as influenza, Ebola, sexually transmitted diseases and HIV. • **Encourage workers to abstain from sex with local people, or to use suitable protection such as condoms.**			
2.4 **Sexual exploitation and gender-based violence increase in local communities, particularly the affected rural towns due to the influx of temporary laborers**	• **Issue policy statements on the project's adherence to Liberian law regarding sexual exploitation (including minors and prostitution) and gender-based violence.** • **Maintain a zero tolerance punitive regime among all project and contractors' staff and workers.** • **Include awareness raising on these issues in trainings and site briefings.**	**Negligible**	**MPW/PIU/Contractor**	**Trainings with County Ministry of Gender programme on GBV / SEA.**
	3. Occupational Health and Safety			
3.1 **Workers are unaware of the dangers from the sites (roadline, quarries, batching plants etc.) they are working in, leading to high rates of injury.**	• **Ensure that workers are given safety inductions, toolbox talks and full daily and weekly briefings.** • **Develop a culture of admonishment for unsafe acts.** • **Obligate managers to set good examples for respecting safety on site.**	**Negligible**	**Contractor**	**Covered under the same programme as for 1.2 above.**
3.2 **Injuries due to inadequate provision of safety equipment**	• **Provide all workers with safety equipment appropriate to the work that they are doing.** • **Do not allow workers on to a site unless they are wearing the appropriate safety gear.** • **Keep first aid kits on all work sites and ensure they remain stocked and all items are in-date.** • **Ensure that there are two people on each work site who know what to do if there is**	**Negligible**	**Contractor**	**Provision of the minimum set of safety equipment per worker (helmet, high visibility waistcoat, boots, gloves and goggles. Ear protection for workers in noisy locations. Training in the use of PPE to be covered in the programme for 1.2 above.**

	an accident and how to use the first aid kit.			
	4. Community Impacts Management			
4.1 **Incoming workers do not respect local communities, leading to social disruption, particularly in the affected rural towns.**	• **Ensure that the site supervisors brief all workers at the start of every job, and at the beginning of each week, on the main messages regarding respect for the local communities.** • **Ensure that all professional and technical staff respect the local communities and behave well.** • **Do not ignore blatant disrespect for communities by professional and technical staff.**	**Negligible**	**Contractor**	**Covered under the same programme as for 1.2 above.**
4.2 **Houses are lost in the road right of way.**	• **Pay the full and fair compensation as agreed following the procedures given in the Resettlement Action Plan.** • **Assist the affected persons to relocate and re-establish their lives and livelihoods.** • **Do not allow any work to commence on a site before full resettlement compensation has been completed.**	**Affected families should end up at least as well off, with fully restored livelihoods, but emotional trauma may remain.**	**MPW/PIU**	**Resources and costs are covered in the Resettlement Action Plan. Estimated resettlement costs are about US$717,650.48 for properties, including landlords and tenants (but mostly owner-occupiers).**
4.3 **Loss of land use and business sites in the road right of way, particularly in the three cities.**	• **Pay the full and fair compensation as agreed following the procedures given in the Resettlement Action Plan.** • **Assist the affected persons to relocate and re-establish their livelihoods.** • **Do not allow any work to commence on a site before full compensation has been completed.**	**Negligible. The Resettlement Action Plan includes provision for full livelihood restoration.**	**MPW/PIU**	**Resources and costs are covered in the Resettlement Action Plan. Estimated livelihood replacement costs are about US$16,800.00**
4.4 **Cultivated land and crops are disturbed or destroyed, mainly in the rural areas along the road and in**	• **Avoid the use of cultivated land wherever possible. This includes fallow agricultural land, rubber and other tree plantations.** • **Where use of such land is required, check with the CLO at last four weeks**	**Reduced agricultural productivity in the area. Affected families may take time to recover livelihoods.**	**MPW/PIU**	**Resources and costs are covered in the Resettlement Action Plan. Estimated compensation costs for economic crops in the road**

the locations chosen for quarries, borrow areas, camps, batching plants, etc.	**prior to commencement of activities (ideally earlier) that mitigation measures have been agreed and implemented.** • **Do not start using cultivated land before the occupier has fully agreed the compensation strategy, all amounts have been paid and this is confirmed by the CLO.** • **Avoid damage crops or land beyond agreed boundaries.**			**right of way are about US$16,926.75**
4.5 **Local people's livelihoods are adversely affected by project activities.**	• **Establish an equitable and fair employment strategy. Liaise with the CLO to ensure that it is understood in the local communities (i.e. that it is transparent).** • **Give priority to local men and women in labour crews, and those who used to earn livelihoods on land in the RoW.** • **Pay the usual accepted County wage rates.** • **Do not demand unpaid work by local farmers or others.**	**Affected families may take time to recover livelihoods.**	**MPW/PIU/Contractor**	**Resources and costs are covered in the Resettlement Action Plan**
4.6 **Cumulative losses are incurred by social groups unable to respond to change.**	• **Give priority to local men and women in labour crews, and those who used to earn livelihoods on land in the RoW.** • **Maintain an active policy to ensure gender equality and opportunities for vulnerable groups.** • **Pay the usual accepted County wage rates.** • **Do not demand unpaid work by local farmers or others.**	**The Resettlement Action Plan includes provision for support to vulnerable groups, but sometimes economic support is inadequate.**	**MPW/PIU/Contractor**	**Resources and costs are covered in the Resettlement Action Plan.**
	5. Traffic Management			
5.1 **Use of public roads by project vehicles increases the accident**	• **Minimise vehicle movements.** • **Enforce transport rules and regulations rigorously.** • **Conduct driving safety awareness campaigns.**	**Risk of road accidents will always remain.**	**Contractor**	**Appropriately prepared and targeted training materials on driving safety and mitigation of impacts from trucks and machines for managers, site**

rate and generates nuisance levels of dust: mainly the Putuken-John Davis Town road, but also between it and other project infrastructure (camps etc.) and Monrovia.	• **Do not tolerate any poor behaviour, dangerous driving or even minor traffic infringements by any staff or sub-contractors.** • **Do not allow dust generation to affect the ambient air quality outside the site.** • **Spray dust suppression water as required, but ensure it is not applied at such rates that it causes erosion and washing out of the roads.**			**supervisory staff, machine operators and drivers.** **1 person month of a national consultant to create these materials and conduct initial trainings. Subsequent cascaded trainings and toolbox talks to be undertaken by managers.**
5.2 **Increased traffic on public roads, running at faster speeds, leading to more accidents and more serious accidents: on sections of the Putuken-John Davis Town road as they are completed during construction.**	• **Maintain strict transport rules and regulations.** • **Undertake community safety awareness campaigns.** • **Undertake regular driving safety awareness campaigns to ensure safe driving.** • **Maintain close liaison with Liberian National Police traffic control units.**	**Risk of road accidents will always remain.**	**Contractor**	**To be covered during completion.**
	6. Cultural Heritage Management			
6.1 **Cultural sites are damaged, anywhere that new land is cleared, such as for diversions, camps, quarries and borrow areas.**	• **Check with local people, through the CLO, as to whether any activities will affect sites of cultural or religious importance.** • **Avoid any works where cultural sites might be affected, as far as possible.** • **If an unexpected archaeological site is discovered, use the chance find guideline** • **If damage to cultural sites cannot be avoided, agree compensation measures with the local community, through the CLO.**	**Negligible**	**MPW/PIU/Contractor**	**Allow for one chance find investigation,**
	7. Hazardous Materials Management			

7.1 **Pollution to air, soil or water and danger (illness or injury) from the delivery and handling of hazardous materials (including bitumen, mixed asphalt, fuels, lubricants and cement) at project camps, workshops, plants and construction sites.**	• **Follow the hazardous materials management guidelines fully.** • **Use the safest available transportation option. On roads, use convoys with accompanying support.** • **Deliver only to prepared locations.** • **Maintain supplies of spill kits and granules in all vehicles and at all offloading locations.** • **Ensure competent drivers and close supervision.** • **Provide emergency training to all personnel involved in the movement and handling of hazardous materials.** • **Use international labelling for identifying hazardous substances.** • **Maintain emergency response / fire-fighting teams trained for a spillage event and appropriate equipment at each facility.**	**The risk of accidental leakages or spills will always remain.**	**Contractor**	**Appropriately prepared and targeted training materials on hazardous materials and waste handling and management for managers, site supervisory staff, machine operators, drivers and workers in stores, workshops, refuelling stations, camps, etc.**
7.2 **Pollution to air, soil or water and danger (illness or injury) from fuel and oil storage at project stores and workshops.**	• **Follow the hazardous materials management guidelines fully.** • **Only use the designated storage areas, with bunding of 150% volume of total capacity.** • **Only use facilities located down gradient of public water supply boreholes and distant from watercourses.** • **Ensure that there are retention systems, including walls, bunds and lined drains to contain any spillages.** • **Ensure that there is hard standing, with a drainage system that includes oil/water separators.** • **Ensure spill kits and granules are available, and if used, dispose of waste appropriately.** • **Check facilities, safeguards and**	**The risk of accidental leakages or spills will always remain.**	**Contractor**	**Covered under the same programme as for 7.1 above.**

	procedures for any potential for explosions to occur. • **Maintain emergency response / fire-fighting teams trained for a spillage event and appropriate equipment at each facility.** • **Provide training for all personnel handling fuel and oil.** • **Take rapid action if uncontained spills and leakages to occur, to prevent soil, and ground and surface water contamination** • **Do not allow soils to become contaminated and effectively sterilised, or for water courses to be affected by runoff carrying toxic substances, affecting community water supplies, aquatic biodiversity and wildlife.** • **Have controls in place to minimise opportunities for fuel pilferage.**			
7.3 **Pollution to air, soil or water and danger (illness or injury) from refuelling operations at project camps, workshops, plants and construction sites.**	• **Follow the hazardous materials management guidelines fully, which include procedures for refuelling vehicles and site plant.** • **Spill kits are to be carried by all refuelling vehicles.** • **Refuel vehicles only on impermeable hard standings with controlled drainage (traps and interceptors).** • **Plant refuelling on site is to be carried out according to strict protocols for refuelling in unprotected areas.** • **Enforce the reporting system for spillage incidents.**	**The risk of accidental leakages or spills will always remain.**	**Contractor**	**Covered under the same programme as for 7.1 above.**
7.4 **Pollution to air, soil or water and danger**	• **Follow the hazardous materials management guidelines fully.** • **Use of cement, ready-mix concrete, asphalt, etc. at plants is to be carried out**	**The risk of accidental leakages or spills will always remain.**	**Contractor**	**Covered under the same programme as for 7.1 above.**

(illness or injury) from concrete and asphalt batching plants	**according to strict protocols.** • **Enforce the reporting system for spillage incidents.**			
	8. Construction Materials Management			
8.1 **Damage to the land from borrow pits and quarries**	• **Identify borrow pits and quarry areas as early as possible, and conduct specific impact assessment and mitigation on these areas.** • **Allow adequate time for the consultation, resettlement and compensation of people whose land is affected.** • **Ensure that only the approved borrow pits and quarries are used.** • **Install sediment control measures to prevent runoff from causing contamination and siltation of water bodies.** • **Take appropriate measures to prevent emissions and dust from affecting the ambient air quality outside the immediate site boundaries.** • **Ensure proper geotechnical management so that excavation and tips do not trigger slope instability.** • **All road construction-related activities are to be covered by the detailed, site specific and project specific components of the ESMP.**	**Land surfaces can never be fully restored following extraction, but revegetation can be undertaken to begin the process of ecological restoration.**	**Contractor**	**Appropriately prepared and targeted training materials on the management of quarries and borrow areas for managers, site supervisory staff, machine operators, drivers and workers in these sites. These will include the environmental components of the weekly and daily site toolbox talks for these areas.**
8.2 Disturbance and danger from quarry operation – general	• **Ensure that only the approved quarry areas are used throughout the re-opening and operation period.** • **Ensure quarry plans include drainage assessment and water management controls, to prevent the contamination and siltation of water bodies.** • **Maintain the quarry area in a clean, safe and efficient condition.**	**The risk of accidents is always present in quarries, even with good management systems in place.**	**Contractor**	**Covered under the same programme as for 8.1 above.**

	• Ensure proper geotechnical management so that excavation and tips do not trigger slope instability. • Take appropriate measures to prevent excessive noise and emissions from crushers at road material quarries. • Rehabilitate the quarry to a fully stable and vegetated condition after work has ceased.			
8.3 **Disturbance and danger from quarry operation – explosives and blasting**	• Obtain formal licensing from the government. • Abide by Liberian laws and regulations, regarding the handling, storage and use of explosives. • Be particularly strict in enforcing safety regulations when using explosives. • Follow the detailed specifications for blasting provided in this ESMP. • Ensure that quarry blasting does not create excessive noise and vibration disturbance to wildlife and communities. • Do not allow any unauthorised person to have access to explosives. • Do not allow anyone to use welding equipment, smoke, cook food or light any fire within 50 metres of an explosives store.	**The risk of accidents is always present when using explosives, even with good management systems in place.**	**MPW/PIU/Contractor**	**The contractors must employ qualified and certified quarry masters, who must be responsible for compliance with these mitigation measures as part of their job. Additional costs should therefore not be necessary. These provisions should also cover the mitigation of vibrations listed in impact 14.2 below.**
	9. Waste Management			
9.1 Pollution of soil or water and ill-health from waste generation and management at camps and construction sites.	• Operate a waste management strategy based on principles of reduction, recovery, recycle and reuse. • Collect and segregate waste into hazardous and non-hazardous at the source. • Avoid waste spills during storage and handling. • Dispose of all waste in an appropriate manner.	**Negligible**	**Contractor**	**Covered under the same programme as for 7.1 above.**

	• **Conduct recycling and waste reduction campaigns.** • **Ensure use of PPE by staff when handling all forms of waste.** • **Ensure that waste collection, segregation, storage and disposal systems avoid environmental degradation, contamination, and hazards to human and animal health.** • **Do not allow an increase in disposable income among employees to create more waste, both quantity and type, without challenging perceptions.**			
9.2 Pollution of soil or water and ill-health from waste disposal at camps.	• **Dispose of wastes in the most environmentally sound manner possible.** • **Never burn waste, creating air pollution.** • **Dispose of wastes to EPA-authorised facilities.** • **If there are no alternatives, design and construct a landfill site that is lined and to international standards. This should be in an area that is not prone to slippage, cannot leach to surface water and groundwater, and is a suitable distance from settlement. It should be located down gradient of any water supply boreholes.** • **Ensure that the landfill site is in a secure compound and that its operation conforms to international standards.** • **Deal with hazardous waste according to international best practice and EPA guidelines.**	**Negligible**	**Contractor**	**Covered under the same programme as for 7.1 above.**
9.3 Pollution of soil or water from poor sanitation at work sites – camps and construction sites.	• **Provide proper water closet toilet facilities at all long term (> 1 month) work sites.** • **Do not allow water to run out at toilets.** • **Maintain all toilets in a clean and**	**Negligible**	**Contractor**	**Covered under the same programme as for 7.1 above.**

	sanitary condition. • **Provide proper earth pit latrines at all work sites where work will be undertaken for periods of up to one month.** • **Fill the latrines in once they become full and when site work is complete.** • **Do not allow site workers to defecate in the open anywhere on the site or in its vicinity.** • **Add the use of sanitation arrangements in tool box talks**			
9.4 Pollution of soil or water from site camps and stores.	• **Ensure that all potentially hazardous materials (i.e. fuel, oil, other chemicals, sewage) are stored or disposed of in appropriate ways.** • **Devise on-site emergency spillage plans and train staff in their implementation.** • **Remove all debris and litter from site.** • **Take active measures to prevent pollution to the soil or water courses.**	**Negligible**	**Contractor**	**Covered under the same programme as for 7.1 above.**
	10 Soil Erosion Control			
10.1 **Erosion and physical damage of soils and earthworks – all construction sites, camps and ancillary infrastructure areas.**	• **Only disturb the soil where it is necessary to do so for the agreed works.** • **Use existing tracks and previously disturbed areas as far as possible.** • **Do not make access tracks wider or other cleared areas larger than is absolutely necessary.** • **Do not allow erosion to happen without taking rapid control measures: install erosion and sediment controls as the very first physical site activity.** • **Grade any newly formed slopes to the minimum angle possible.** • **Cut slopes to grades appropriate to the material found.** • **Level surfaces to prevent erosion as soon**	**In an environment of highly erodible soils and intense tropical rainfall, erosion can be reduced to acceptable limits but cannot be stopped entirely.**	**Contractor**	**Appropriately prepared and targeted training materials on the management of earthworks, drainage systems and erosion control for managers, site supervisory staff, machine operators, drivers and workers in these sites. These will include the environmental components of the weekly and daily site toolbox talks for these areas. Might also be linked to the programme for impact 8.1 above.**

	as works have been completed. • Keep earth piles away from the edges of steep slopes and watercourses. • Allow small plants to grow back on the edges of tracks. • Where it is present, top soil to a depth of 200 mm should be removed and stockpiled for later site restoration use. • Undertake soil erosion and sediment controls as necessary, to protect areas from slips and erosion. All soil slopes steeper than 10° must be revegetated. • Avoid compaction of the soil in temporary use areas by limiting machine and vehicle access. • Deep-rip compacted soil using the tines on a bulldozer at the start of site rehabilitation.			
	11. Water Resources Management			
11.1 **Damage to water resources by pollution with sediment or chemicals in runoff in any of the 11 major creeks and many, minor creeks crossed by the road, or nearby wetlands and water supply boreholes.**	• Do not dispose of anything into any kind of water body. • Keep earthworks, tracks and other cleared areas as far as possible from watercourses or bodies. • Where earthworks, tracks, roads and other cleared areas are within 50 metres of watercourses or bodies, take special care to ensure that fuel, oil and other hazardous substances, and any earthworks, are properly contained. • Ensure that all community water supplies are safeguarded. Confirm the location of local water supplies with the CLO. Be prepared to bring inn clean water for communities where the works have polluted their water sources • Do not extract so much water from a supply that the normal users are short.	**In an environment of highly erodible soils and intense tropical rainfall, sediment influxes to watercourses can be reduced to acceptable limits but cannot be stopped entirely.**	**Contractor**	**Covered under the same programme as for 10.1 above.**

	• Schedule major earthworks only in the dry season. • Use surface protection measures to control soil erosion and protect watercourses. • Regulate water discharge and run off using sediment ponds. • Monitor downstream water quality routinely.			
11.2 **Pollution by entrained sediment from poor drainage systems entering any of the 11 major creeks and many, minor creeks crossed by the road, or nearby wetlands and water supply boreholes.**	• Provide culverts wherever water needs to flow across the road or an access track. • Ensure water from culverts and other drains is discharged at low energy via drop structures and aprons. • Avoid long gaps between culverts or turnouts, so that a lot of water flow builds up. • Make temporary drains as necessary to avoid waterlogging or erosion. These must be adequate for accumulated runoff water as well as rainfall. • Discharge drains into well vegetated areas. Provide mini silt collection ponds if drains must discharge straight into water courses. Never allow sediment from bare eroding surfaces to be washed into water courses.	**In an environment of highly erodible soils and intense tropical rainfall, sediment influxes to watercourses can be reduced to acceptable limits but cannot be stopped entirely.**	**Contractor**	**Covered under the same programme as for 10.1 above.**
	12. Air Emissions Management			
12.1 **Dust from construction sites and access tracks to ancillary infrastructure affects local communities and crops.**	• Enforce dust control measures during the dry season. • Enforce strict speed limits on earth tracks by placing speed bumps. • Spray water on to dry earth surfaces. • Stop work in very windy, dry weather. • Fit crushers with water sprays.	**Dust can never be totally eliminated, but it can be reduced to acceptable levels.**	**Contractor**	**Covered under the same programme as for 10.1 above.**

12.2 **Exhaust fumes affect local communities close to the road and all project ancillary infrastructure.**	• **Use only vehicles and equipment with engines that comply with national emissions standards.** • **Maintain engines in good working order.**	**Negligible**	**Contractor**	**Not applicable. This should be covered automatically through the contractors' good management of its resources.**
	13. Ecological Management Plan			
13.1 **Vegetation other than invasive species (i.e. both natural plants and farm plants) is damaged or destroyed unnecessarily – beyond the agreed boundaries, particularly natural plants in the forested sections between Saclapea and Tappita.**	• **Only cut vegetation that is in the way. This means plants that are in the direct area required for the agreed works.** • **Do not cut any more vegetation than is necessary for site access and working.** • **Do not use fire to remove vegetation.** • **Do not burn cut vegetation.**	**Vegetation can be planted to replace that lost, but restoring species assemblages and the associated ecology takes a long time and may not always be achievable.**	**Contractor**	**Covered under the same programme as for 10.1 above.**
13.2 **Increased but poorly controlled exploitation of forest resources, including NTFPs, as a result of improved road access, particularly natural plants in the forested sections between Saclapea and Tappita.**	• **Instruct workforce not to collect or purchase NTFPs on site or in markets between Ganta and Tappita.** • **Avoid all use of fire.** • **Provide workers with food from domesticated plants when they are living in places where there is no market source of it.**	**The elimination of the use of forest products, including NTFPs is unlikely, but its use needs to be limited to sustainable levels.**	**Contractor**	**Covered under the same programme as for 1.2 above.**

13.3 **Wild animals other than very common or non-native pest species are killed, particularly in the forested sections between Saclapea and Tappita.**	• **Instruct workforce not to hunt, deal in or transport bushmeat on site.** • **Provide meat from domestic animals if there is no alternative.** • **Avoid all use of fire.** • **Provide workers with workers meat from domesticated animals when they are living in places where there is no market source of it.**	**The complete elimination of the use of proscribed bushmeat is unlikely, although its consumption can be limited.**	**Contractor**	**Covered under the same programme as for 1.2 above.**
	14. Noise and Vibration Management			
14.1 **Noise disturbance at excessive levels from construction activities, quarries, borrow areas and batching plants.**	• **Minimise site-generated noise to the greatest possible extent.** • **Do not allow works to occur during the hours of darkness (6 pm to 6 am), on Sundays and religious holidays, other than in exceptional circumstances (such as casting bridge slabs).** • **Provide warnings of blasting, starting at least 24 hours ahead, and ensure no one is within the 500-metre clearance zone.** • **Provide communities, through the CLO, with details of the works programme.** • **Do not deviate from the agreed timing of works.** • **Provide all site workers exposed to noise over 70 dB(A) with ear protection.** • **Do not allow any person to come close to a machine without having ear protection in place.**	**Construction noise will inevitably be disturbing in rural areas with low ambient noise levels, although it should be feasible to keep it within legal limits.**	**Contractor**	**Covered under the same programme as for 1.2 above. It should also be covered through the contractors automatically following good management practices.**

6.2 Environmental and Social Management Plan Monitoring

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and are effective. Environmental and social monitoring will also enable response to new and developing issues of concern during the project implementation hence ensuring that project activities comply with and adhere to environmental provisions and standard specifications of the Bank and those of the EPA.

The overall responsibility of the environmental and social monitoring will lie with the Project Implementation Unit at the Ministry of Public Works. The EPA also has statutory responsibility to conduct monitoring to ensure conditions of the Environmental Permit are being adhered to. The Bank will also follow up through its E&S experts assigned to the projects to ensure adherence to local environmental and social requirements, the Bank's environmental and social safeguards requirements as well as the environmental and social conditions in the Financing Agreement, especially during supervision missions.

The whole exercise of ESMP monitoring will involve monitoring compliance with regulations, managing worksites, executing specific environmental and social works and seeking solutions to emerging environmental problems. The ESMP monitoring team will ensure regular reporting, which will be on a monthly, quarterly or annual basis depending on the aspects being monitored to avoid any serious environmental consequences. The Bank requires monthly ESMP and RAP implementation reports. This will be the responsibility of the PIU. Annual Environmental Audits are also required for this project. The audit has to be conducted by an independent environmental evaluator. This has already been budgeted for and included in the ESMP implementation cost. The EPA requires quarterly environmental monitoring report. The PIU will ensure that these reports are provided in timely manner.

6.3 Responsibilities for ESMP Implementation

The application of mitigation measures required under this ESMP is the sole responsibility of Ministry of Public Works through its project implementation unit. However, since actual construction works will be carried out by Private Contracting Entity, the MPW will ensure that implementation of the project ESMP is incorporated in the contract agreement with the contractor and or Monitoring Consultant (MC), including the requirement for contractor to develop a contractor's ESMP, which includes a health and safety plan, in accordance with this

ESMP. The contractor's ESMP will be reviewed and approved by the PIU Environmental and Social Safeguards Specialists. The MPW/PIU or MC is responsible to instruct, observe and monitor its contractors against his ESMP provisions. The Monitoring Consultant (MC) should make sure that corrective actions are applied by the contractors, when necessary.

6.4 Estimated ESMP Implementation Cost

The ESMP implementation budget refers to all costs that will be incurred to implement the requirements or recommendations in this Environmental and Social Management Plan. In the ESMP, the requirements are to ensure that implementation of the project integrates environmental and social issues for the sustainability of the project as well as its components and sub-components. Among other things, the ESMP recommends the following key issues namely: implementation and management of this ESMPs, preparation of site-specific ESIAs, training and capacity building, environmental screening, reviewing and monitoring mechanisms. These issues have been clearly described in this ESMP. The staff who will be involved in the implementation of the project will be trained to enhance their skills on specific environmental and social issues, including occupational health and safety, and sexual exploitation and abuse.

Building the capacity of staff from the implementing unit, division/departments/ sections especially those who will be directly involved in implementing the project and its subprojects, value chain systems as well as Management and Finance will enable them to review and monitor environmental issues in the project as well as sub-projects to ensure compliance with requirements of the national policies, laws, and regulations as well as AfDB safeguard policies. Detailed breakdown of the estimated cost for implementation of the ESMP is provided in Table below.

Table 5 Detailed Itemised Cost for Implementing ESMP

No.	Activity	Timeframe	Cost $ (USD)	Responsibility
1	**Contractor's ESMP Preparation and EPA License Acquisition**			
	Preparation of contractor's site-specific ESMP	First quarter in the pre-construction phase	**$50,000.00**	Contractor
	EIA License Acquisition and monitoring fee	Prior to the start of construction works and annually	**$24,000.00**	MPW/Contractor
2	**Estimated cost of mitigation activities/measures**	Throughout project implementation	**$200,000.00**	Contractor/MPW
Subtotal			**$274,000.00**	Project/Contractor/MPW
3	**GRM implementation Cost**			
	Communication and awareness raising on the GRM	Throughout project implementation	**$20,000.00**	MPW/PIU
	Cost associated establishment of the various GRM bodies		**$10,000.00**	
	Transport and communication cost associated with GRM operation		**$20,000.00**	
	Training of the Grievance Redress Committee members		**$15,000.00**	
	Cost for purchasing and operating equipment for GRM implementation		**$5,000.00**	
	GRM monitoring and reporting		**$10,000.00**	
	GRM committees Sitting (this include local level sitting)		**$10,000.00**	
	Professional Services including Case Management System including Travel associated with complaints/requests		**$10,000.00**	
Subtotal			**$100,000.00**	**Project**
4	**Involuntary Displace/Resettlement Cost and Associated cost**			
	Involuntary Displace/Resettlement Cost	Prior to the start of Construction	**$854,217.23**	MPW/PIU
Subtotal			**$854,217.23**	**MPW**
5	**ESMP Monitoring**			

	Regular supervisions of environmental and social issues including health and safety and reporting	Throughout the project implementation	**$100,000.00**	MPW/PIU
6	HIV/AIDS, covid-19 / communicable disease awareness and prevention campaign	Quarterly Supervision	**$30,000.00**	MPW/PIU/Contractor
8	Capacity Building of Technical Officers-Environmental Matters	Quarter 1 & 2 of project Implementation	**$20,000.00**	MPW/PIU
9	Capacity Building of Marketers/Businesswomen and farmers (farming practices and farm inputs)	Quarter 2 of project commencement	**$20,000.00**	MPW/PIU
10	Annual E&S audit	Annually throughout the life of the project	**$50,000.00**	MPW/PIU
Subtotal			**$220,000.00**	**Project**
Grand Total Cost			**1,448,217.23**	

7.0 PROJECT GRIEVANCE REDRESS MECHANISM

A Grievance Redress Mechanism (GRM) for the project has been developed to address all project related complaints including those that may arise from RAP implementation. It follows customary norms and fits into the statutory administrative process of the Government of Liberia. Grievance Redress Committees will be established and trained prior to the commencement of work. The grievance mechanism will be widely advertised to the stakeholders so that they are aware of the process and informed about their right to submit a grievance, and understand how the mechanism will work to address their grievances.

To facilitate effective implementation of the project GRM, an itemised cost for implementation has been developed including the following activities/items:

(i) Communication and awareness raising on GRM
(ii) Establishment of GRM committees
(iii) Transport and communication cost associated with GRM operation
(iv) Training of various GRM committee members
(v) Cost for purchasing and operating equipment for GRM implementation
(vi) Cost of monitoring and reporting GRM activities
(vii) Cost associated with facilitating GRM committees works

The overall cost estimate for GRM implementation $100,000 (One hundred thousand United States Dollars). This cost is also incorporated into the overall project ESMP implementation cost.

8. STAKEHOLDER CONSULTATIONS AND PUBLIC PARTICIPATION

Stakeholder Engagement and Public Participation Process particularly with local citizens affected by development proposals, is frequently construed as an integral aspect of successful decision making in the ESIA processes for major developments. As such, Public Participation is a policy requirement by the Government of Liberia and a mandatory procedure as stipulated in the EPA EIA Procedural Guidelines 2017. It is also a requirement of the Bank.

Stakeholder involvement and public consultation was carried out within Weonville Township and Kilepo Kanweaken to record concerns of community dwellers as well as gather their input into the project design. The Stakeholder Engagements were done in order to foster mutual understanding, addressing concerns and incorporate opinions into the report. This process enabled the establishment of a communication channel between the general public and the project; and the concerns of the stakeholders to be known to the decision-making bodies at an early phase of project development.

More than 50 key informants were interviewed from March 17 to April 1, 2021 within River Gee and Grand Gedeh counties, while formal public meetings were conducted in the Townships of Putuken and Kilepo Kanweaken. The meetings were held on the 28th and 31st, March 2021, respectively, and were meant to introduce the project to the communities and get better understanding of social and community structures.

Over 200 members of the public attended the meetings in the project area. Several concerns were raised during these stakeholder consultations. The main concerns raised and responses provided are summarised below:

(i) **Employment Concerns for local residents**: Many participants raised concerns about giving local community members opportunity to work on the project. They expressed fear about “outsiders” coming to take available jobs. They were however assured that local community members will be given opportunity to work despite the fact that people from other parts of the country will also be provided with employment opportunities. Participants were also informed about the project labour needs. The project will need skilled, semi-skilled and unskilled labour and that most of the skilled labour required to execute the project effectively may not be available locally and even nationally is some cases. So, there will always be the need to employ people outside of the project communities.

(ii) **RAP related concerns**: There were several concerns raised about RAP issues, including how payment will be done and when, and whether payment will be made before demolition of structures is undertaken. Clarifications were made about project requirements to pay all project affected people before the start of work and demolition exercise, and that those affected will be duly informed about payment well in advance, and agreement reached on how payment should be carried out before compensations are paid.

(iii) **Road Safety and accidents emanating from speeding vehicles and construction machines**: This was one of the main areas of concern for most the community members. Several concerns were raised about traffic management during the construction phase as well as the operation phase of the project. The participants were informed about measures in the project ESMP to manage traffic hazards during construction phase, including the institution and enforcement of speed limit as well as a mechanism in place for community residents to report dangerous and reckless driving activities. For the operation phase, participants were informed about dedicated project activities that supposed to address road safety issues.

Overall, despites all the concerns raised, there is overwhelming support for the project as its benefits clearly outweigh its potential negative environmental and social risks and impacts.

9. CONCLUSIONS

This study has clearly shown through the alternative and impact analyses as well as other sections of the report that the positive benefits to be accrued from this project enormously outweigh the associated potential environmental and social risks and impacts. There is no question that this is a worthy development for Liberia. The project is expected to generate numerous positive benefits both for the economy and the environment, including economic growth, increased in economic activities in the project counties, and boosting of the informal sector and provision of employment opportunities during the construction phase. This development also has the potential to facilitate the development of the project counties and increase their access to important services such as education and health.

Despite the numerous benefits identified, the ESIA and the RAP have identified several potential negative environmental and social risks and impacts that will need to be managed to ensure that the project is delivered in environmentally and socially acceptable manners. Amongst the main risks and impacts identified are those associated with involuntary resettlement and land acquisition triggered by project activities. The Government of Liberia is committed to ensuring that PAPs will be fully compensated to ensure that their conditions are not made worse by the project activities, in addition to implementing measures to safeguard the environment as identified in the ESMP and all other relevant project documents.