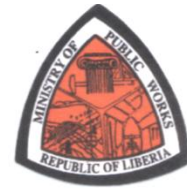




REPUBLIC OF LIBERIA
INFRASTRUCTURE IMPLEMENTATION UNIT
MINISTRY OF PUBLIC WORKS



P. O. BOX 9011
SOUTH, LYNCH STREET
MONROVIA, LIBERIA

Environmental Management Plan (EMP)

For

Rural Road Emergency Maintenance Project (RREMP)

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List of Acronyms

EPA = Environmental Protection Agency

EMP = Environmental Management Plan

RREMP = Rural Road Emergency Maintenance Project

MHSW = Ministry of Health and Social Welfare

MLM&E = Ministry of Lands, Mines, and Energy

MPW = Ministry of Public Works

Executive Summary

Road infrastructure is essential to building and maintaining a strong health system. But in Liberia poor road infrastructure has been and remains a major impediment to accessing health and other social services in many parts of the country, especially during the rainy season when most of the roads become impassible to vehicular movement. Building reliable and sustainable health system will therefore require ensuring physical access to health facilities, particularly in remote rural communities across the country.

During the Ebola Epidemic in Liberia this part of the country suffered a major setback as a result of poor deplorable road condition. In Lofa County access to healthcare facilities became a major challenge for health workers to move in due to the poor state of road network. According to the Ministry of Health report, during the EVD outbreak in Liberia, Lofa County recorded the highest EVD victims due to poor health facilities and the lack of access to prompt healthcare services including information on prevention and management. Consequently, people began to contract the virus because of ignorance regarding the contagious nature of the disease.

The Rural Road Emergency Maintenance Project (RREMP), an MPW proposed program, aims to improve community access to health services by rehabilitating road access to health facilities. Under this project, the MPW will rehabilitate crucial roads and bridges leading to health facilities in selected communities in Lofa County, namely: Zorzor – Yeala Road, Barzewen – Barwen – A Yimah Road, Verzala – Kpademai Road, Kolieble Town – Massamai Bridge and Kolahun – Hembbeh Road.

The project activities will consist of clearing and preparing the selected sites, transportation of materials, supply and installation of treated timber in major bad spots of the road corridor, construction and instillation of timbers and bailey bridges, provision of erosion control measures and drainage improvement on the existing laterite (gravel) surfaced roads in the selected project areas. The project will mainly use human labor with a minimum application of machinery to execute the works.

Although this project is not a Category A project, it will nonetheless impact both the surrounding physical and social environments. These impacts can be negative as well as beneficial impacts. The negative impacts include construction traffic and noise, dust emission, soil contamination, surface and ground water pollution and disruption of pedestrian traffic. The positive impacts include poverty reduction through temporary job creation opportunities for skilled and unskilled local residents, improved movement of goods and services, enhanced access to critical healthcare facilities and improved community health system.

The overall objective of this EMP is to ensure the project's compliance with applicable national environmental and social requirements. It also seeks to outlines the mitigation and monitoring measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts.

The Environmental Management Plan (EMP) includes measures to address the potential environmental impacts. Overall potential environmental and safety impacts are readily avoidable and can be easily mitigated by adopting good engineering practice and monitoring project activities.

The implementation of the EMP shall be the responsibility of the Contractor as indicated in the contract agreement. As part of its overall project supervision, the MPW/IIU will closely monitor the implementation of the EMP and the environmental performance of the project

Summary of Impacts and Mitigation Measures

Table 1: Summary of Impacts and Mitigation Measures

No#	Environmental Attributed	Potential impact	Mitigation Measure
1	Air Quality	<ul style="list-style-type: none"> • Dust emission from clearing of debris, excavation, stock piling, and other construction activities; • Vehicular emission from construction machinery; • Noise pollution from construction equipment 	<ul style="list-style-type: none"> • Sprinkle water on soil to prevent dust generation; • Vehicles delivering or removing materials and wastes from sites shall be covered to reduce spills on roads or around the site; • Maintain construction equipment to good standard;
2	Potential Impact	There will be no significant adverse impacts due to operational noise levels are anticipated	<ul style="list-style-type: none"> • Reduce site activities to day time operation; • Construction equipment will strictly conform to international noise standards; workers shall be equipped with ear plugs
3	Potential Impact	<ul style="list-style-type: none"> • Soil contamination from accidental spill of oil, paints, lubricates; • Soil disturbance (excavation, backfilling, etc.); • Soil erosion and modification of surface relief. 	<ul style="list-style-type: none"> • Dispose all waste at approved points to avoid leaking and soil contamination; • Backfill soil and restore site to avoid erosion during installation.
4	Water quality	<ul style="list-style-type: none"> • Surface and ground water contamination from run-off; • Accidental spill and uncontrolled discharges 	<ul style="list-style-type: none"> • Construct good drainage at site during construction; • Store, apply and dispose of all oil and chemicals safely.
5	Biodiversity	<ul style="list-style-type: none"> • Loss of flora from fauna from construction activities and oil spill 	<ul style="list-style-type: none"> • No sitting and excavations in sensitive habitat; and • Careful planning and selection of sites.
6	Socio – economic	<ul style="list-style-type: none"> • Traffic congestion; • Unemployment rate among skilled and unskilled people • Poor health condition 	<ul style="list-style-type: none"> • Traffic management prescribed and performed in accordance with the local laws with appropriate measures and signaling system (e.g.; appropriate lighting traffic safety signs, barriers and flag persons) that are easily seen or easy to follow; • Temporary job

			<p>opportunities for skilled and unskilled local residents;</p> <ul style="list-style-type: none"> • Improved health condition through enhance access to healthcare facilities
7	Waste Management	<ul style="list-style-type: none"> • Odour and possible loss of esthetic due to piling of construction wastes, excavated soils and solid waste debris 	<ul style="list-style-type: none"> • Dispose of environmental harmful materials (asbestos sheet) in as appropriate legal and safe manner; • Proper disposal of waste material at appropriate location specified by local authorities. • Cover waste materials removed from site to reduce adour and discharges on roads
8	Health	<ul style="list-style-type: none"> • Vector attraction; • Dispersion of diseases agent; • Respiratory diseases from dust or P.M. inhalation 	<ul style="list-style-type: none"> • Clear solid wastes on time and dispose of at appropriate location; • Backfill burrow pit and excavated areas to avoid stagnant water bodies; • Provide workers with safety instructions and protective equipments as required by local laws

Chapter one: Introduction

1.0 Background of the EMP

Road infrastructure is essential to building and maintaining a strong health system. But in Liberia poor road infrastructure has been and remains a major impediment to accessing health and other social services in many parts of the country, especially during the rainy season when most of the roads become impassible to vehicular movement. Building reliable and sustainable health system will therefore require ensuring physical access to health facilities.

During the Ebola Epidemic in Liberia, Lofa County suffered a major setback as a result of poor deplorable road condition. In Lofa County access to healthcare facilities became a major challenge for health workers to move in due to the poor state of the road network. According to the Ministry of Health report, during the EVD outbreak in Liberia, Lofa County recorded the highest EVD victims due to poor health facilities and the lack of access to prompt healthcare services including information on prevention and management. Consequently, people began to contract the virus because of ignorance regarding the contagious nature of the disease.

The Environmental Management Plan is a key requirement that must be in place prior to commencement of road construction/ rehabilitation activities. The current timber road project is being undertaken by the Government of Liberia through the Ministry of Public Works and financed by the World Bank. The Environmental Management Plan (EMP) is prepared in fulfillment of requirements set by the Environmental Protection Agency (EPA) of Liberia aimed at ensuring adherence to national environmental regulations/frameworks, as well promoting environmental management and sustainability. Potential impacts on air, water, soil, aquatic life, landscape, as well as vegetation and corresponding mitigation measures are considered in the EMP. The nature and scale of the project is such that it is highly unlikely to cause any physical and economic displacement.

The supply and installation of the timber road project will enhance basic economic and social activities in the selected project areas of Lofa County. This EMP lays out procedures for effective environmental management by the contractor during the execution of the project.

1.0.1 Background of the Project Area

Following the outbreak of the Ebola Virus Disease, Ebola Treatment Units (ETUs) were set up in Zorzor, Voinjama, Kolahun, Foyah and Vahun to cater to people infected by the disease. However, getting the affected people to these facilities proved very difficult due to bad road condition leading to these and other health facilities.

The Rural Road Emergency Maintenance Project (RREMP), an MPW proposed program, aims to improve community access to health services by rehabilitating road access to health facilities. Under this project, the MPW will rehabilitate crucial roads and bridges leading to health facilities in selected communities in Lofa County, namely: Zorzor – Yeala Road, Barzewen – Barwen – A Yimah Road, Verzala – Kpademai Road, Kolieble Town – Massamai Bridge and Kolahun – Hembah Road. These existing but hardly maintained roads traverse through hills and valleys, primary and secondary forests and savannah land. Like much of the country, the climate is tropical with little variation between day and night and between seasons.

Economic activities: majority of the county residents including those directly along the project area of influence are engaged in subsistence farming mainly of rice, cassava, sweet potatoes, eddoes, corn, plantain and palm oil, pulses and vegetables ; small scale cash crop production (cocoa, coffee and oil palm); and petty trade as the main economic activities. Few people hold formal jobs in the local government administration, non-governmental organization and private enterprises.

Geology and topography: Lofa is a highland county with wide and deep valleys, high mountains, dense tropical forests and plateau. The project area is endowed with a variety of wildlife and water resources. Granites and Precambrian rocks are widely spread across the county.

1.2 Project Description

The project primarily consists of the supply and installation of timber in major bad spots along the project road corridors, the installation of culverts and bailey bridges, provision of erosion control, improvement of drainages and related works. The project will mainly use human labor with minimal application of machinery for the execution of the works.

This Environmental Management Plan (EMP) has been prepared in compliance with the Bank's guidelines and the environmental policies and laws of the Government of Liberia. The EMP identifies mitigation, monitoring and institutional measures to be taken for avoiding or minimizing adverse environmental impacts during project design, implementation and operation, and specifies activities needed to implement such measures more specifically; this EMP is organized to cover the following issues:

- Executive Summary: Brief discussion of significant financing and recommended actions
- Project Description: Brief description of the scope of the project, geographical areas of coverage and proposed implementation arrangements.
- Policy, Legal and Administrative Framework: Summary description of applicable national and international agreements, policies, Laws, regulations, standards and guidelines relevant to the proposed project activities, and information on the responsible institutions and their roles.
- Existing Condition: provides a description of the physical, biological and socioeconomic environment within the proposed project area. The description is based on the reviews of available documentation, field surveys and investigations.
- Potential Environmental Impacts: Summary description of potential direct and indirect environmental impacts and proposed mitigation measures.
- Environmental Management Plan: The EMP outlines the appropriate preventive actions and mitigation measures for addressing the potential adverse environmental and social impacts identified for the project activities. A monitoring plan, with monitoring indicators and assigned responsibilities to key stakeholders is given.

Improvement in access road would also encourage healthcare and other service providers to increase their service level to local communities in the project areas. The activities would in

turn generally bring hefty financial returns, enhance community access to healthcare facilities and contribute to social and economic development activities in the project areas.

1.3 **Objective of the EMP**

The primary objective of the EMP is to identify possible adverse environmental and social impact associated with the project and proposes mitigating measures to prevent, minimize, or remedy such problems in order to ensure environmental sustainability. The specific objectives include:

- To describe and assess the existing environment likely to be impacted;
- To identify and assess the types and magnitude of the potential impacts;
- To prepare plans for managing impacts so that they are kept within acceptable levels; and
- To identify adverse, social impacts.

The EMP will also serve the purposes specified below:

- A) To provide a standalone document for project implementation that engenders appraisal of the project and to provide a single source of environmental information for contractors, inspectors and other associated with the project during design, construction and operations;
- B) To identify Institutional Roles and Responsibilities of relevant institutions involved in environmental management during project implementation; and
- C) To Summarized Environmental Monitoring Plan during design, construction and operation phases:
 - The EMP will identify requirement related to the environmental monitoring program.
 - Environmental monitoring will be carried out during both the construction and operation phases to ensure the effectiveness of mitigation measures, to respond to unanticipated environmental concerns at an early stage, and to determine the accuracy of impact predictions.

1.4 **Objectives of the Project**

- To improve community access to health facilities by improving road access to those healthcare facilities in the selected areas of Lofa.
- To enhance trade and commerce
- To ensure safety (through improving very bad spots along the selected rural roads

Works

Construction works including digging, excavation, and installation of timber and bailey bridges will be carried out in addition to subsequent transportation of debris's for disposal.

Applicable Environmental Quality Standards

The Water Quality Standards for Liberia are presented in Table 1 below. However, there are not yet approved national environmental quality standards for air, noise and other media.

Consequently international applicable standards or suitable standards from the West African Region will be used/adopt for environmental management in connection with this project. The following guidelines on Air Quality and Noise level (Tables 2-5) from Ghana are presented for consideration

The Contractor will be responsible for the Liberia Water Quality Standards and that the Ghanaian air and noise standard will be applied to the project and the Contractor will be responsible for maintaining them.

Table 2: Liberia Water Quality Standard

Pollutants	Unit	Acceptable Level
Ph	logH	6.0-9.0
Chloride	Mg Cl/L	≤350.0
Sulphate	Mg SO ₄ /L	≤200.0
Hardness	Ca CO ₃ mg/l	≤300.0
Iron Total	Fe mg/L	≤1.5
Manganese	Mn mg/L	≤0.3
Zinc Total	Zn mg/L	≤2.0
Coliform Bacteria	n/ml	0
Bacteria Total	n/ml	≤10
Dissolved Subst	mg/L	≤1000
Suspended Solids	mg/L	≤30.0
Ammonia	mg NH ₄ /L	≤3.0
Nitrate	mg NO ₃ /L	≤60
Nitrite	mg NO ₂ /L	≤0.5
Phosphate	mg PO ₄ /L	≤0.02
Phenois	mg /L	≤0.02
Detergents	mg /L	≤2.0
Fluoride	F mg/L	≤1.5
Cyanide	Cn mg/L	≤0.02
Lead	Pb mg/L	≤0.1
Mercury	Hg mg/L	≤0.005
Copper	Cu mg/L	≤0.1
Cadmium	Cu mg/L	≤0.001
Chromium Trivalent	Cd mg/L	≤0.5
Chromium Hexavalent	Cr mg/L	≤0.1
Nickel	Ni mg/L	≤1.0
Silver	Ag mg/L	≤0.01
Vanidium	V mg/L	≤1.0
Boron	B mg/L	≤1.0
Arsenic	As mg/L	≤0.05

SCHEDULE 2

(Regulation 3)

Waste Discharge Standards – Air (GHANA)

Table 3: The following standards are maximum limits for the corresponding waste

POLLUTANT	APPLICABLE TO	STANDARD
(i)a Smoke	All stationary fuel burning source	Ringlemann No.2 or equivalent opacity (not to exceed more than 5 minutes in any period of one hour)
(i)b Smoke	All stationary sources other than fuel burning equipment	Ringlemann No.2
(ii) Solid particles	Any trade, industry, process, industrial plant or fuel-burning equipment.	200 mg/m ³
(iii) Sulphuric acid mist or sulphur trioxide	<p>a) Any trade, industry or process (other than combustion processes and plants for the manufacture of sulphuric acid).</p> <p>b) Any trade, industry or process in which sulphuric acid is manufactured.</p>	<p>120 mg/m³ as sulphur trioxide</p> <p>30,000 mg/m³ as sulphur trioxide</p>
(iv) Fluorine compounds	Any trade, industry or process in the operation of which fluorine, hydrofluoric acid or any inorganic fluorine compounds are emitted.	100 mg/m ³ as hydrofluoric acid
(v) Hydrogen Chloride	Any trade, industry or process	200 mg/m ³ as hydrogen

		chloride
(vi) Chlorine	Any trade industry or process	100 mg/m ³ as chlorine
(vii) Hydrogen sulphide	Any trade industry or process	5 ppm as hydrogen sulphide gas
(viii) Nitric acid or oxides or Nitrogen	Any trade industry or process in which the manufacture of nitric acid is carried out.	2000 mg/m ³ as nitrogen dioxide
(ix) Nitric acid or oxides of Nitrogen	Any trade, industry or process other than nitric acid plant	1000 mg/m ³ as nitrogen dioxide
(x) Carbon monoxide	Any trade, industry or process.	1000 mg/m ³ as carbon monoxide

SCHEDULE 3**Guidelines****Table 4: Ambient Air Quality Guidelines (GHANA)**

Substance	Time Weighted Average (TWA)		Averaging Time
Sulphur Dioxide (SO ₂)	900 µg/m ³	Industrial	1 hr
	700 µg/m ³	Residential	1 hr
	150 µg/m ³	Industrial	24 hr
	100 µg/m ³	Residential	24 hr
	80 µg/m ³	Industrial	1 yr
	50 µg/m ³	Residential	1 yr
Nitrogen Oxides (measured as NO ₂)	400 µg/m ³	Industrial	1 hr
	200 µg/m ³	Residential	1 hr
	150 µg/m ³	Industrial	24 hr
	60 µg/m ³	Residential	24 hr
Total Suspended Particulate	230 µg/m ³	Industrial	24 hr
	150 µg/m ³	Residential	24 hr
	75 µg/m ³	Industrial	1 yr
	60 µg/m ³	Residential	1 yr
PM ₁₀	70 µg/m ³		24 hr

Smoke	150 $\mu\text{g}/\text{m}^3$	Industrial	24 hr
	100 $\mu\text{g}/\text{m}^3$	Residential	24 hr
	50 $\mu\text{g}/\text{m}^3$	Industrial	1 yr
	30 mg/m^3	Residential	1 yr
Carbon Monoxide	100 mg/m^3		15 min
	60 mg/m^3		30 min
	30 mg/m^3		1 hr
	10 mg/m^3		8 hr
Hydrogen Sulphide	150 $\mu\text{g}/\text{m}^3$		24 hr
Mercury	1 $\mu\text{g}/\text{m}^3$		1 yr
Lead	2.5 $\mu\text{g}/\text{m}^3$		1 yr
Cadmium	10-20 ng/m^3		1 yr
Manganese	1 $\mu\text{g}/\text{m}^3$		24 hr
Dichloromethane(Methylene Chloride)	3 mg/m^3		24 hr
1,2-Dichloroethane	0.7 mg/m^3		24 hr
Trichloroethane	1 mg/m^3		24 hr
Tetrachloroethene	5 mg/m^3		24 hr
Toluene	8 mg/m^3		24 hr
Arsenic	30 ng/m^3	Industrial	24 hr
	15 ng/m^3	Residential	24 hr

SCHEDULE 4**(Regulation 10)****Table 5: Ambient Noise Level Standards (GHANA)**

Ozone	Description of Areas of Noise Reception	Permissible Noise Level in DB(A)	
		DAY 0600 – 2200	NIGHT 2200 – 0600
A	Residential areas with low or infrequent transportation	55	48
B1	Educational (school) and health (hospital, clinic) facilities	55	50
B2	Areas with some commercial or light industry	60	55
C1	Areas with some light industry, places of entertainment or public assembly, and places of worship located in this zone.	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial commercial areas	70	60
E	Predominantly heavy industrial areas	70	70

SCHEDULE 4**(Regulation 10) GHANA)****Table 6: Permissible adjustment to measure noise level for intermittent noise**

Cumulative period for which intermittent noise is present in any hour.	Maximum allowable adjustment above the permissible ambient level (dB _A).
More than 15 minutes	±0
Exceeding 5 minutes but not exceeding 15 minutes	-5
Exceeding 1 minute but not exceeding 5 minutes	-10
Not exceeding 1 minute	-15

Note 1: Schedule 4 is for the calculation of (noise level) from its duration of the potential annoyance level where any noise present and measured is intermittent and not measured by statistical method.

Note 2: These duration adjustments are not applicable when noise being assessed includes discrete noise impulses or consists of repetitive noise with an impulsive character e.g. hammering or riveting.

Note 3: Ambient noise level standards in Db (A) refer to rating level L_r.

2.0 CHAPTER TWO: ENVIRONMENTAL MANAGEMNET PLAN (EMP)

2.1 EXISTING ENVIRONMENT

Air Quality: - Air Quality in the proposed project site is relatively less polluted as a result of the project location which is rural in nature. Dust particles from the gravel surfaced road are also sources of air pollution. Currently, however, Liberia has no air quality standards and there are no data on the air quality of the proposed project area.

Soil: - The soil is basically literate and clay which is prone to erosion especially during the rainy season. The erosion causes deep gullies on the road and increased sedimentation in the nearby creeks and streams.

Water quality- The creeks and streams on the project roads may be polluted as a result of disposal of raw sewage and garbage into these water bodies. Results of the water samples analysis are presented in Table 6 below.

Flora: - There are varieties of tree species in the project areas.

Aquatic life: - Creeks and streams in the area contain many fresh water fish, which include Tilapia, Catfish, Groupers, Snappers, Crustaceans, etc. The concentration of pollutions in the fish has not been determined.

2.2 ENVIRONMENTAL IMPACT

Given the nature of the improvement works which include installation of timber and bailey bridges, the project is expected to have little or no adverse impacts on the surrounding physical and social environments.

Table 7: Environmental Impact Matrix

S/N	Environmental Attributes	Potential Impact	Project Activities					
			Site clearing and excavation	Transportation of materials	embankment construction	Road grading works	Drainage works	Installation of timber and bailey bridges
1	Air Quality	Dust emission from clearing of debris, excavation, stock piling and other construction activities	-	-	-	-	-	-
		Emissions from construction vehicle	-	-	-	-	-	-
		Noise increment from construction Equipment	-	-	-	-	-	-
2	Soil	Soil contamination from accidental spill of oil, paints, lubricants	-	-	-	-	-	-
		Soil disturbance (excavation, back filling etc)	-	-	-	-	-	-
		Soil erosion	-	-	-	-	-	-

		and modification of surface relief						
3	Water Quality	Surface and groundwater contamination from surface runoff	-	-	-	-	-	-
		Accidental spill and uncontrolled discharges into river	-	-	-	-	-	-
		Sedimentation of drainage channels and surface waterways	-	-	-	-	-	-
4	Biodiversity	Loss of flora from fauna from construction activities and oil spill	-	-	-	-	-	
5	Socioeconomic	Creation of employment for skilled and unskilled people	+	+	+	+	+	+
		Traffic	-	-	-	-	-	-
		Improved living condition	+	+	+	+	+	+
		Odour and possible loss of aesthetic	-	-	-	-	-	-
			-	-	-	-	-	-
6	Health	Vector attraction	-	-	-	-	-	-
		Contract-specified requirements will require						

		introductory safety orientation programs, including HIV/AIDs and STD awareness programs, and the identification of emergency facilities. Contractors will be required to provide basic emergency health facilities for workers						
		Dispersion of disease agent	-	-	-	-	-	-
		Respiratory diseases from dust or PM inhalation	-	-	-	-	-	-

Key: + = Positive impact
 - Negative Impact

Water: - Although the creeks/streams over which the road will be improved are relatively less polluted, the construction exercises could exacerbate the turbidity by accidental disposal of solid matter into the water bodies.

Noise: Noise will be generated from installation and construction activities. During operation phase the main source of noise will be from the traffic. However, since sensitive receptors such as schools and hospitals are not close to the sites, the acoustic impact will be in an acceptable range.

2.3. ENVIRONMENTAL IMPACT MITIGATION MEASURES

Necessary measures to mitigate potential impacts associated with the design, construction, and operation phases are summarized below.

Noise Reduction

- Machinery with low noise and/or sound absorption materials will be used as much as possible; for example, on-site generator with muffler or silencer. If necessary, working hours should be such that noise is reduced during the nighttime hours.

Disposal of Debris from Construction

Debris from construction will to be hauled in covered trucks and disposed of on sites (away from sensitive receptors) approved by the Environmental Protection Agency. The disposal sites identification and selection will be done in consultation with the EPA.

Accident Prevention.

- The construction area will be well marked with lights and signs to warn motorists and pedestrians away from danger areas.
- Barriers will be erected and guards will be posted to prevent people from entering the construction area, falling through openings in road, etc.
- Construction workers will be required to wear safety helmets, safety shoes, and eye protection.
- Flagmen will be on hand during operations involving trucks and heavy equipment moving into or out of the construction area, to prevent traffic jams and accidents.

Air Quality

- Responsible authorities (EPA and line Ministries and Agencies) need to develop national air quality standards and enforce the necessary law.
- Air quality monitoring equipment need to be set up (by EPA) in strategic commercial, industrial and residential sites.
- The use of Tail-Gas purifier on vehicles be enforced (by the EPA and the Liberia National Police) as means to reduce emission of pollutants.
- The use of public transport will be encouraged for higher efficiency of passengers.

Noise reduction

- Standards for noise in various acoustic environments be developed and monitored by responsible authorities of the EPA.
- Vehicle with noise exceeding the standard will be requested to be repaired or use efficient silencer.
-

2.4 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring will be undertaken during both the construction and the operation phases to ensure the effectiveness of mitigation measures, to determine the accuracy of impact prediction, and to respond to unanticipated environmental concerns at an early stage in order to adopt appropriate remedial measures.

The purposes of the environmental monitoring plan are to:

- Evaluate the effectiveness of mitigation measures;
- Respond in a timely manner to unanticipated environmental impact when the project is under construction; and
- Provide supporting information for formulating regulations and improving traffic management and environmental controls, based on monitoring data.

Compliance monitoring

The monitoring will be carried out by the IIU/MPW to ensure regulatory compliance with standards with respect to air quality and noise levels. Turbidity will also be monitored in respect of water quality. Monitoring will be carried out at the project site when construction activities are in progress.

Operation Phase

Traffic noise and impact of motor vehicle emission on sensitive area will be monitored at the road by SE and IIU/MPW.

Summary of Mitigation Measures

This section summarizes the mitigation measures designed and described in the EMP. The measures are divided into those for the construction and operation phases. The summary is presented in **Tables 7-8**. It includes brief description of mitigation measures and, responsible party for their implementation.

Table 8: Mitigation Measures during Construction Phase

Environmental Issue	Mitigation Measures	Responsibility
Air quality	Installation of Timber and Bailey Bridges which will general noise during installation works along the road. Therefore construction sites within 30 meters from sensitive receptors will be separated with tarpaulin or similar sheet to control the dust. Water spray will also be carried out intermittently to control dust from demolition.	Contractors
	Vehicles transporting project materials (e.g. timber and bridge pieces) will be covered with tarpaulin.	
	Roads under construction where dust is generated will be watered at regular intervals	
Accident Prevention.	The construction area will be well marked with lights and signs to warn motorists and pedestrians away from danger areas.	
	Barriers will be erected and guards will be posted to prevent people from entering the construction area.	
	Construction workers will be required to wear safety helmets, safety shoes, and eye protection.	

	Flagmen will be on hand during operations involving trucks and heavy equipment moving into or out of the construction area, to prevent traffic jams and accidents.	
	The construction area will be well marked with lights and signs to warn motorists and pedestrians away from danger areas.	

Table 9: Mitigation Measure during Operation Phase

Environmental Issue	Mitigation Measures	Responsibility
Air quality	The use of Tail –Gas purifier on vehicles be enforced as means to reduce emission of pollutants	EPA Liberia National Police
	The use of public transport be encouraged for higher efficiency of passengers	Ministry of Transport
Noise	The installation will be maintained regularly	Ministry of Public Work
	Vehicle with noise exceeding the standard will be requested to be repaired or use efficient silencer	EPA Liberia National Police

2.6: Mitigation Measures during Construction Phase

Air and Noise. Mitigation measures for air and noise during construction phase will be included in the engineering cost.

Water quality

Temporary toilet facilities will be built for construction workers at selected camp sites along the project areas. Control human feces through the construction of toilets would avoid water contamination through runoff

Accident prevention.

Costs of Accident prevention awareness measures including the use of safety gears, guard posts with security, flags to alert pedestrians and motorists of danger, etc. will be inclusive in the contractor fee.

2.6.1: Mitigation Measures during Operation Phase

Mitigation measures to ensure air quality and reduce noise levels to acceptable standards will be borne by motorists and contractors (engineers) in respect of purchase of appropriate materials and equipment.

Appendix 1: Environmental Guidelines for Contractors

- 1 In addition to these general conditions, the Contractor shall comply with any specific Environmental Management Plan (EMP) or Environmental and Social Management Plan (ESMP) for the works he is responsible for. The Contractor shall inform himself about such an EMP, and prepare his work strategy and plan to fully take into account relevant provisions of that EMP. If the Contractor fails to implement the approved EMP after written instruction by the Supervising Engineer (SE) to fulfill his obligation within the requested time, the Owner reserves the right to arrange through the SE for execution of the missing action by a third party on account of the Contractor.
- 2 Notwithstanding the Contractor's obligation under the above clause, the Contractor shall implement all measures necessary to avoid undesirable adverse environmental and social impacts wherever possible, restore work sites to acceptable standards, and abide by any environmental performance requirements specified in an EMP. In general these measures shall include but not limited to:
 - a) Ensure that noise levels emanating from machinery, vehicles and noisy construction activities (e.g. offloading, installing) are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and nearby communities.
 - b) Ensure that existing water flow regimes in rivers, streams and other natural or irrigation channels is maintained and/or re-established where they are disrupted due to works being carried out.
 - c) Prevent oils, lubricants and waste water used or produced during the execution of works from entering into rivers, streams, irrigation channels and other natural water bodies and also ensure that stagnant water in uncovered borrow pits is treated in the best way to avoid creating possible breeding grounds for mosquitoes.
 - d) Upon discovery of ancient heritage, relics or anything that might or believed to be of archaeological or historical importance during the execution of works, immediately report such findings to the SE so that the appropriate authorities may be expeditiously contacted for fulfillment of the measures aimed at protecting such historical or archaeological resources.
 - e) Discourage construction workers from engaging in the exploitation of natural resources such as hunting, fishing, and collection of forest products or any other activity that might have a negative impact on the social and economic welfare of the local communities.
 - f) Implement soil erosion control measures in order to avoid surface run off and pollution,
 - g) Ensure that garbage, sanitation and drinking water facilities are provided in construction worker camps.
 - h) Ensure that, in as much as possible, local materials are used to avoid importation of foreign material and long distance transportation.
 - i) Ensure public safety, and meet traffic safety requirements for the operation of work to avoid accidents.
 - j) Ensure construction vehicles and other motorized equipment are well maintained to minimize emissions
 - k) Install barriers, filter strips and diversions to prevent sedimentation of drainage channels and water ways
3. The Contractor shall indicate the period within which he/she shall maintain status on site after completion of civil works to ensure that significant adverse impacts arising from such works have been appropriately addressed.
4. The Contractor shall adhere to the proposed activity implementation schedule and the monitoring plan /strategy to ensure effective feedback of monitoring information to project management so

that impact management can be implemented properly, and if necessary, adapt to changing and unforeseen conditions.

5. Besides the regular inspection of the sites by the SE for adherence to the contract conditions and specifications, the Owner may appoint an Inspector to oversee the compliance with these environmental conditions and any proposed mitigation measures. State environmental authorities may carry out similar inspection duties. In all cases, as directed by the SE, the Contractor shall comply with directives from such inspectors to implement measures required to ensure the adequacy rehabilitation measures carried out on the bio-physical environment and compensation for socio-economic disruption resulting from implementation of any works.

Worksite/Campsite Waste Management

6. All vessels (drums, containers, bags, etc.) containing oil/fuel/surfacing materials and other hazardous chemicals shall be bundled in order to contain spillage. All waste containers, litter and any other waste generated during the construction shall be collected and disposed of at designated disposal sites in line with applicable government waste management regulations.
7. All drainage and effluent from storage areas, workshops and camp sites shall be captured and treated before being discharged into the drainage system in line with applicable government water pollution control regulations.
8. Used oil from maintenance shall be collected and disposed of appropriately at designated sites or be re-used or sold for re-use locally.
9. Entry of runoff to the site shall be restricted by constructing diversion channels or holding structures such as banks, drains, dams, etc. to reduce the potential of soil erosion and water pollution.
10. Construction waste shall not be left in stockpiles along the road, but removed and reused or disposed of on a daily basis.
11. If disposal sites for clean spoil are necessary, they shall be located in areas, approved by the SE, of low land use value and where they will not result in material being easily washed into drainage channels. Whenever possible, spoil materials should be placed in low-lying areas and should be compacted and planted with species indigenous to the locality.

Material Excavation and Deposit

- 12 Shall not be located in the vicinity of settlement areas, cultural sites, wetlands or any other valued ecosystem component, or on high or steep ground or in areas of high scenic value, and shall not be located less than 1km from such areas.
- b) Shall not be located adjacent to stream channels wherever possible to avoid siltation of river channels.
- c) Shall not be located in archaeological areas.
- d) Shall not be located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the appropriate authorities and an environmental impact study shall be conducted.
- e) Shall be easily rehabilitated. Areas with minimal vegetation cover such as flat and bare ground, or areas covered with grass only or covered with shrubs less than 1.5m in height, are preferred.

Rehabilitation and Soil Erosion Prevention

- 19 Always remove and retain topsoil for subsequent rehabilitation. Soils shall not be stripped when they are wet as this can lead to soil compaction and loss of structure.
- 20 Topsoil shall not be stored in large heaps. Low mounds of no more than 1 to 2m high are recommended.
- 21 Ensure reshaped land is formed so as to be inherently stable, adequately drained and suitable for the desired long-term land use, and allow natural regeneration of vegetation.
- 22 Minimize the long-term visual impact by creating landforms that are compatible with the adjacent landscape.
- 23 Minimize erosion by wind and water both during and after the process of reinstatement.
- 24 The Contractor shall at all costs avoid conflicting with water demands of local communities.
- 25 Site spoils and temporary stockpiles shall be located away from the drainage system, and surface run off shall be directed away from stockpiles to prevent erosion.

Traffic Management

- 26 Location of access roads/detours shall be done in consultation with the local community especially in important or sensitive environments. Access roads shall not traverse wetland areas.
- 28 Upon the completion of civil works, all access roads shall be ripped and rehabilitated.
- 29 Access roads shall be sprinkled with water at least five times a day in settled areas, and three times in unsettled areas, to suppress dust emissions.

Disposal of Unusable Elements

- 30 Unusable materials and construction elements will be disposed of in a manner approved by the SE. The Contractor has to agree with the SE which elements are to be surrendered to the Client's premises, which will be recycled or reused, and which will be disposed of at approved landfill sites.

Health and Safety

- 31 In advance of the construction work, the Contractor shall mount an awareness and hygiene campaign. Workers and local residents shall be sensitized on health risks particularly of AIDS and EVD.
- 32 Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points.
- 33 Construction vehicles shall not exceed maximum speed limit of 40km per hour.

Repair of Private Property

- 34 In cases where compensation for inconveniences, damage of crops etc. are claimed by the owner, the Client has to be informed by the Contractor through the SE. This compensation is in general settled under the responsibility of the Client.

Training of Contractor's Personnel

- 40 The Contractor shall provide sufficient training to his own personnel to ensure that they are aware of the relevant aspects of these general conditions, any project EMP, and his own EHS-MP, and are able to fulfill their expected roles and functions. Specific training should be provided to those employees that have particular responsibilities associated with the implementation of the EMP.

Cost of Compliance

- 41 It is expected that compliance with these conditions is already part of standard good workmanship and state of art as generally required under this Contract. The item "Compliance with Environmental Management Conditions" in the Bill of Quantities covers these costs. No other payments

