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## **ACRONYMS**

|                 |                                                           |
|-----------------|-----------------------------------------------------------|
| °C              | Temperature in degrees Celsius                            |
| µg              | Microgram                                                 |
| ADI             | Area of Direct Influence                                  |
| ADP             | Agricultural Development Projects                         |
| AERMIC          | AMS/EPA Regulatory Model Improvement Committee            |
| AERMOD          | AERMIC Dispersion Model                                   |
| AfDB            | African Development Bank                                  |
| AHA             | African Humanitarian Action                               |
| AHUs            | Air Handling Units                                        |
| All             | Area of Indirect Influence                                |
| Airshed         | Airshed Planning Professionals (Pty) Ltd                  |
| AITB            | Agricultural and Industrial Training Bureau               |
| Al              | Aluminum                                                  |
| ALARP           | As Low as Reasonably Practicable                          |
| AMS             | Artisan Mining Sector                                     |
| ANFO            | Ammonium Nitrate Fuel Oil                                 |
| AoI             | Area of Influence                                         |
| AOO             | Area of Occupancy                                         |
| APELL           | Awareness and Preparedness for Emergencies at Local Level |
| AQSR            | Air Quality Sensitive Receptors                           |
| ARD             | Acid Rock Drainage                                        |
| ARI             | Acute Respiratory Illness                                 |
| ASG             | Atmospheric Studies Group                                 |
| ASPT            | Average Score per Taxon                                   |
| ASTM            | American Society for Testing and Materials                |
| ATSDR           | Federal Agency for Toxic Substances and Disease Registry  |
| BDI             | Biological Diatom Index                                   |
| BESU            | Bengal Engineering and Science University                 |
| BID             | Background Information Document                           |
| BIF             | Banded Iron Formation                                     |
| BMFR            | Bomi Mines Feasibility Report                             |
| BMQ             | Banded Magnetite Quartzite                                |
| BOD             | Biochemical Oxygen Demand                                 |
| BPHS            | Basic Package of Health Services                          |
| CA              | Certificate of Approval                                   |
| CBL             | Central Bank of Liberia                                   |
| CDR             | Crude Death Rate                                          |
| CEAP            | County Environment Action Plans                           |
| CEO             | County Education Officer                                  |
| CER             | Certified Emissions Reductions                            |
| CH <sub>4</sub> | Methane                                                   |
| CHSWTs          | County Health and Social Welfare Team                     |

|                   |                                                         |
|-------------------|---------------------------------------------------------|
| CITES             | Convention on International Trade in Endangered Species |
| CLO               | Community Liaison Officer                               |
| CO                | Carbon Monoxide                                         |
| CO <sub>2</sub>   | Carbon Dioxide                                          |
| CO <sub>2</sub> e | Carbon Dioxide Equivalent                               |
| COD               | Chemical Oxygen Demand                                  |
| COP               | Conference of Parties                                   |
| CPRs              | Common Property Resources                               |
| CR                | Critically Endangered                                   |
| CSR               | Corporate Social Responsibility                         |
| CZ                | Central Zone                                            |
| dB                | Decibels                                                |
| DD                | Data Deficient                                          |
| DIN               | German Deutsches Institute fuer Normung                 |
| DPM               | Diesel Particulate Matter                               |
| DSO               | Direct Shipping Ore                                     |
| DSTV              | Digital Satellite Television                            |
| DTM               | Digital Terrain Model                                   |
| EC                | Electrical Conductivity                                 |
| ECOWAS            | Economic Community of West African States               |
| EEC               | Earth Environmental Consultancy Incorporated            |
| EHS               | Environmental, Health and Safety                        |
| EIA               | Environmental Impact Assessment                         |
| EIA               | Environmental Impact Assessment                         |
| EIS               | Environmental Impact Statement                          |
| EITI              | Extractive Industries Transparency Initiative           |
| EM                | Environmental Manager                                   |
| EMP               | Environmental Management Plan                           |
| EMS               | Environmental Management System                         |
| EN                | Endangered                                              |
| EOO               | Total Extent of Occurrence                              |
| EPA               | Environmental Protection Agency                         |
| EPAA              | Environment Protection Agency Act                       |
| EPFI              | Equator Principles Financial Institutions               |
| EPHS              | Essential Package of Health Services                    |
| EPML              | Environmental Protection and Management Law of Liberia  |
| EPRP              | Emergency Preparedness and Response Plan                |
| EPs               | Equator Principles                                      |
| EPSS              | Essential Package of Social Services                    |
| ERC               | Emergency Response Coordinator                          |
| ERM               | Environmental Resources Management                      |
| ERT               | Emergency Response Team                                 |
| ESIA              | Environmental Social Impact Assessment                  |
| ESMP              | Environmental and Social Management Plan                |

|       |                                                  |
|-------|--------------------------------------------------|
| EWD   | Eastern Waste Dump                               |
| EZ    | Eastern Zone                                     |
| FAO   | Food and Agriculture Organization                |
| FDA   | Forestry Development Authority                   |
| FDA   | Food and Drug Administration (United States)     |
| FDI   | Foreign Direct Investment                        |
| Fe    | Iron                                             |
| FEED  | Front End Engineering and Design                 |
| FGD   | Focused Group Discussion                         |
| FGM   | Female Genital Mutilation                        |
| FIBLL | First International Bank Liberia                 |
| FONSI | Found of No Significant Impact                   |
| FoV   | Field of Vision                                  |
| FPIC  | Free, Prior, and Informed Consent                |
| FRP   | Fiberglass Reinforced Plastic                    |
| FSNS  | Comprehensive Food Security and Nutrition Survey |
| GDI   | Gender Related Development Index                 |
| GDP   | Gross Domestic Product                           |
| GEF   | Global Environmental Facility                    |
| GHG   | Greenhouse Gas                                   |
| GIIP  | Good International Industry Practice             |
| GLCC  | Global Land Cover Characterization               |
| GMCS  | Grievance management Cells                       |
| GoL   | Government of Liberia                            |
| GPS   | Geographic Positioning System                    |
| GRC   | Grievance Redressal Committee                    |
| GRM   | Grievance Redressal Mechanism                    |
| GSM   | Gravel, Sand and Mud                             |
| GTBL  | Guaranty Trust Bank Liberia                      |
| GVs   | Guideline Values                                 |
| GWP   | Global Warming Potential                         |
| HC    | Hydrocarbons                                     |
| HEMM  | Heavy Earth Moving Machinery                     |
| HF    | High Flow                                        |
| HFCE  | Household Final Consumption Expenditure          |
| HFO   | Heavy Fuel Oil                                   |
| HH    | Household                                        |
| HPGR  | High Pressure Grinding Roll                      |
| HSE   | Health Safety and Environment                    |
| Hz    | Hertz                                            |
| IA    | Impact Assessment                                |
| IBAs  | Important Bird Areas                             |
| ICMM  | International Council on Mining and Metals       |
| ICP   | Informed Consultation and Participation          |

|                |                                                          |
|----------------|----------------------------------------------------------|
| IDPs           | Internally Displaced Persons                             |
| IFC            | International Finance Corporation                        |
| IFI            | International Financial Institution                      |
| IH             | Instream Habitat                                         |
| IHI            | Index of Habitat Integrity                               |
| ILO            | International Labor Organization                         |
| IPCC           | Intergovernmental Panel on Climate Change                |
| IPDP           | Indigenous People Development Plan                       |
| IRIS           | Integrated Risk Information System                       |
| ISO            | International Standards organization                     |
| ITCZ           | Inter Tropical Convergence Zone                          |
| ITTA           | International Tropical Timber Agreement                  |
| IUCN           | International Union for the Conservation of Nature       |
| IWRMP          | Integrated Water Resources Management Plan               |
| kg             | Kilogram                                                 |
| km             | Kilometer                                                |
| KOP            | Key Observation Point                                    |
| KPIs           | Key Performance Indicators                               |
| kWh            | Kilowatt Hour                                            |
| LAC            | Liberia Agriculture Company                              |
| LBBC           | Liberia Beverage and Bottling Company                    |
| LBDI           | Liberian Bank for Development and Investment             |
| LC             | Least Concern                                            |
| LF             | Low Flow                                                 |
| LiDAR          | Light Detection and Ranging                              |
| LIFE           | Liberia Indigenous Forum for the Environment             |
| LIMS           | Low Intensity Magnetic Separators                        |
| LMC            | Liberia Mining Company                                   |
| Lmo            | Monin-Obukhov length                                     |
| LNP            | Liberia National Police                                  |
| LOM            | Life of Mine                                             |
| Lp             | Sound Pressure Level                                     |
| LPG            | Liquid Petroleum Gas                                     |
| LPP            | Local Procurement Plan                                   |
| LRRC           | Liberia Refugee Repatriation and Resettlement Commission |
| LSFRP          | Liberian Swedish Feeder Road Project                     |
| LTA            | Liberia Telecom Authority                                |
| LVIA           | Landscape and Visual Impact Assessment                   |
| LW             | Sound Power Level                                        |
| LWSC           | Liberia Water and Sewage Corporation                     |
| m              | Meter                                                    |
| m <sup>2</sup> | Meter Squared                                            |
| m <sup>3</sup> | Meter Cubed                                              |
| mamsl          | Meters above mean sea level                              |

|                 |                                                                                       |
|-----------------|---------------------------------------------------------------------------------------|
| MAP             | Mean Annual Precipitation                                                             |
| mbs             | Meters below surface                                                                  |
| MCH             | Maternal and Child Health                                                             |
| MCIMS           | Mineral Cadaster Information Management System                                        |
| MDA             | Mineral Development Agreement                                                         |
| MEAs            | Multilateral Environmental Agreements                                                 |
| mg              | Milligram                                                                             |
| ML              | Mining Lease                                                                          |
| MoA             | Ministry of Agriculture                                                               |
| MoF             | Ministry of Finance                                                                   |
| MoH             | Ministry of Health and Social Welfare                                                 |
| MoI             | Ministry of Internal Affairs                                                          |
| MoJ             | Ministry of Justice                                                                   |
| MoLME           | Ministry of Land, Mines and Energy                                                    |
| MoPW            | Ministry of Public Works                                                              |
| MoT             | Ministry of Transport                                                                 |
| MRL             | Minimum Risk Level                                                                    |
| Mt              | Million Tons                                                                          |
| Mtpa            | Million tons per annum                                                                |
| MW              | Mega Watt                                                                             |
| NEAP            | National Environmental Action Plan                                                    |
| NEAP            | National Environmental Action Plan                                                    |
| NEC             | National Energy Committee                                                             |
| NECOLIB         | National Environmental Commission of Liberia                                          |
| NEP             | National Environmental Policy                                                         |
| NEPC            | National Environmental Policy Council                                                 |
| NFPA            | National Fire Protection Association                                                  |
| NGO's           | Non-Government Organizations                                                          |
| NHSB            | National House and Savings Bank                                                       |
| NIOC            | National Iron Ore Company                                                             |
| NLTCP           | National Leprosy and Tuberculosis Control Program                                     |
| NO              | Nitrogen Monoxide                                                                     |
| NO <sub>2</sub> | Nitrogen Dioxide                                                                      |
| NOAEL           | No Observed Adverse Effect Level                                                      |
| NoI             | Notice of Intent                                                                      |
| NO <sub>x</sub> | Nitrogen Oxides                                                                       |
| NPA             | National Ports Authority                                                              |
| NPI             | Australian National Pollutant Inventory                                               |
| NSR             | Noise Sensitive Receptor                                                              |
| NSSRL           | National Security Sector Strategy for the Republic of Liberia                         |
| NSSRL-IM        | National Security Sector Strategy for the Republic of Liberia - Implementation Matrix |
| NT              | Near Threatened                                                                       |
| NTMP            | National Transport Master Plan                                                        |

|        |                                                                       |
|--------|-----------------------------------------------------------------------|
| NWWD   | Northwestern Waste Dump                                               |
| O3     | Ozone                                                                 |
| OECD   | organization for Economic Co-operation and Development                |
| OPD    | Out-Patients Department                                               |
| PAH    | Polycyclic Aromatic Hydrocarbons                                      |
| PAH    | Project-Affected Household                                            |
| PAP    | Project Affected People                                               |
| PAPs   | Project Affected Parties                                              |
| PBPK   | Pharmacokinetic                                                       |
| PDF    | Postscript Data File                                                  |
| PFC    | Perfluorocarbon                                                       |
| PLP    | Project Linkage Plan                                                  |
| PM     | Particulate Matter                                                    |
|        | Thoracic particulate matter with an aerodynamic diameter of less than |
| PM10   | 10mm                                                                  |
|        | Thoracic particulate matter with an aerodynamic diameter of less than |
| PM2.5  | 2.5mm                                                                 |
| POPs   | Persistent Organic Pollutants                                         |
| PPE    | Personal Protective Equipment                                         |
| ppm    | Parts per Million                                                     |
| PPV    | Peak Particle Velocities                                              |
| PRS    | Poverty Reduction Strategy                                            |
| PS     | Performance Standards                                                 |
| RAP    | Resettlement Action Plan                                              |
| RC     | Resettlement Committee                                                |
| RCC    | Reinforced Cement Concrete                                            |
| REL    | Reference Exposure Level                                              |
| RfCs   | Inhalation Reference Concentrations                                   |
| RH     | Riparian Habitat                                                      |
| ROM    | Run of Mine                                                           |
| RPF    | Resettlement Policy Framework                                         |
| RRAP   | Resettlement and Rehabilitation Action Plan                           |
| RTA    | Road Traffic Accidents                                                |
| S      | Storability                                                           |
| SA DEA | South African Department of Environmental Affairs                     |
| SA     | South African National Ambient Air Quality Standards                  |
| SABS   | South African Bureau of Standards                                     |
| SANS   | South African National Standards                                      |
| SAP    | Social Action Plan                                                    |
| SASS5  | South African Scoring System 5                                        |
| SCUK   | Save the Children UK                                                  |
| SDF    | Social Development Fund                                               |
| SEP    | Stakeholder Engagement Plan                                           |
| SIA    | Social Impact Assessment                                              |

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| SIC                | Stones in Current                                                |
| SIDA               | Swedish International Development Cooperation Agency             |
| SMP                | Soil Management Plan                                             |
| SMU                | Social Management Unit                                           |
| SO <sub>2</sub>    | Sulphur Dioxide                                                  |
| SOOC               | Stones out of Current                                            |
| SoW                | Scope of Work                                                    |
| SRTM               | Shuttle Radar Topography Mission                                 |
| STDP               | Skills and Technology Development Plan                           |
| STIs               | Sexually Transmitted Infections                                  |
| STP                | Sewage Treatment Plant                                           |
| SWWD               | Southwestern Waste Dump                                          |
| T                  | Transmissivity (m <sup>2</sup> /d)                               |
| TB                 | Tuberculosis                                                     |
| TC                 | Tolerable Concentration                                          |
| TC                 | Tribal Certificate                                               |
| TCE                | Tata Consulting Engineers                                        |
| tCO <sub>2</sub> e | Ton of Carbon Dioxide Equivalent                                 |
| TDS                | Total Dissolved Solids                                           |
| TOKTEN             | Transfer of Knowledge through Expatriate Nationals               |
| ToR                | Terms of Reference                                               |
| TS                 | Technical Standards                                              |
| TSF                | Tailings Storage Facilities                                      |
| TSP                | Total Suspended Particulate Matter                               |
| TWQR               | Target Water Quality Range                                       |
| UBALL              | United Bank for Africa Liberia Ltd                               |
| UBN                | Unmet Basic Needs                                                |
| UGF                | Upper Guinea Forest                                              |
| UNCCD              | United Nations Convention to Combat Desertification              |
| UNDP               | United Nations Development Program                               |
| UNEP               | United Nations Environment Program                               |
| UNESCO             | United Nations Educational, Scientific and Cultural Organization |
| UNFCCC             | United Nations Framework Convention on Climate Change            |
| UNMIL              | United Nations Mission in Liberia                                |
| UNPOL              | United Nations Police                                            |
| URFs               | Unit Risk Factors                                                |
| USBM               | United States Bureau of Mines Standard                           |
| USGS               | United States Geological Survey                                  |
| UTI                | Urinary Tract Infections                                         |
| VEG                | Vegetation                                                       |
| VET                | Vocational Education and Training                                |
| VOCs               | Volatile Organic Compounds                                       |
| VOD                | Velocity of Detonation                                           |
| WBCSD              | World Business Council on Sustainable Development                |

## CHAPTER 21 EXPANSION PROJECTS- 10 MTPA

### 21.1 Introduction

Western Cluster Limited (WCL) has commenced iron ore production at its Bomi Hills mine at 4 Mtpa up to the reporting period for this updated ESIA, however, WCL intends to increase its production to 10 Mtpa as per feasibility reports available for geological, mineralogical, metallurgical, geotechnical, hydrological, geographical and other technical required for the sustainable exploitation of the ore body at Bomi Hills. This will result in expansion to its current project facilities and operations includes construction of an ore concentrator plant, haul roads, and ore jetty infrastructure for which the following Chapters (21 & 22) has been included as the final chapters of this updated ESIA.

For the purposes of the social and community health impact assessment, the expansion construction period is planned to be as per different sections of the growth projects, a public announcement of the revised / update of Mineral Development Agreement (MDA). The announcement included the project stages, lay-out plan showing locations of different project components including the identified production areas, alternative roads and jetties, housing and other facilities. The dissemination of this information to the public who may be affected by the Projects has a direct influence on their behaviour and expectations and therefore on the impact assessment of social and community health impacts. Taking possession of the Project site is a pre-requisite for starting constructions activities. The social and community health impacts envisaged during the pre-construction phase includes:

- The effects of the loss of private property and productive assets.
- The effects of psychological stress and uncertainty linked to displacement.
- A brief discussion on these areas of social and community health impact.

Western Cluster Limited, Liberia, is an iron ore mining division of Vedanta Limited. Western Cluster Limited has explored the Bomi concession, covering an area of 114.42 km<sup>2</sup>. Comprehensive drilling across the entire mineralised zone has enabled reserve estimation based on drill hole data.

The iron ore at Bomi occurs in the following two primary forms

- Massive to Semi-Massive
- Magnetite Banded Iron Formation (BIF) – thinly banded rock comprising quartz with hematite or magnetite.

The ore body predominantly comprises Banded Magnetite Quartzite (BMQ), with an estimated Mineral Resource of 249 MnT at an average grade of approximately 36% Fe. Additionally, there is an upside potential of 701 MnT.

Given its low grade, the magnetite ore is unsuitable for direct use in metallurgical plants and requires beneficiation to increase the iron content. To achieve this, WESTERN CLUSTER LIMITED plans to set up concentrator plants in two phases:

- **Phase 1:** One production stream with a capacity of 3 MTPA.
- **Phase 2:** Two additional production streams, each with a capacity of 3 MTPA, increasing the total capacity to 9 MTPA.

With further optimisations and efficiency de-bottlenecking, a 10% increase in production can be achieved, resulting in a total production capacity of 10 MTPA from the Bomi Mines.

### Phase 1 - 3 Mtpa Concentrate Product from Bomi Mine

The Phase -1 consists of the following packages, although it must be understood the Phase 2 is planned be a replica of Phase 1, in other words the plant is planned to be developed in modular form having the same design but in multiple stages.

#### 21.3.1 3 MTPA Concentrator Plant and Power Plant

The plant is planned to produce a 3 MTPA product (67% Fe, <4% SiO<sub>2</sub>, <1% Al<sub>2</sub>O<sub>3</sub> and particle size of P80 = 45 microns) by processing 7.5 MTPA of input BMQ ore at 35% Fe. The concentrator plant shall use Polyacrylamide (PAM) to enhance the settling time, the flocculent type will be also considered for optimisation of the process, currently the flocculant will be non-ionic base flocculant. The circuit of the process does not allow any bleeding during processing; therefore, no impact will be expected.

#### 21.3.2 HFO Diesel Power Generation

The plant needs 30MW of electricity with a 20% buffer capacity. Due to the unavailability of grid electricity, a 38MW HFO-based power plant is planned to be built alongside the concentrator plant. The HFO storage facilities will be sized in accordance with the HFO requirements of the generators and shall have a minimum capacity of no less than 15 days. The storage of HFO, diesel and oil shall be provided accordingly, and the number and sizes of tanks and capacities will be dependent on the installed plant capacity. The HFO, diesel and oil tanks will be constructed in tank farm area in a phased manner with common bunded area to avoid the oil spillage in case of any leakage from tanks. The HFO, diesel and oil storage facility shall

be provided with the necessary fire detection and protection systems in accordance with NFPA rules and standards. A typical HFO and diesel storage layout is shown in figure below. The estimated duration to complete the project is 18 months.

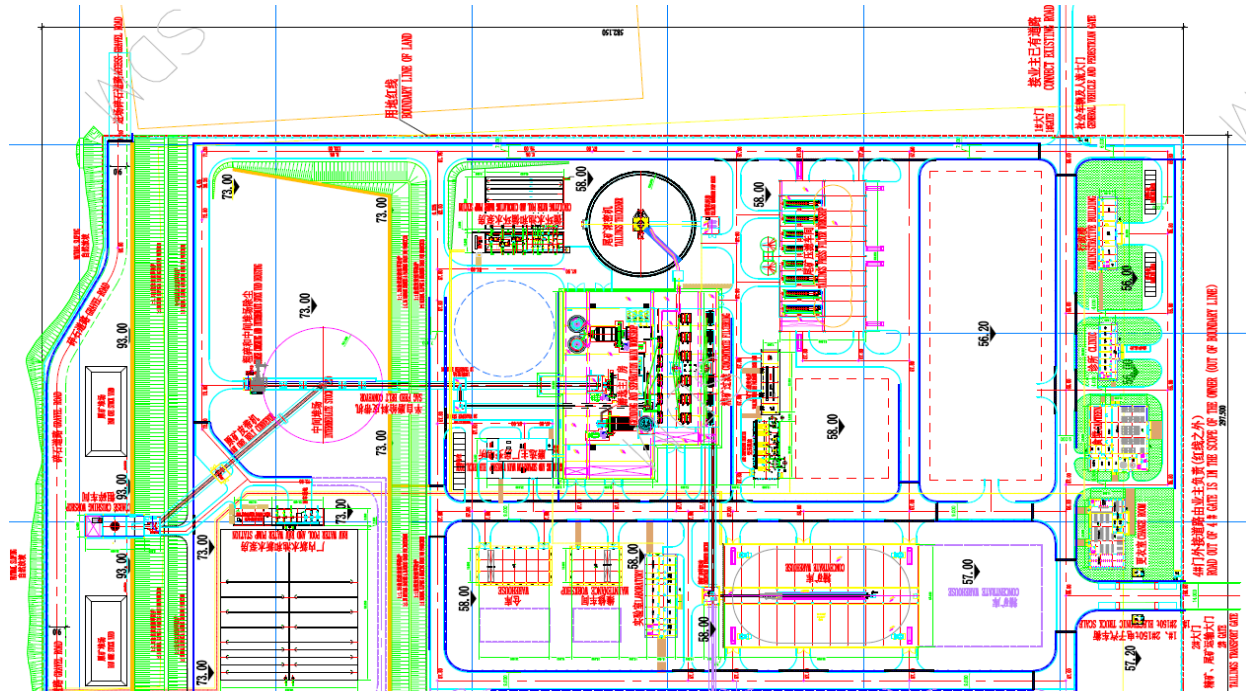


Figure 1: Conceptual Layout Modular Design Concentrator Plant

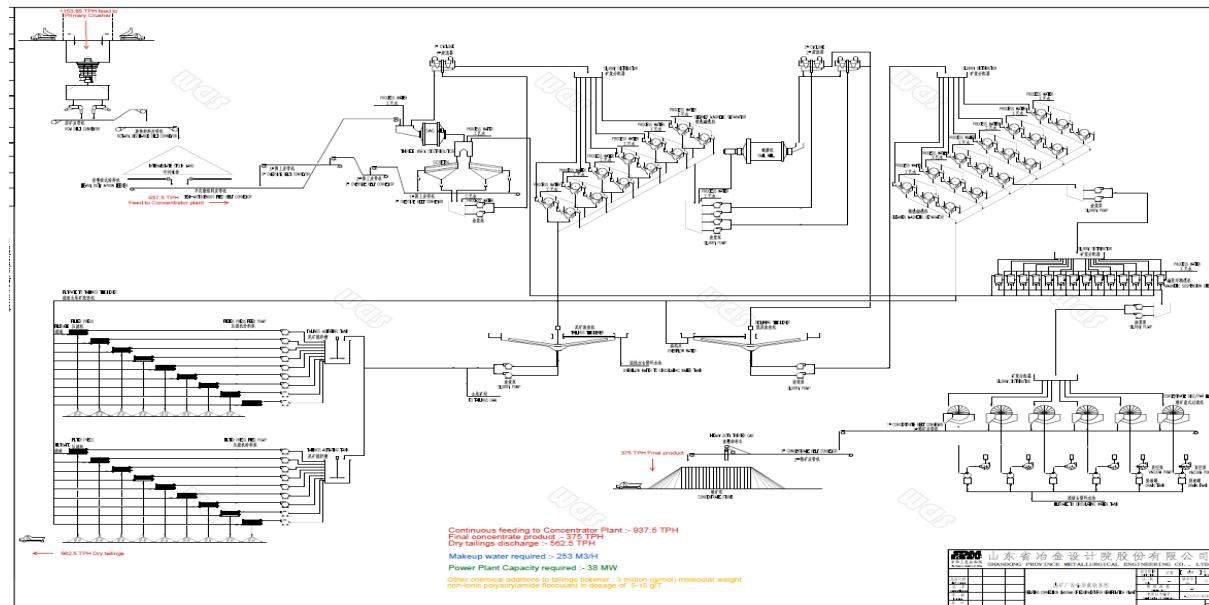


Figure 2: Process Flow Concentrator Plant

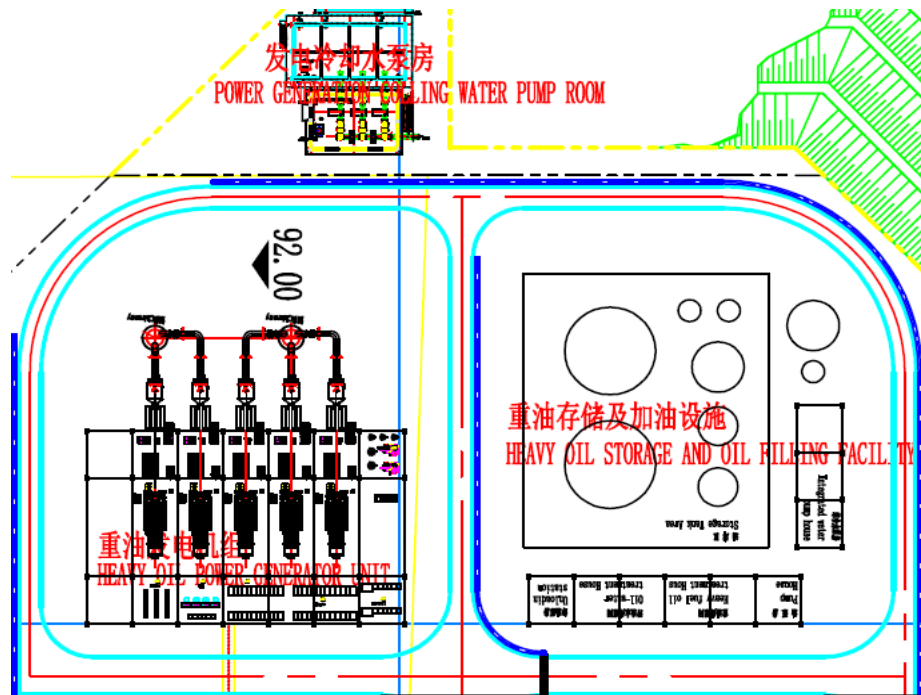


Figure 3: HFO power plant layout

### 21.3.3 Potential Impact – Constructions Phase of Concentrator Plant

The soil impact will be local as the area where the Concentrator plant will be built is already zoned for mining activities. However, soil will be compacted as the construction take place due to unnatural load and increased traffic due to heavy construction vehicles in the area thus changing the soil structure. During the construction phase, soil is susceptible to compaction from heavy construction vehicles when soil is stripped and stockpiled. During the operational phase, soil compaction increases as the weight of the stockpiles results in further compaction as well as constant traffic on the haul roads. During construction soil is again compacted as construction vehicles move up and down to remove infrastructure and move topsoil to areas for rehabilitation purposes.

#### 21.3.4 Potential Consequence

Soil compaction generally reduces the amount of water that plants can take up. This is because compaction crushes many of the macropores into micropores, and the bulk density increases. As the clay particles are forced closer together, soil strength may increase beyond about 2000 kPa, the level considered to limit root penetration. Indirectly, compaction also results in aggravation of run-off erosion as compaction reduces the water infiltration rate which results in an off-site impact.

### 21.3.5 Significance of Impacts

The impacts of soil compaction are mainly direct and although the impact only has local extent, it is permanent as soil compaction is very difficult to remediate and will continue after the mine closure. The impact is of medium magnitude for some areas that have already been compacted by previous mining and infrastructure development activities and the receptors considered only medium sensitive. The impact has moderate significance as soil compaction can be one of the main factors impeding successful mine rehabilitation (Table 21(a)).

Table 1: Soil Compaction Impact

|                     |                                                                                                                                                                                |            |           |               |       |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|---------------|-------|
| Impact              | Soil erosion                                                                                                                                                                   |            |           |               |       |
| Impact Nature       | Negative                                                                                                                                                                       | Positive   |           | Neutral       |       |
| Impact Type         | Impact on soils is negative.                                                                                                                                                   |            |           |               |       |
|                     | Direct                                                                                                                                                                         | In-direct  |           | Induced       |       |
| Impact Duration     | Impact on soils is direct                                                                                                                                                      |            |           |               |       |
|                     | Temporary                                                                                                                                                                      | Short-term | Long-term | Permanent     |       |
|                     | Impacts are considered permanent, as the impacts will continue past closure with only a very slow recovery rate if at all                                                      |            |           |               |       |
| Impact Extent       | Local                                                                                                                                                                          | Regional   |           | International |       |
|                     | Impacts on soils are local to the mine site.                                                                                                                                   |            |           |               |       |
| Impact Scale        | The scale of the impact is estimated to be restricted to the areas used for mining and infrastructure as well as areas roads constructed.                                      |            |           |               |       |
| Frequency           | This impact will still continue after closure of the mine.                                                                                                                     |            |           |               |       |
| Impact              | Positive                                                                                                                                                                       | Negligible | Small     | Medium        | Large |
| Magnitude           | Impact magnitude is considered medium as this is a brownfield site and the soils have already been impacted by compaction in the past.                                         |            |           |               |       |
| Receptor            | Low                                                                                                                                                                            | Medium     |           | High          |       |
| Sensetivity         | The receptor sensitivity is considered as medium for although compaction will most likely occur, a large area of the site has already been impacted by housing infrastructure. |            |           |               |       |
| Impact Significance | Negligible                                                                                                                                                                     | Minor      | Modarate  | Major         |       |
|                     | Significance of impact is considered to be Moderate.                                                                                                                           |            |           |               |       |

### Mitigation Measures, Management and Monitoring

Apart from the embedded controls to be included in project design, the following mitigation measure will reduce the significance of soil compaction:

- Restrict access of vehicles and construction vehicles to haul roads and active project areas. Vehicles should not be permitted to drive on areas of natural or semi-natural vegetation unnecessarily.
- Once stockpiles have been established, they should not be moved around to other areas but directly used for rehabilitation again to avoid creating more compacted areas.

### 21.3.6 *Significance of Residual Impacts*

With proper mitigation measures and the embedded controls as recommended above, it is anticipated that the significance of this impact will be moderate. The commissioning and operations of the concentrator plant shall be detailed covered on a project brief and subsequent issuing the operational permit, this will include a detailed EIA audit study that will indicate the operational aspect and impact. The conclusion of operational aspect will also bring about the monitoring and its intervals.

## 21.2 Water Balance for Concentrator Plant

The project shall utilise water that is planned to be abstracted from the Mahe river that is laying 8 kilometres East of plant location within the Bomi Hill Mine concession, this water source was historical used by the historical LMC for their same purpose on mine ore washing and processing. The pump station and installation design shall be constructed as per below configuration to meet the demand of 10 MTPA.

### 21.2.1 *Water Pipeline details from Mahe River to Concentrator plant location*

- MOC of pipeline: Low carbon steel (ASTM A53/A53M)
- Size: 500 mm diameter
- Number of pipelines: To ensure safety and reliability, two runs of the pipeline planned to be provided with necessary valves for isolation and maintenance.
- Length: Each pipeline from the river pumping station to the plant location that is around 8 km long.

### 21.2.2 *Water pump details a river water pumping station*

- Flow: 474-790-972 m<sup>3</sup>/h
- Head: H=68-61-53m
- Speed: 1480 rpm
- Power: 185 kW
- Qty: 3 nos. (2 running 1 Standby)

### 21.2.3 *Power requirement of water pumping station*

- Diesel Generator Power is planned to run the pump station.
- Rating of Diesel Generator: 800 kW.

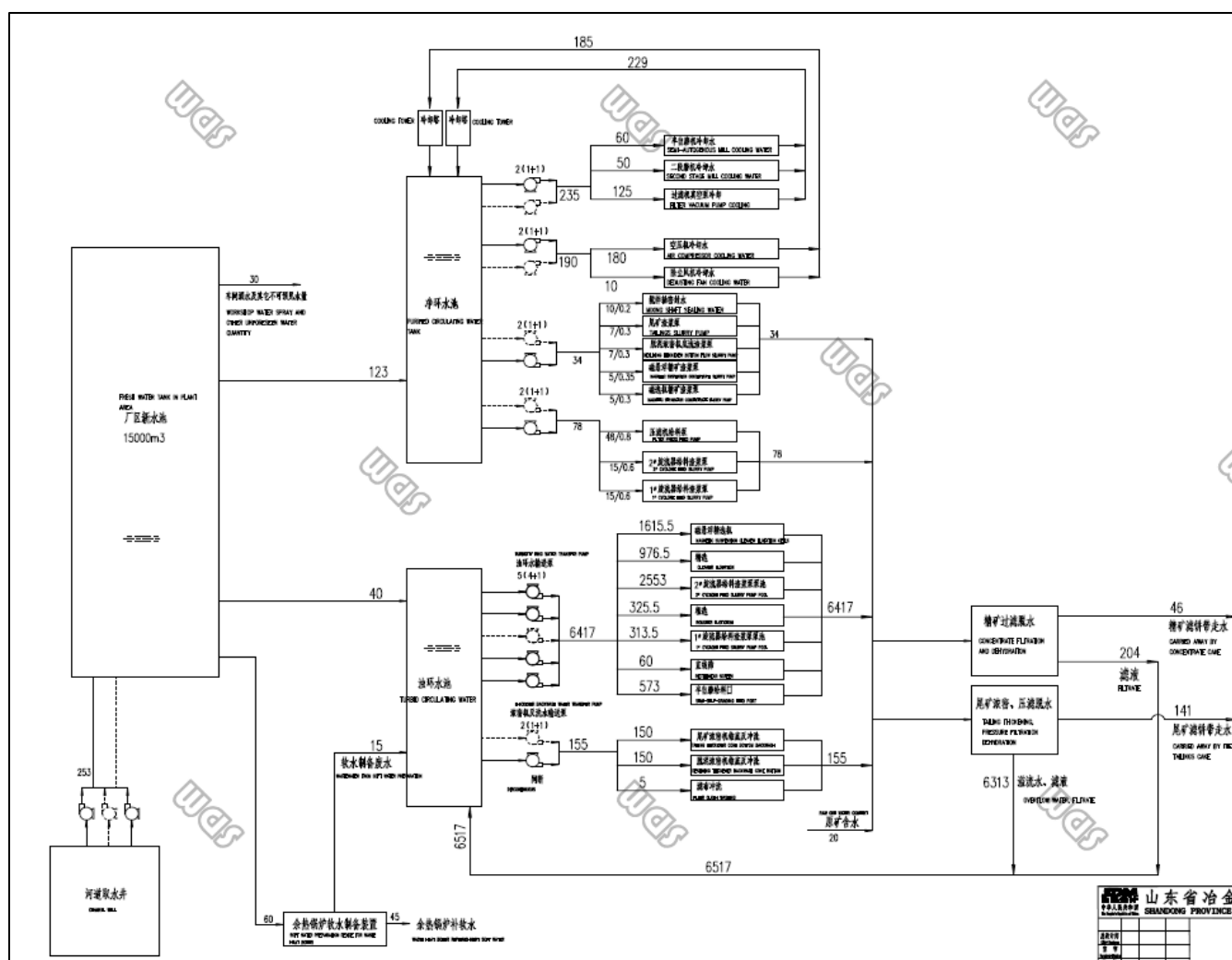


Figure 4: Illustration of water balance model

### 21.3 Mine Waste- Tailings from Concentrator Plant

The Concentrator Plant shall produce a waste product in form of tailings, DST process is considered the sustainable safe and environmentally friendly practise.

**Dry Stack Tailings (DST)** systems are particularly suited to mining operations operating in areas where **water conservation is critical** – they also provide significant safety and other environmental benefits; this option is considered for its practicality where water saving is a focus, and its stability compared to wet tailings.

**Water is life.** The world's water is becoming increasingly poorer in quality and a new approach to the way we plan, manage and use water is required, else we are likely to have to deal with water shortages in the not-too-distant future.

**Sustainable water management**, together with **safety**, are increasingly important topics for **mining operations, investors** and all **stakeholders** around the world; especially in areas where **water conservation** is **critical** and/or **tailings failure risks** are **significant**. Demand for domestic, commercial and industrial water is projected to **increase** and **sustainable water management is therefore becoming an increasingly important and challenging issue**.

#### *21.3.1 Advantage of Dry Stack Tailings*

DST systems offer several advantages to other surface tailings storage options – some of which include:

- Significant safety improvement with the risk of catastrophic dam failure and tailings runout being eliminated.
- DST facilities are also suitable to areas of high seismic activity and areas where there is limited construction material to develop a conventional retention impoundment
- Reduced water requirements, principally achieved by recycling process water and near elimination of water losses through seepage and/or evaporation
- Groundwater contamination through seepage is virtually eliminated
- Smaller tailings footprint and can be used in “aggressive environments” (e.g. undulating or steep terrain)
- Significantly better regulator and public perceptions
- Easier to close and rehabilitate

Adopting a DST system with regards the management of tailings is thus a tangible approach to sustainable water and safety management efforts.

#### *21.3.2 Location of Tailings Storage Facility*

Location of the TSF is ideally selected considering the designs, location, environmental, social and safety aspect of tailings management and storage, the TSF is to be directly or indirectly managed with Western

Cluster Limited as the registered permit holder of the TSF, the permit will be in line with EPA and GIST (Global Industry Standard Tailings Management).

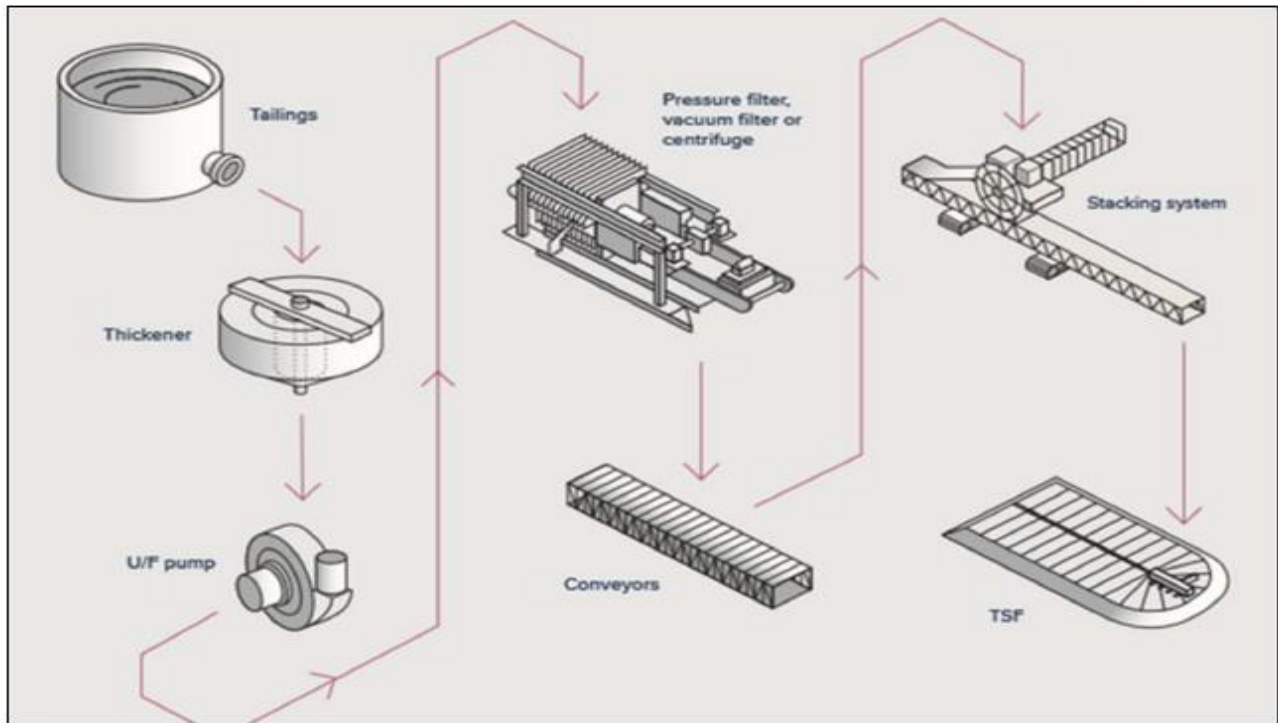


Figure 5: Typical Dry Stacking Material Flow

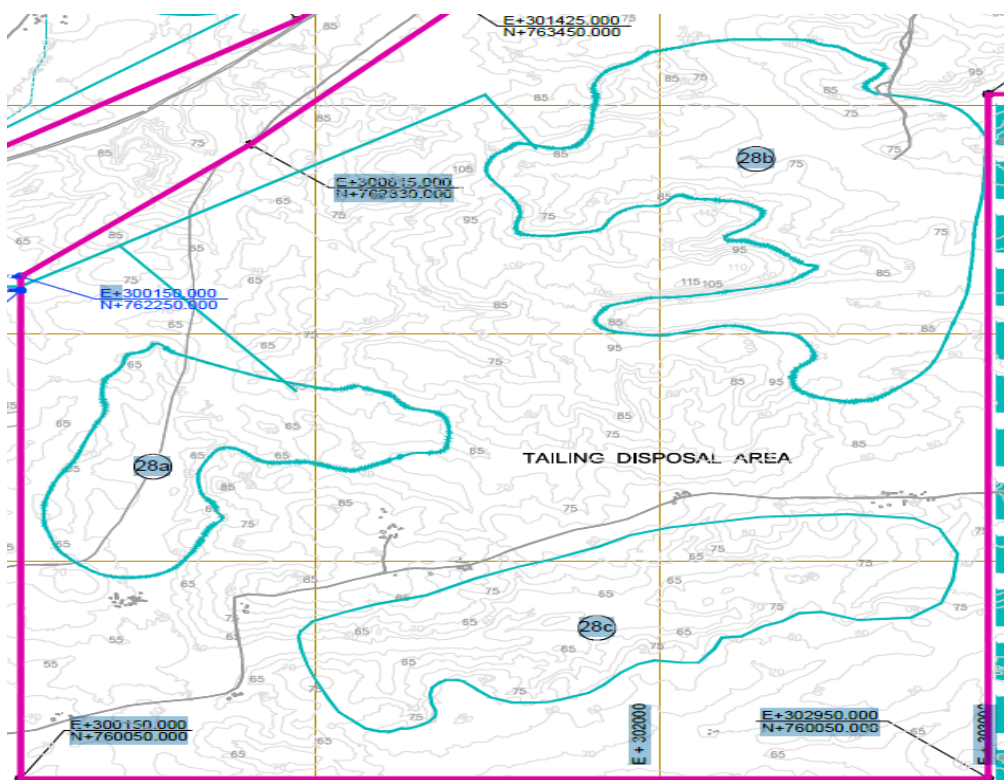


Figure 6: TSF (Tailings Storage Facility - EPA approved (ED/EPA-01/0100/14/RL

## 21.4 Laboratory

Operations shall be complemented and supported by a fully flagged laboratory that will meet the Environmental Protection Agency (EPA) and Environmental Management Protection Laws (EPML) of Liberia. The Laboratory may be directly or outsourced. The laboratory shall operate in line with local and international requirements. The laboratory will have a localised chemical storage facility designed to meet the below requirements of EPA (*Chemical Guidelines of Liberia* - REGULATORY INSTRUMENT No: RI/C&E-002-04/20).

### Process Flow Plan for BOMI Wet Iron Ore Analytical Laboratory

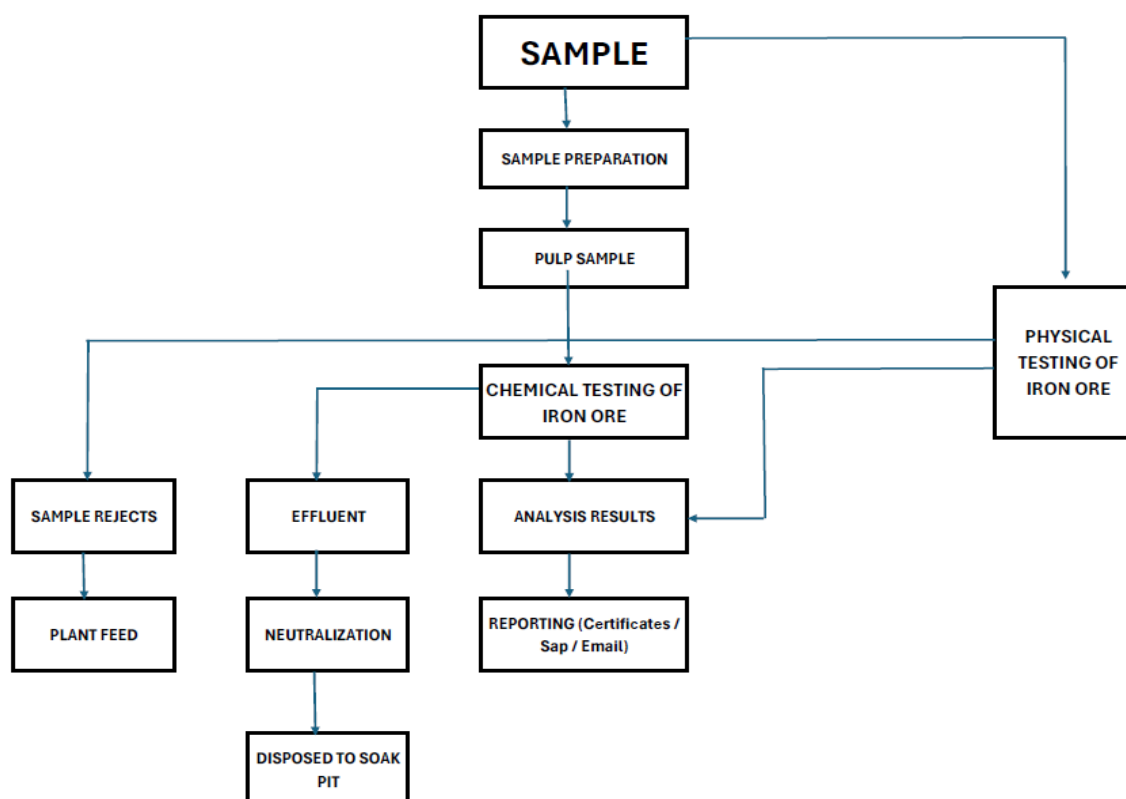


Figure 7: Process Flow Diagram of the Laboratory

## 21.5 Construction Methodology

To support the concentrator plant's O&M (operation and maintenance) during commissioning and normal operation, WESTERN CLUSTER LIMITED intends to build a township that provides safe and comfortable staff accommodation.

Instead of using only the traditional construction method, alternative construction technologies that are advanced, durable, fire-resistant, and environment-friendly will be considered for building the township. The selected construction method will adopt the latest international standards of engineering and technologies, which are most effective and efficient. Also, the construction method will be chosen to ensure minimal dust, waste, and noise during construction.

## 21.6 Ore Transport Haul Roads and Jetty Infrastructure

To ensure the cost-effective, efficient, and ESG-compliant transportation and export of 3 MTPA of concentrated iron ore from Bomi mines, WESTERN CLUSTER LIMITED intends to construct a dedicated road network and jetty at a feasible location. There are number of options that are currently under feasibility studies.

The mine currently utilises the Bomi Highway at transport the iron ore cargo from Bomi Hill Mine to the Freeport of Monrovia, the transportation is regulated by a Road User Permit issued by the Government of Liberia under the Department of Mister of Public Works.

### 21.7.1 Ore Transport Haul Roads

A specialised firm is conducting a technical feasibility study and engineering work for a dedicated gravel road corridor and suitable barge loading jetty. This engineering work is expected to be completed by January 2025. Afterwards, this infrastructure will be built based on the feasibility, design, engineering, and scope of work. The estimated duration for building it for the Bomi Mine is 18 months from the award of the contracts, aligning with the concentrator plant timeline. The project will be connected by roads network that will serve the mine and where possible service communities in the areas, the road network will be of a specific design.

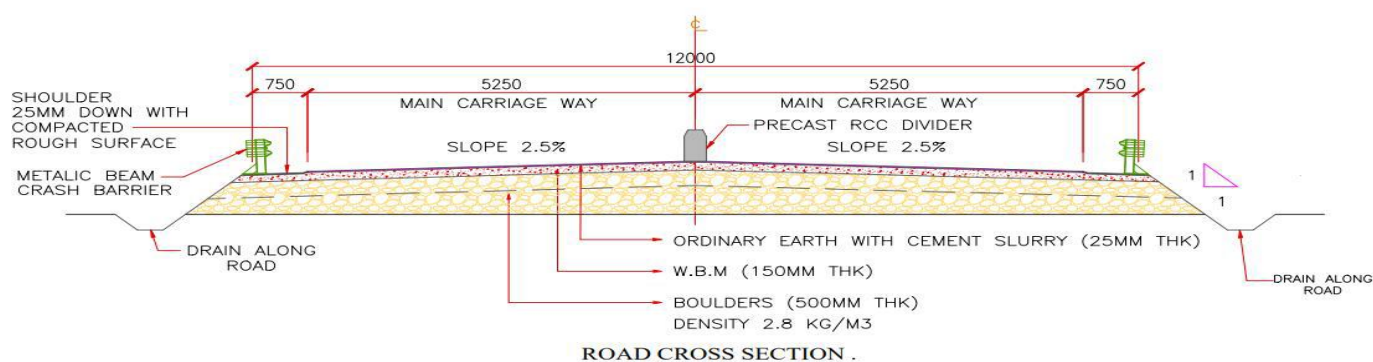


Figure 8: Ore Transport Haul Road design

### 21.7.2 Potential Impact during Road Construction

Soil erosion is caused by the removal of soil particles from the landscape because of water and wind movement. For the proposed project and considering previous mining operations, all soil forms will be prone to erosion where vegetation has been removed. However, the areas where Ferralsols (989 ha) and the combination of Stagnosols and Gleysols (245 ha) has been identified has the least susceptibility to soil erosion. The highest impact of erosion is anticipated for the area where Plinthosols have been identified

(6 458 ha), for apart from the obvious soil loss, the exposure of subsurface plinthic horizons will result in irreversible hardening that make soil difficult to remediate. Areas with Technosols are also very susceptible to erosion where vegetation cover has previously not been re-established.

During the construction phase, all soil forms will be susceptible to erosion to some extent because the natural vegetation will be cleared before construction takes place in both the mining and infrastructure areas. During the operational phase, topsoil stockpiles consisting of Plinthosols as well as haul roads following steep slopes down valleys will still be susceptible to erosion. The walls of tailings storage facilities or areas where soils are temporarily stored for additional construction purposes, will also be susceptible to erosion. Opening new pits for mining purposes in areas with a slope where Plinthosols occur will also result in erosion risk. Soil surfaces with infrastructure such as buildings will not be exposed to erosion any longer.

### 21.7.3 Potential Consequence

The main potential consequences of soil erosion are the reduction in soil quality and the reduced water-holding capacity of eroded soils. The indirect consequences of soil erosion include disruption of riparian ecosystems and sedimentation leading to reduced water quality.

Table 2: Potential impact associated with the haul road construction

|                     |                                                                                                         |            |            |  |           |               |           |  |       |
|---------------------|---------------------------------------------------------------------------------------------------------|------------|------------|--|-----------|---------------|-----------|--|-------|
| Impact              | Soil erosion                                                                                            |            |            |  |           |               |           |  |       |
| Impact Nature       | Negative                                                                                                |            | Positive   |  |           | Neutral       |           |  |       |
| Impact Type         | Impact on soils is negative.                                                                            |            |            |  |           |               |           |  |       |
|                     | Direct                                                                                                  |            | Indirect   |  |           | Induced       |           |  |       |
|                     | Impact on soils is direct and indirect                                                                  |            |            |  |           |               |           |  |       |
| Impact Duration     | Temporary                                                                                               |            | Short-term |  | Long-term |               | Permanent |  |       |
|                     | Impacts are considered permanent, as the impacts will continue post closure with slow recovery rate     |            |            |  |           |               |           |  |       |
| Impact Extent       | Local                                                                                                   |            | Regional   |  |           | International |           |  |       |
|                     | Impacts on soils are local to the mine site.                                                            |            |            |  |           |               |           |  |       |
| Impact Scale        | The scale of the impact is estimated to be restricted to the areas cleared for mining and ifrastructure |            |            |  |           |               |           |  |       |
| Frequency           | Throughout the life time of the mining operations as well as once mining stopped if left unmitigated.   |            |            |  |           |               |           |  |       |
| Impact              | Positive                                                                                                | Negligible |            |  | Small     |               | Medium    |  | Large |
| Magnitude           | Impact magnitude is considered medium.                                                                  |            |            |  |           |               |           |  |       |
| Receptor            | Low                                                                                                     |            | Medium     |  |           | High          |           |  |       |
| Sensetivity         | The receptor sensitivity is considered as high.                                                         |            |            |  |           |               |           |  |       |
| Impact Significance | Negligible                                                                                              |            | Minor      |  | Modarate  |               | Major     |  |       |
|                     | Significance of impact is considered to be Moderate.                                                    |            |            |  |           |               |           |  |       |

#### 21.7.4 Significance of Impacts

The impacts of soil erosion are both direct and indirect. The direct impacts are the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil and the reduced water-holding capacity of eroded soils. The off-site indirect impacts of soil erosion include the movement of the soil particles to waterways and lakes and dams which leads to disruption of riparian ecosystems and reduced water quality. Soil erosion causes an impact when the resource has been lost from the landscape, until it is suitably reclaimed and rehabilitated. Although there are off-site indirect impacts associated with this, the impact is mainly considered to be local. The impacts may continue after mining activities have ceased in the case of insufficient vegetation re-establishment. The magnitude of the impact is considered as medium and of a moderate significance (Majority of the surface infrastructure facilities have been planned on the area which was disturbed by earlier mining activities) (Table 2).

Mitigation Measures, Management and Monitoring Apart from the embedded controls to be included in project design, the following mitigation measures will reduce the significance of soil erosion:

- Stripping of topsoil should not be conducted earlier than required (maintain vegetation cover for as long as possible) to prevent the erosion (wind and water) of organic matter, clay and silt.
- Stripped soils should be stockpiled at a slope of not more than 33 percent as a berm upslope (majority) and surrounding the disturbed area.
- Erosion control measures such as intercept drains, and toe berms must be constructed where necessary.
- Soil stockpiles must be sampled, ameliorated (if necessary) and re-vegetated as soon after construction as possible. This is to limit exposure to rainfall and wind, as well as to slow and trap runoff, thereby reducing soil erosion. Plant species indigenous to the area are preferred, given both their adaptation to the natural site conditions as well as their lower maintenance requirements. This is highly recommended to maintain the natural biological soil life associated with the indigenous vegetation.
- Gravel and haul roads must be well drained to limit soil erosion.
- The vegetation cover on the soil stockpiles (berms) must be regularly monitored to maintain a high basal cover. Such maintenance will limit soil erosion due to both water (runoff) and wind (dust) erosion.

The project site has a distinct wet and dry season. It is recommended that the erosion monitoring be programmed to be carried out periodically during construction and operations to determine if any seasonal variations do occur. Thereafter, there should be plan for annual monitoring.

Monitoring programmed should include a physical observation and reporting of the following:

- Evidence of erosion or land degradation.
- Condition of access roads.
- Condition of cleared areas.
- Condition of perimeter drains (if installed) and associated settlement ponds (if installed); and
- Compliance with applicable regulatory and corporate requirements.

#### 21.7.5 Significance of Residual Impacts

With proper mitigation measures and the embedded controls as recommended above, it is anticipated that the significance of this impact can be reduced to minor. Taking the high rainfall area and the extent of the proposed mining operations into consideration it is unlikely that soil erosion will have low significance.

Table 3: Impact on fertile soil loss and sterilization

|                        |                                                                                                                           |            |           |               |
|------------------------|---------------------------------------------------------------------------------------------------------------------------|------------|-----------|---------------|
| t                      | Loss and sterilization of fertile topsoil layer                                                                           |            |           |               |
| t Nature               | Negative                                                                                                                  | Positive   |           | Neutral       |
| t Type                 | Impact on soils is negative.                                                                                              |            |           |               |
|                        | Direct                                                                                                                    | In-direct  |           | Induced       |
|                        | Impact on soils is direct                                                                                                 |            |           |               |
| Impact Duration        | Temporary                                                                                                                 | Short-term | Long-term | Permanent     |
|                        | Impacts are considered long-term and rehabilitation after closure might restore the soil fertility to a large extent.     |            |           |               |
| Impact Extent          | Local                                                                                                                     | Regional   |           | International |
|                        | Impacts on soils are local to the mine site.                                                                              |            |           |               |
| t Scale                | The scale of the impact is estimated to be restricted to the areas used for mining roads constructed.                     |            |           |               |
| ency                   | This impact will still continue after closure of the mine.                                                                |            |           |               |
| t itude<br>itor        | Positive                                                                                                                  | Negligible | Small     | Medium        |
|                        | Impact magnitude is considered medium as this is a brownfield site and the soils have already been impacted by            |            |           |               |
|                        | Low                                                                                                                       | Medium     |           | High          |
| tivity                 | The receptor sensitivity is considered as medium for although compaction will most likely occur, a large area of the site |            |           |               |
| Impact<br>Significance | Negligible                                                                                                                | Minor      | Modarate  | Major         |
|                        | Significance of impact is considered to be Moderate.                                                                      |            |           |               |

#### 21.7.6 *Potential Impact*

During the construction phase, topsoil wherever found is stripped and stockpiled for proposed activities including construction of the side walls of the road and reconditioned areas of the project per area, main roads and haul roads and other areas. The reason for stripping topsoil is to have soil material available for rehabilitation purposes during construction phases. The most critical and important part of the soil is the uppermost 20 cm as this is the repository for seeds, tubers, bulbs etc. Under natural conditions most grass seed remains viable for only about one (1) year (reproductive seedbank life), with only very few species having seed that can survive for up to 2 - 3 years. Under stockpile conditions it is probable that the seedbank life will be shorter as compared to natural conditions.

#### 21.7.7 *Potential Consequence*

The stockpiles will remain for more than six (6) months during which the organic carbon content of the soil will decompose in the absence of new carbon sources from dead plant roots and leaf litter. This will result in the soil carbon cycle being disturbed. The disturbance of the soil nutrient cycle will lead to imbalances in the soil microbial population that form an integral part of the soil-plant ecosystem of the area.

#### 21.7.8 *Significance of Impacts*

The impact on topsoil through stripping and stockpiling is direct but of local extent as it is restricted to the site area. It is considered a long-term impact though it may be restored to a certain extent after closure. The impact is of medium magnitude as topsoil will be stripped and stockpiled and become sterilized to a certain extent, especially with the long duration of the life of mine. The impact is considered to have moderate significance (Table 3).

#### 21.7.9 *Dewoin Jetty - Option*

The Proposed location for the jetty is identified at the Dewoin district site along the seacoast, with a dedicated road network of around 45 km from Bomi Mines to the site. Iron Ore will be loaded into the barges through the conveyor loading system at the proposed jetty. Ocean-going vessels will be loaded at the outer anchorage near the Dewoin District Sea coast using transhippers/floating cranes/self-geared vessels to export DSO/concentrate magnetite (final product). This dedicated road network, and jetty will be away from highways and other public settlements, ensuring smooth transportation without affecting nearby communities. Government support in obtaining the licenses and permits to build the infrastructure, acquiring the required land and obtaining ROW (Right of Way) will be vital to the project's success.

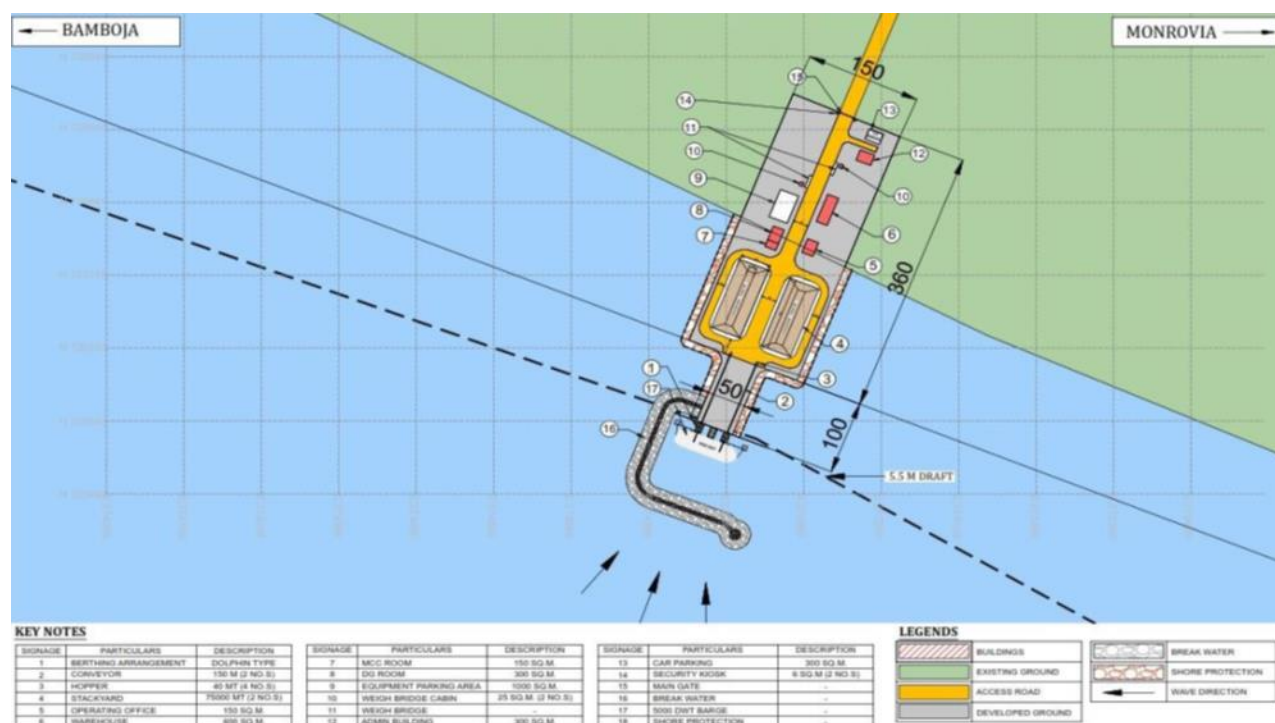


Figure 9:Details of proposed jetty

#### 21.7.10 Boa Chico Jetty (Sass Town) - Option

The company entered an MDA with the Liberian government in 2022 to extract iron ore in Gbarpolu County following an exploration activity. Since commencing operations, the company has undertaken various initiatives, including constructing a road connecting Bomi, Gbarpolu, and Montserrado Counties to improve transportation and enhance trade within the western region of the country. Boa Chico has established a jetty infrastructure on the seacoast 26 kilometres away from the Freeport of Monrovia, the jetty is accessible via a current gravel road established for the mining vehicle purpose, the gravel road stretch 7 kilometres for the Bomi National Highway. Management of Western Cluster engaged in partner with Bao Chico management to part use the Jetty for the evacuation of iron ore. The systematic arrangement includes utilisation of sea barges and tranship the cargo to either loading onto vessel at mid sea or sail the bagies and load at the LMC port, studies are currently ongoing.

On this option shall established alternative road / slurry pipeline with either same arrangement at the LMC port infrastructure upgrade. The other option shall be the utilisation of the current motor way Bomi Highway for about 29 kilometres and have access to the Boa Chico Jetty where the tranship barges can be loaded.

#### 21.7.11 Chemical Soil Pollution – Jetty Construction & Operation

During the construction phase, chemical soil pollution can result from oil and fuel leakages from construction vehicles. During the operational phase, accidental spillages can result in contaminants entering groundwater and water resources and soil ecosystems. Spillages from fuel storage units and leakages from construction vehicles can also result in chemical pollution.

#### 21.7.12 Potential Consequence

The use of vehicles can result in oil and fuel spills on site as well as waste generation by construction and construction workers and the proposed workshop can result in possible chemical soil pollution. Spillages from fuel storage units can result in chemical soil pollution. These soil contaminants can have significant harmful consequences for ecosystems. The changes in soil chemistry can arise from the presence of many hazardous chemicals even at low concentration in the contaminant species. These changes can manifest in the alteration of metabolism of endemic microorganisms and arthropods resident in a given soil environment. The result can be virtual eradication of some of the primary food chain, which in turn could have major consequences for predator or consumer species. Even if the chemical effect on lower life forms is small, the lower pyramid levels of the food chain may ingest pollutant chemicals, which normally become more concentrated for each consuming rung of the food chain.

Contaminated or polluted soil can also directly affect human health through direct contact with soil or via the infiltration of soil contamination into groundwater aquifers used for human consumption, sometimes in areas apparently far removed from any apparent source of above ground contamination.

#### 21.7.13 Significance of Impacts

Chemical soil pollution will have a negative impact on soil and will directly impact the soil where the pollution occurs. The duration of pollution once it has taken place is long term, depending on the nature and properties of the specific pollutant. It is considered to have high receptor sensitivity and be of major significance as soil chemical pollution may have a negative impact on ecosystem and/or human health (Table 4)

Table 4: Impact on Soil &amp; Water Chemical Pollution

|                 |                                                                                                                            |            |           |           |               |       |
|-----------------|----------------------------------------------------------------------------------------------------------------------------|------------|-----------|-----------|---------------|-------|
| Impact          | Chemical Soil Pollution                                                                                                    |            |           |           |               |       |
| Impact Nature   | Negative                                                                                                                   |            | Positive  |           | Neutral       |       |
| Impact Type     | Impact on soils is negative.                                                                                               |            |           |           |               |       |
|                 | Direct                                                                                                                     |            | In-direct |           | Induced       |       |
| Impact Duration | Impact on soils is direct                                                                                                  |            |           |           |               |       |
|                 | Temporary                                                                                                                  | Short-term |           | Long-term | Permanent     |       |
|                 | Impacts are considered long-term and rehabilitation after closure might restore the soil fertility to a large extent.      |            |           |           |               |       |
| Impact Extent   | Local                                                                                                                      |            | Regional  |           | International |       |
|                 | Impacts are considered short and long-term, as the impacts will continue past closure with only a very slow recovery rate. |            |           |           |               |       |
| Impact Scale    | The scale of the impact is dependent on the type of pollutant but would mainly be restricted to the mine site.             |            |           |           |               |       |
| Frequency       |                                                                                                                            |            |           |           |               |       |
| Impact          | Positive                                                                                                                   | Negligible |           | Small     | Medium        | Large |
| Magnitude       | Impact magnitude is considered medium as this is a brownfield site and the soils have already been impacted by             |            |           |           |               |       |
| Receptor        | Low                                                                                                                        |            | Medium    |           | High          |       |
| Sensetivity     | The receptor sensitivity is considered as medium for although compaction will most likely occur, a large area of the site  |            |           |           |               |       |
| Impact          | Negligible                                                                                                                 |            | Minor     | Modarate  | Major         |       |
| Significance    | Significance of impact is considered to be Moderate.                                                                       |            |           |           |               |       |

#### 21.7.14 Mitigation Measures, Management and Monitoring

Apart from the embedded controls to be included in project design, the following mitigation measure will reduce the significance of chemical soil pollution:

- Any chemical spillage should be cleaned up immediately and treated or disposed.
- An intercept drain should possibly be constructed downslope of polluted areas, to drain potentially polluted water into a pollution control dam.
- Drains and intercept drains should be maintained to ensure that they continue to redirect clean water away from the polluted areas.
- Conduct proper chemical waste management to avoid spillage of chemicals during all the phases of the project cycle.

### 21.7.15 Significance of Residual Impacts

With proper mitigation measures as recommended above, it is anticipated that the significance can be mitigated to minor.

## 21.7 Transit Plot Utilization into full Capacity

The transit plot site is in Vincent Town-Po-River, near the Chinese Timber Woods Company along the Montserrado-Bomi Highway, Dewion District #3, Bomi County. It is situated on 4.5 acres of land, which was lease from Hon. Abraham Varmunya Conneh, by the Management of Western Cluster Limited, the site is about 459ft away from the main Montserrado – Bomi Highway and surrounding maintains high bush no residential housing facilities around the site, only the northwestern sections of the project area is a Chinese Timber Woods Company fence and the western part of the site is Vincent Town which is distant away from the main project site. There is access to LEC at the project area and water is from individual boreholes. See map of the project area along with other areas of interest.

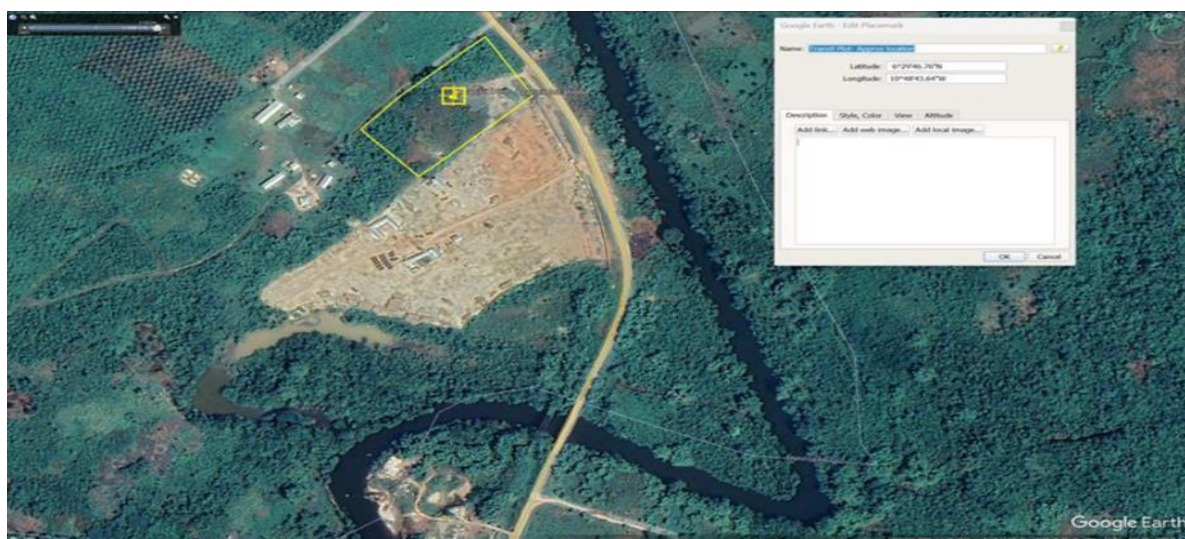


Figure 10: Goggle earth snap plotting of Transit Plot

Table 5: UTM Coordinates showing the Location of the site (ref. WGS 84 map datum)

| Vertex | UTM_E  | UTM_N  |
|--------|--------|--------|
| Pt. 1  | 299682 | 718456 |
| Pt. 2  | 299573 | 718439 |
| Pt. 3  | 299541 | 718409 |
| Pt. 4  | 299559 | 718376 |
| Pt. 5  | 299585 | 718333 |
| Pt. 6  | 299622 | 718354 |
| Pt. 7  | 299620 | 718395 |

Pt. 8      299634      718405

The utilisation of the Transit Plot has been accessed on two scenarios in favour of the Road User Permit times to achieve maximum usage of the surface area for stocking of shippable iron ore.

- Scenario 1 – 22H00pm to 05H00am (Using the Bomi Highway)
- Scenario 2 - 19H00pm to 06H00am (Using the Bomi Highway)

### 21.7.1 Scenario 1 – Transit Plot Utilization

This scenario is on the current Road User Permit, with minimum 80 trucks and max 170 trucks on shift.

Table 6: Transit plot utilization table

| Scenario-1                                             |        |        |        |        |        |        |        |        |        |         |
|--------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| Timing 2200hrs to 0500hrs                              |        |        |        |        |        |        |        |        |        |         |
|                                                        | Case-1 | Case-2 | Case-3 | Case-4 | Case-5 | Case-6 | Case-7 | Case-8 | Case-9 | Case-10 |
| Trucks available at mines                              | 80     | 90     | 100    | 110    | 120    | 130    | 140    | 150    | 160    | 170     |
| Trucks reports at site for 1st trip from mines to port | 64     | 72     | 80     | 88     | 96     | 104    | 112    | 120    | 128    | 136     |
| Trucks report for 2nd trip to Port                     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40      |
| Trucks from mines to port                              | 104    | 112    | 120    | 128    | 136    | 144    | 152    | 160    | 168    | 176     |
| Trucks report for 2nd trip to Plot                     | 12     | 16     | 20     | 24     | 28     | 32     | 36     | 40     | 44     | 48      |
| Extra Trucks from mines to plot                        | 30     | 30     | 30     | 30     | 30     | 30     | 30     | 30     | 30     | 30      |
| Extra Trucks from Plot to Port                         | 20     | 20     | 20     | 20     | 20     | 20     | 20     | 20     | 20     | 20      |
| Trucks from Plot to Port 1st trip                      | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 16      |
| Trucks from Plot to Port 2nd trip                      | 14     | 14     | 14     | 14     | 14     | 14     | 14     | 14     | 14     | 14      |
| Trucks from Plot to Port 3rd trip                      | 10     | 10     | 10     | 10     | 10     | 10     | 10     | 10     | 10     | 10      |
| Total trucks from Plot to Port                         | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40      |
| Total trips to Port                                    | 144    | 152    | 160    | 168    | 176    | 184    | 192    | 200    | 208    | 216     |

| Total trips per day on public road |        |        |        |        |        |        |        |        |        |        |
|------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Trips from mines to Port           | 104    | 112    | 120    | 128    | 136    | 144    | 152    | 160    | 168    | 176    |
| Trips from mines to plot           | 42     | 46     | 50     | 54     | 58     | 62     | 66     | 70     | 74     | 78     |
| Trips from Plot to port            | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     |
| Trips to Port                      | 144    | 152    | 160    | 168    | 176    | 184    | 192    | 200    | 208    | 216    |
| Total trips                        | 186    | 198    | 210    | 222    | 234    | 246    | 258    | 270    | 282    | 294    |
| Total tonnages hauled per day      | 5580   | 5940   | 6300   | 6660   | 7020   | 7380   | 7740   | 8100   | 8460   | 8820   |
| Total tonnages from mines to port  | 3120   | 3360   | 3600   | 3840   | 4080   | 4320   | 4560   | 4800   | 5040   | 5280   |
| Tonnage hauled from mines to plot  | 1260   | 1380   | 1500   | 1620   | 1740   | 1860   | 1980   | 2100   | 2220   | 2340   |
| Tonnage hauled from plot to port   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   |
| Tonnage hauled to Port             | 4320   | 4560   | 4800   | 5040   | 5280   | 5520   | 5760   | 6000   | 6240   | 6480   |
| Total Qty to Port per month        | 120960 | 127680 | 134400 | 141120 | 147840 | 154560 | 161280 | 168000 | 174720 | 181440 |
| No. of Shipment per month          | 2      | 2      | 2      | 3      | 3      | 3      | 3      | 3      | 3      | 3      |

| Truck Requirement |     |     |     |     |     |     |     |     |     |     |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Mines to Port     | 80  | 90  | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 |
| Mines to Plot     | 30  | 30  | 30  | 30  | 30  | 30  | 30  | 30  | 30  | 30  |
| Plot to Port      | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  |
| Total Trucks Req  | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 |

The calculated scenario indicates operations under extreme pressure as transportation starts 22:00 hrs to 06:00. Cost of operation is extremely high and the traffic increases by 40% doubling compared to the scenario 2, making it unavailable for sustainable business. Although this is also covered by the External Traffic Management Plan communicated to EPA, Minister of Public Works and Minister of Transport. This transportation arrangements is regulated by the GOL on RUP. All associated conditions are clearly stipulated on the permit. A separate traffic monitoring report and study is covered in details on

Chapter 22 of the ESIA, where all traffic volume is taken in considerations, social aspect and impact is assessed.

### 21.7.2 Scenario 2 – Transit Plot Utilization

This scenario is on the current Road User Permit, with minimum 80 trucks and max 170 trucks on shift.

The calculated scenario indicates the transportation starting at 19H00pm to 06H00am. The operations are covered by the External Traffic Management Plan communicated to EPA, Minister of Public Works and Minister of Transport. This transportation arrangement is regulated by the GOL on RUP. All associated conditions are clearly stipulated on the permit. A separate traffic monitoring report and study is covered in detail on Chapter 22 of the ESIA, where all traffic volume is taken in considerations, social aspect and impact is assessed.

Table 7: Scenario 2 for transit plot option

| Scenario-2                                             |        | Timing 1900 hrs to 0600 hrs |        |        |        |        |        |        |        |         |  |
|--------------------------------------------------------|--------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|---------|--|
|                                                        | Case-1 | Case-2                      | Case-3 | Case-4 | Case-5 | Csae-6 | Case-7 | Case-8 | Case-9 | Case-10 |  |
| Trucks available at mines                              | 80     | 90                          | 100    | 110    | 120    | 130    | 140    | 150    | 160    | 170     |  |
| Trucks reports at site for 1st trip from mines to port | 64     | 72                          | 80     | 88     | 96     | 104    | 112    | 120    | 128    | 136     |  |
| Trucks report for 2nd trip to Port                     | 48     | 54                          | 60     | 66     | 72     | 78     | 84     | 90     | 96     | 102     |  |
| Trucks from mines to port                              | 112    | 126                         | 140    | 154    | 168    | 182    | 196    | 210    | 224    | 238     |  |
| Extra Trucks from mines to plot                        | 40     | 40                          | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40      |  |
| Extra Trucks from Plot to Port                         | 20     | 20                          | 20     | 20     | 20     | 20     | 20     | 20     | 20     | 20      |  |
| Trucks from Plot to Port 1st trip                      | 16     | 16                          | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 16      |  |
| Trucks from Plot to Port 2nd trip                      | 14     | 14                          | 14     | 14     | 14     | 14     | 14     | 14     | 14     | 14      |  |
| Trucks from Plot to Port 3rd trip                      | 10     | 10                          | 10     | 10     | 10     | 10     | 10     | 10     | 10     | 10      |  |
| Total trips from Plot to Port                          | 40     | 40                          | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40      |  |
| Total Trips to Port                                    | 152    | 166                         | 180    | 194    | 208    | 222    | 236    | 250    | 264    | 278     |  |

|                                    |        |        |        |        |        |        |        |        |        |        |
|------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Total trips per day on public road |        |        |        |        |        |        |        |        |        |        |
| Trips from mines to Port           | 112    | 126    | 140    | 154    | 168    | 182    | 196    | 210    | 224    | 238    |
| Trips from mines to plot           | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     |
| Trips from Plot to port            | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     | 40     |
| Trips to Port                      | 152    | 166    | 180    | 194    | 208    | 222    | 236    | 250    | 264    | 278    |
| Total trips                        | 192    | 206    | 220    | 234    | 248    | 262    | 276    | 290    | 304    | 318    |
| Total tonnages hauled per day      | 5760   | 6180   | 6600   | 7020   | 7440   | 7860   | 8280   | 8700   | 9120   | 9540   |
| Total tonnages from mines to port  | 3360   | 3780   | 4200   | 4620   | 5040   | 5460   | 5880   | 6300   | 6720   | 7140   |
| Tonnage hauled from mines to plot  | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   |
| Tonnage hauled from plot to port   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   | 1200   |
| Tonnage hauled to Port             | 4560   | 4980   | 5400   | 5820   | 6240   | 6660   | 7080   | 7500   | 7920   | 8340   |
| Total Qty to Port per month        | 127680 | 139440 | 151200 | 162960 | 174720 | 186480 | 198240 | 210000 | 221760 | 233520 |
| No. of Shipment per month          | 2      | 3      | 3      | 3      | 3      | 3      | 4      | 4      | 4      | 4      |

|                   |     |     |     |     |     |     |     |     |     |     |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Truck Requirement |     |     |     |     |     |     |     |     |     |     |
| Mines to Port     | 80  | 90  | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 |
| Mines to Plot     | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  |
| Plot to Port      | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  |
| Total Trucks Req  | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 |

## 21.8 Phase 2 - 10 Mtpa Concentrate Product Expansion

### 3MTPA Expansion Concentrator Plants

The expansion will include two additional concentrator plants, each with a capacity of 3 MTPA. The decision to proceed with this expansion will depend on the power sourcing arrangement's positive outcome, the slurry pipeline's feasibility, and the feasibility of upgrading the Monrovia port LMC pier to

10 MTPA capacity. As HFO power plant is not ideal due to inefficient and costly power generation. WESTERN CLUSTER LIMITED intends to explore efficient, cost-effective, and environmentally friendly power options, including potential power sourcing from LEC. This is a crucial enabler of the expansion.

### **21.9 10 Mtpa Slurry Pipeline from Bomi Mine to Freeport Monrovia**

The current road logistics and the proposed dedicated road and jetty facilities are not the most cost-effective and efficient logistics modes for such a high volume. Therefore, WESTERN CLUSTER LIMITED plans to build a technologically advanced slurry pipeline to ensure economical, efficient, and ESG (Environmental, Social, and Governance) compliant transportation of the 10 MTPA iron ore concentrate from Bomi Mines to Monrovia Port. Once WESTERN CLUSTER LIMITED implements the slurry pipeline, the dedicated road and jetty will serve as backup logistic arrangements.

A slurry, a mixture of concentrated magnetite and water, offers an environmentally friendly transportation solution by avoiding dust, pollution, noise, and spillages, thereby minimising disruption to the surrounding ecosystem.

The underground slurry pipeline will be approximately 70 km from Bomi Mines to Monrovia port. A specialised American firm is conducting feasibility and FEED (Front End Engineering and Design) work. The most feasible route for the pipeline has been identified based on comprehensive field investigations. Government support in obtaining the licenses and permits to build the pipeline and associated infrastructure, acquiring the required land, and securing ROW (Right of Way) will be vital to the project's success.

### **21.10 Monrovia Port Capacity Upgrade to 10 Mtpa**

WESTERN CLUSTER LIMITED uses the LMC Pier to export and load ocean-going vessels (OGVs) up to Supramax size. However, the existing port facilities are inadequate for exporting 10 MTPA of product. Therefore, an upgrade of the port infrastructure is necessary for future expansion.

WESTERN CLUSTER LIMITED plans to build a new ESG complied port terminal infrastructure facility at the current WESTERN CLUSTER LIMITED site to berth Baby Cape or Mini Capsize bulkers to export 10 million tonnes per annum (MTPA) concentrated iron ore from Monrovia Free Port in the most cost-effective and environmentally friendly way without having an unfavorable social impact. The port facility will also include a dewatering plant to convert the slurry received from mine into dry product before loading into Ocean Going Vessels. The feasibility study and the FEED are underway with a renowned and specialised German firm to evaluate various innovative and technologically advanced port development options. The

firm will identify a suitable, cost-effective, efficient, and ESG-compliant choice for the port upgrade and design the scheme. Government support in obtaining the licenses and permits to build the infrastructure and acquiring the required land will be vital to the project's success. The following infrastructure will be constructed:

The feasibility study and the FEED are underway with a renowned and specialised German firm to evaluate various innovative and technologically advanced port development options. The firm will identify a suitable, cost-effective, efficient, and ESG-compliant choice for the port upgrade and design the scheme. The port facility will also include a dewatering plant to convert the slurry into dry product.

Government support in obtaining the licenses and permits to build the infrastructure and acquiring the required land will be vital to the project's success. The following infrastructure will be constructed:

#### *New Port Terminal Elements*

- Land reclamation for placing the required landside facilities,
- Quay wall,
- 10 filter presses with 190 pressing plates each (plate dimensions 2 m x 2 m),
- Two buffer tanks with agitators (18 m diameter, 18 m height),
- Recycled water tank (18 m diameter, 18 m height),
- Pumps for slurry and water,
- Stockpile,
- Conveyor belt system,
- Stacker/Reclaimer Combo,
- Cranes or Bulk Ship Loaders

#### *Cargo Handling Processes*

The cargo handling process involves the following activities:

- ✓ The hinterland processes include the mixing of the slurry at the mine site and injecting the slurry into the pipeline and pumping it to the WESTERN CLUSTER LIMITED site in the Freeport of Monrovia
- ✓ The terminal reception processes include the arrival of the cargo to the WESTERN CLUSTER LIMITED site in the Freeport of Monrovia, interim storage of the slurry in buffer tanks and subsequent dehydrating in filter presses. Dehydrated iron ore concentrate will be dropped from

filter presses to conveyor belt system. Collected water from dehydrating system will be stored in buffer tank prior to its clarification.

- ✓ The outdoor storage processes include the reception of the iron ore at the stockpile area and building the stockpile. Upon arrival of the empty vessel, the ore is loaded into vessel.

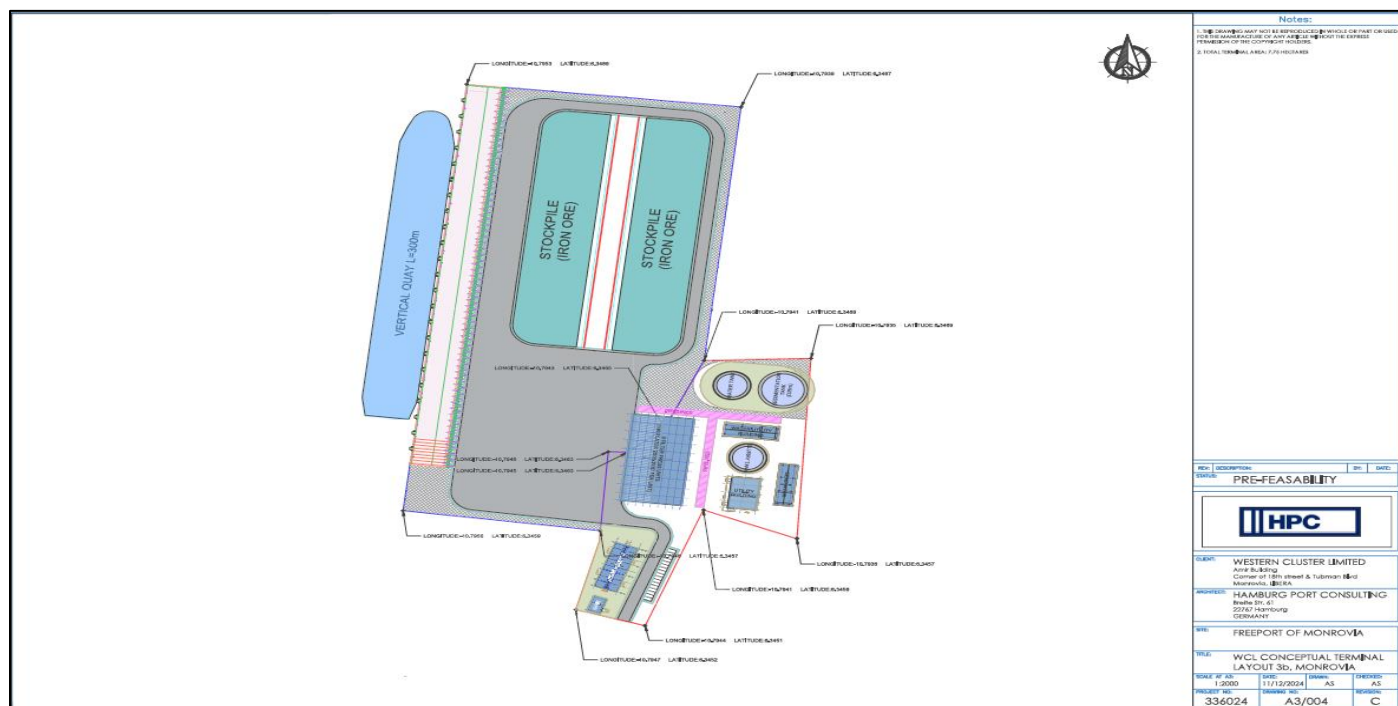


Figure 11: Port layout infrastructure

## CHAPTER 22- ROAD TRAFFIC AND SOCIAL ASPECT

### 22.1 Introduction

For the purposes of the utilisation of the Bomi Highway for haulage of iron ore as authorised and regulated by the Road User Permit issued by the GOL under the Minister of Public Works, the assessment of social and community health impact relating to the activities is regarded as integral part of the business of Western Cluster Limited. The social and community health impacts envisaged during the operations and transportation of the iron ore – classification DSO (Direct Shipping Ore)

- The effects on transportation

- Traffic volumes and interaction with other road users
- The socio economics and a job creation.
- Repairs and maintenance of the road corridor
- Risk-socio aspect associated with the activities

#### *Western Cluster Limited Resources*

Western Cluster Limited, Liberia, is an iron ore mining division of Vedanta Limited. Western Cluster Limited has explored the Bomi concession, covering an area of 114.42 km<sup>2</sup>. Comprehensive drilling across the entire mineralised zone has enabled reserve estimation based on drill hole data.

The iron ore at Bomi occurs in the following two primary forms

- Massive to Semi-Massive
- Magnetite Banded Iron Formation (BIF) – thinly banded rock comprising quartz with hematite or magnetite.

The ore body predominantly comprises Banded Magnetite Quartzite (BMQ), with an estimated Mineral Resource of 249 MnT at an average grade of approximately 36% Fe, with 3.7 MnT of DSO with average grade of 62% Fe (which are currently minable). Additionally, there is an upside potential of 701 MnT, with 3.7 MnT of DSO with average grade of 53% Fe.

## 22.2 Road Permit and Authorization

Currently the Bomi Mine is operating and transporting its Direct Shipping Ore (DSO) using the Bomi Highway from Tubumanburg to the Freeport of Monrovia LMC pier. The transportation is regulated by a Road User Permit issued by the GOL (Government of Liberia) under the Minister of Public Works (MPW).

Western Cluster Limited have a transit plot that will be used for stocking of iron ore, the transit plot is in Vincent Town-Po-River, near the Chinese Timber Woods Company along the Montserrado-Bomi Highway, Dewion District #3, Bomi County. It is situated on 4.5 acres of land, which was lease from Hon. Abraham Varmunya Conneh, by the Management of Western Cluster Limited, the site is about 459ft away from the main Montserrado – Bomi Highway and surrounding maintains high bush no residential housing facilities around the site, only the northwestern sections of the project area is a Chinese Timber Woods Company fence and the western part of the site is Vincent Town which is distant away from the main project site. The plot has an 80ton capacity weighbridge, access to LEC at and water is from individual borehole.

### 22.9.1 Road User Permit

Western Cluster Limited holds a Road User Permit issued on the 22 June 2022, **Permit No: 220620 – 004**, permit issued by the MPW (Minister of Public Works), the permit is issued for road segment and related transportation facilities, on Freeport of Monrovia - Bomi Hills Road Bomi Road Corridor and Mosterrado counties for commercial haulage of iron ore. The Permit have conditions and requirements herein. The permit has been re-instated several times, the latest being **reference RLG-M/MPW-RL/592/'24**, dated September 17, 2024, with revised conditions form the original conditions stated on the permit issued 22 June 2024.

- ✓ First Issue - Permit No: 220620 – 00422 June 2022 (Annexure)
- ✓ Re-instated - Permit No: 220620 – 004 ref RLG-M/MPW-RL/592/'24, dated September 17, 2024 (Annexure)

### 22.9.2 Conditions of the RUP

The reinstated **Permit No: 220620 – 004 ref RLG-M/MPW-RL/592/'24**, dated September 17, 2024, list several specific conditions namely below:

22.2.2 (a) Transportation time being 22pm to 05am in line with the current ESIA permit issued by the Environmental Protection Agency - **EPA/TEMP/FAR/ESIA/001-0322 Condition 5.3b**

22.2.2 (b) Approved Traffic Management Plan – Compliance of trucks to the External Traffic Management Plan: **TMP No: 170520-004** (Western Cluster Limited proprietary procedure / document)

22.2.2 (c) Public Road Safety Awareness – Joint road safety awareness by Minister of Public Works, Minister of Transport and Western Cluster Limited.

22.2.2 (d) Road Repairs and Maintenance - This includes the following:

- Potholes and maintenance of the road using technological means by overlaying on the road surface to prevent further potholes,
- Installation of weighbridge at PO River,
- Assessment of the parallel St Paul bridge and tarring for the diverting off the public concrete bridge
- Adherence to the stipulated transport time 22pm – 05am

22.2.2 (e) Medium- and Long-Term Trucking of Ore (National Investment Commission),

- The development of dedicated alternative road – feasibilities of alternative haulage roads connecting to other means of transport (Jetty)
- Permanent Port at “Bamboja”

## 22.3 Traffic Management and Road Usage

Western Cluster Limited have designed the External Traffic Management Plan in accordance with the Traffic Laws of Liberia. The External Traffic Management Plan of Western Cluster sought compliance with the Road User Permit issued by the Dept of Ministry of Public Works of Liberia. The External Traffic Management Plan outlines the traffic control and traffic management procedures to be implemented by Western Cluster Limited and its service partners to manage potential hazards associated with the traffic environment during transportation of iron ore from Bomi Mine to Freeport of Monrovia LMC Pier. The External Traffic Management Plan of Western Cluster sought compliance with the Road User Permit issued by the Dept of Ministry of Public Works of Liberia.

The objectives of the External Traffic Management Plan are to ensure:

- The safety of the other road users - pedestrians, motorcycles, motorbikes and safety of the haulage truck drivers. This include road workers and other service persons that may be conducting work closer to the motorway.
- The performance of the road network is not unduly impacted and the disruption and inconvenience to all road users are minimised during the haulage times.
- Ensure minimum nuisance, environmental impact and aspect are prevented and managed

### 22.3.1 External Traffic Management Strategies

- Providing enough delay time in between of a dispatching the fleet of haulages to accommodate vehicle volumes.
- GPS Monitoring of the 45km/h – max 50 km/h speed allocated and agreed for a haulage truck to be travelling on the motorway.

### 22.3.2 Accountabilities and Responsibilities

Western Cluster Limited shall be responsible for the implementation of the External Traffic Management Plan as revised, the entire External Traffic Management Plan shall be shared with all service partners that operating with Western Cluster Limited, service partner shall be liable to educate themselves and their

drivers include their sub-contractors on the requirements and adherence to the External Traffic Management Plan. Western Cluster shall not be held liable for any misconduct or any deviation by the service provider neither their drivers and or their subcontractors, it will remain the duty and the responsibility of the service partners to be in compliant with the requirements of the EXTMP. Western Cluster Limited shall monitor all haulage truck for speed and recklessness driving, any misconduct shall be reported to the service partner who shall be expected to resolve and supply proof to Western Cluster at reasonable time of reporting. Western Cluster Limited reserve the right to immediately advise the service partner for an immediate stoppage of a driver or fleet not to operate and enter the mines in case deemed necessary

### 22.3.3 Private Control Point (Western Cluster Limited)

Western Cluster Limited is planning to control the movement of the haulage trucks on the following areas of the Bomi Hill Road, the controls are indicated on the description column of the table below, this controls shall be applicable as well when partially usage of the road is used or during extension of the Road User Permit.

Table 8: List of control points along haul road

| <b>Mines</b>             | <b>DESCRIPTION</b>                                                       |
|--------------------------|--------------------------------------------------------------------------|
| Mine Security Gate       | Truck Compliance, Driver Fitness (Alcohol Test) PPE and Drivers Licences |
| Mine Weighbridge         | Driver Licence, Planned Load, Weighing (Dry / Wet)                       |
| Snowe Junction Gate      | Driver Alcohol Test Fitness, Declare Off-Mine limit                      |
| <b>Public Checkpoint</b> | <b>DESCRIPTION</b>                                                       |
| Klay Junction            | Truck Compliance, Driver Fitness (Alcohol Test) PPE and Drivers Licences |
| Speed zone               | Selective control point speed check by National Traffic Police.          |
| Traffic Compliance Zone  | Selective control point speed check by National Traffic Police.          |
| Freeport Gate (LMC)      | Truck Compliance, Driver Fitness (Alcohol Test) PPE and Drivers Licences |
| <b>LMC Pier</b>          | <b>DESCRIPTION</b>                                                       |
| Security Gate            | Truck Compliance, Driver Fitness (Alcohol Test) PPE and Drivers Licences |

| Mines            | DESCRIPTION                                  |
|------------------|----------------------------------------------|
| Port Weighbridge | Driver Licence, Planned Load, Weighing (Wet) |

## 22.4 Classification of Trucks Used for Haulage of Iron Ore

### 22.4.1 Truck Specifications

The Road User Permit classify and prescribe the specification of the fleet that Western Cluster Limited must use for the haulage of iron ore using the Bomi Hi-Way, there are number of factors that are technical to this fleet specifications.

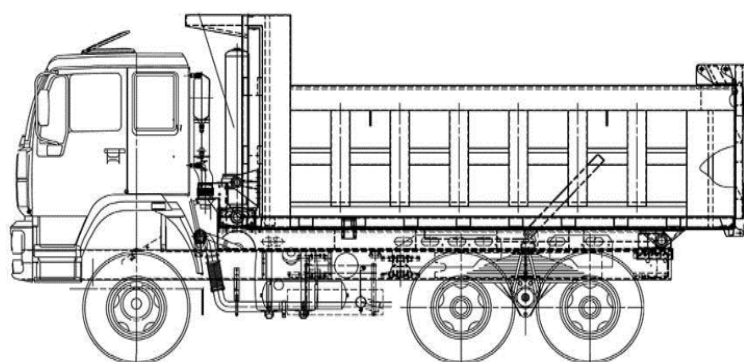


Figure 13: Length of Truck must be: 34.0 Feet (long)



Figure 12: Width of the truck: 8.5 Feet (wide)

### 22.4.2 Inspections and Conditions of Trucks

Service partners and their subcontractors are responsible to ensure the below: The Guideline of Inspections and Conditions shall be shared by Western Cluster:

- The truck shall must be registered to operate on the public road, having up to date licencing records,
- Licence number plates affixed back and front of the truck.
- Valid and fit fire extinguisher (9kg DCP) with a valid inspection sticker issued by the Liberia Fire Services.

- All trucks shall be equipped with tarpaulin to cover the Iron Ore during transportation to prevent airborne dust generation – trucks without tarpaulin shall not be loaded and dispatched.
- It is the responsibility of the service partner to ensure that the tarpaulin is in good condition and are used properly at all transportation times.
- The truck shall undergo the vehicle testing and inspection at the mine, the inspection shall be recorded on form: HSE HMV INSP 001 rev01.
- Trucks that are found to be defective or not meeting the requirements of the inspection shall not be qualified for access loading at the mine.
- All truck undergoes inspected before commencing hauling ensuring the condition and safety operatives of the truck, should a truck fail inspection, such truck get disqualified and may not be allowed to operate for company.
- All trucks in service undergo re-inspection on quarterly basis to ensure that trucks are kept maintained and up to conformity standards for Western Cluster.
- At any time, random inspection is conducted for all trucks in service, should at any time the truck be observed to be out of requirement conformity, such truck shall be removed out of service, the service provider shall attend to the issue identified, once the repairs are completed, such truck shall be reinspected to be in service.

#### 22.4.3 *Operator / Driver Responsibility and Accountability*

The operator / drivers have a responsibility for their own safety & health and the safety & health for other person and other road users. This does not limit the driver from not reporting observation and act that could lead to an incident on the road and at the area of work.

All drivers, Supervisors and their managers shall attend the Trucking and Haulage Safety Induction / Haulage Training and ISPS Training. This shall be pre-requisite of the mines.

Drivers should be always fit to be able to operate. drive their truck to ensure the safety of themselves and the safety of other road users. The drivers shall always be alert and sober. Consumption of alcohol and usage of illicit drugs is forbidden at all operations and activities associated with Western Cluster, the ZERO Tolerance objectives apply to all employees and activities of Western Cluster.

Should there be proof that an operator / driver is committing, conducting and or not abide by the rules and regulation of Western Cluster including any Laws of the Republic of Liberia, such operator / driver will be immediate removed out of the operations and activities of Western Cluster Limited.

Drivers / Operators of haulage trucks shall maintain safe speed regulated by the mine and the recommended by the Ministry of Public Works a speed of 45 km/h to maximum of 50km/h. Drivers / operators that will be found and monitored to be exceeding the maximum speed of 50km/h shall be subjected to discipline and repeats are established on the same case such driver / operator shall be completely a removed of the service related to Western Cluster Limited and such driver shall be blacklisted with all service providers that have business contract with Western Cluster Limited.

Operators / drivers are to always maintain their trucks in safe operating conditions, operator / drivers shall report immediately to their respective supervisors any inoperative or defectives or malfunctions of their trucks, such truck shall be warranted to be out of operation till its operational.

## **22.5 Road Condition Reporting**

### *22.5.1 Road Conditions*

Operator / drivers have a responsibility to report unsafe condition and unsafe act – these are observations for their daily operation on the national hi-way. Any driver / operator shall report any observation to the Logistics Department of Western Cluster, such report will be attended for actioning and correction. Any reports shall be documented and investigated.

Road Safety Inspections shall be conducted on weekly basis by the Health & Safety department, their inspection shall be recorded and filled with Logistic Department for correction and follow-up.

The reports that need maintenance shall be shared with appointed contractor for repairs and corrections. The appointed contractor or responsible person shall sign off on the inspection's reports indicating the repairs are conducted and closed off, in case where repairs are not possible due to other technical reasons, such reasons shall be noted on the job card and communicated to the Head Logistics and Senior Management of Western Cluster.

There are few technical risks associated with Roads Conditions; the Road Risk Assessment below addresses those risks.

Table 9: Road Safety &amp; Health Risk Assessment

| Item | Risk Event                                             | Consequence                                             | Pre-treatment Risk |   |   | Treatment                                                                                                             | Residual Risk |   |   | Residual Consequence                                                   |
|------|--------------------------------------------------------|---------------------------------------------------------|--------------------|---|---|-----------------------------------------------------------------------------------------------------------------------|---------------|---|---|------------------------------------------------------------------------|
|      |                                                        |                                                         | L                  | M | H |                                                                                                                       | L             | M | H |                                                                        |
| 1    | Operation out of permit                                | Accident / Fatal Incident                               |                    |   | H | All operation shall comply with RUP requirements                                                                      |               | M |   | All permit conditions shall be met                                     |
| 2    | Defective trucks                                       | Accident / Fatal incident                               |                    |   | H | All trucks shall be inspected before putting in service and quarterly inspection must be conducted.                   |               | M |   | Auditing service providers and internal controls                       |
| 3    | Operator / driver competency                           | Accident / Fatal incident & Damage to equipment / truck |                    |   | H | All operators must be found competent: valid drivers' licenses, testing and background                                |               | M |   | Verification of licences, checking and training of competent operators |
| 4    | Operator / driver reported to be committing misconduct | Reputation, cause incident, bad culture                 |                    |   | H | All reports of misconduct and reckless driving shall be investigated, and appropriate action be taken. ZERO Tolerance |               | M |   | Road observation and incident response shall be kept                   |

| Item | Risk Event                                                       | Consequence                                             | Pre-treatment Risk |   |   | Treatment                                                                                                             | Residual Risk |   |   | Residual Consequence                                                                                                                           |
|------|------------------------------------------------------------------|---------------------------------------------------------|--------------------|---|---|-----------------------------------------------------------------------------------------------------------------------|---------------|---|---|------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                                                                  |                                                         | L                  | M | H |                                                                                                                       | L             | M | H |                                                                                                                                                |
| 5    | Operator / driver found to be under alcohol and or illicit drugs | Accident / Fatal incident & Damage to equipment / truck |                    |   | H | Immediate stoppage and removal out of the company operations – ZERO Tolerance                                         |               | M |   | Driver committing offense shall be removed from company operations                                                                             |
| 6    | Speeding and Reckless operation / driving                        | Accident / Fatal incident & Damage to equipment / truck |                    |   | H | All reports of misconduct and reckless driving shall be investigated, and appropriate action be taken. ZERO Tolerance |               | M |   | The service score of the operator shall be impacted, deduction of points shall be made, operator / driver shall be suspended as per discipline |

Table 10: Road Specific Risks

| Item | Risk Event  | Consequence                      | Pre-treatment Risk |   |   | Treatment                                                                                                                                                                                                 | Residual Risk |   |   | TMP/T                                     |
|------|-------------|----------------------------------|--------------------|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---|---|-------------------------------------------|
|      |             |                                  | L                  | M | H |                                                                                                                                                                                                           | L             | M | M |                                           |
| 1    | Pedestrian  | Accident and injuries            |                    | M |   | All areas where towns are along the road – drivers shall reduce speed and drive with caution                                                                                                              | L             |   |   | Pedestrian<br>Speed n<br>Speed            |
| 2    | Motorbike   | Accident and injuries            |                    | M |   | Motorbike shall be treated like other motor vehicle on the road                                                                                                                                           | L             |   |   | Reckless dr                               |
| 3    | Breakdowns  | Other road user causing accident |                    | M |   | Breakdown vehicles shall be indicated by reflective triangle 500 m away from the front and the back to warn other road users of the broken-down truck.                                                    | L             |   |   | All trucks<br>Breakdown<br>(part o<br>req |
| 4    | Communities | Accident and injuries            |                    |   | H | Communities along the road should maintain a safer distance of at least 50 feet away from the National Highway. Also, the communities should practise road safety visibility and stay away from the road. |               | M |   | Communi<br>aware<br>conduce               |

| Item | Risk Event            | Consequence         | Pre-treatment Risk |   |   | Treatment                                                                                                                                                          | Residual Risk |   |   | TMP/T                                                          |
|------|-----------------------|---------------------|--------------------|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---|---|----------------------------------------------------------------|
|      |                       |                     | L                  | M | H |                                                                                                                                                                    | L             | M | M |                                                                |
| 5    | Dust from the traffic | Noise pollution     |                    | M |   | A safe distance of at least 50 feet away from the National Highway. Trucks must be a proper mechanical state and intact to prevent rattling sound being generated. | L             |   |   | Enforce distance from highway, vehicle proper mechanical       |
| 6    | Pollution (other)     | Biodiversity impact |                    | M |   | Trucks and vehicle must be maintained in a proper state where no oil leaks are allowed including fuel.                                                             | L             |   |   | Trucks inspected, conduct Safety E inspection and other impact |

## 22.6 TRAFFIC MANAGEMENT PLANNING

### 22.6.1 Roads Requirements – Traffic and Speed

Table 11: Road speed way requirements

| Location             | Hi-Way Speed | Residential Speed | Stopping Areas                                      |
|----------------------|--------------|-------------------|-----------------------------------------------------|
| Bomi National Hi-Way | Max 50km/h   | 45-50 m/h         | Snowe Junction Transition Plot<br>Freeport Monrovia |

### 22.6.2 Temporary Speed Zones

The notice of changes on the road shall be communicated to all service partners and operator / driver should there be a change or situation that influence the normal operating condition. (This shall be communicated daily on Operators / Drivers Safety Toolbox Talk, and on Group WhatsApp). Temporary safety identification warning signs shall be placed.

### 22.6.3 Existing Traffic Signals - Road Signs & Warning

Table 12: Distribution of road signs along the haul route

| Location and Type of Signs              | Number of Signs | Signs Installation Location                             |
|-----------------------------------------|-----------------|---------------------------------------------------------|
| St Paul Bridge                          | 02              | Diversion Signs (Use of LMC train Bridge)               |
| Speed Limit (50 Km/h)<br>Haulage Trucks | 10              | 5 x Signs (Towards Bomi)<br>5x Signs (Towards Monrovia) |
| Slow Down Pedestrian<br>Crossing        | 20              | 10x Towns Towards Bomi<br>10X Towns Towards Monrovia    |
| Bridge Chevrons                         | 12              | 6 x Toward Bomi Bridges<br>6x Toward Monrovia Bridges   |

### 22.6.4 Impact to Adjoining Road Network

Klay Junction – present a traffic flow from the Sierra Leone Border and other operating companies with Mano and Cape Mount. Traffic congestions are noted only during daytime, thus have no impact to our Haulage Permit Time. Bottleneck observed at Klay checkpoint just before the Sierra Leone motorway. There are informal street vendors that conduct business selling prepared street food and soft drinks, thus make the junction busy business areas for the local citizen creating a socio-economic dependence.

#### 22.6.5 *Portable Traffic Control Devices (PTCDs)*

Global Positioning Systems (GPS) – full controlled for speed and reckless driving monitoring, GPS reports are to be retrieved daily, operation hours monitoring on live platform. Raider Speed detectors are to be used to spot and monitor speed, the dual functionality of the National Police, Traffic Police of Liberia and Western Cluster Safety & Health department are to monitor, the Liberia National Police and Traffic Police shall act of the operators / drivers that are to be found in violation of the permit requirements and the state Road Traffic laws.

### 22.7 Other Road Users

#### 22.7.1 *Pedestrians*

Pedestrians are only identified at the towns along the highway, market areas and checkpoints. During our permit operating hours very a smaller number of pedestrians has been observed as reasonable very low, at other areas there are no pedestrians at all. There are almost every 5km a local produced agriculture produce that is display for sale along the road corridor, this range from local produced fruits and vegetable include palm wine that is taped form the palm stem. Also, there are informal fuel and gas traders in strategic areas of the road corridor. This is a source of income for the local citizens that reside alongside or nearby villages. There are two town that host weekly market: Sass Town and Barh Town at closer to Mano plantation. During the market days you notice volume of traffic during day times.

#### 22.7.2 *Motor Cyclists*

Motorcycle / motorbikes are regarded as authorised road users as well, there for the traffic requirements and rules applies as normal. No traffic congestions are an observed during our permit operating hours.

#### 22.7.3 *Public Transport*

Mainly the public transport is used, the yellow taxis are used as means of transport between Bomi and Monrovia, very less impact and is observed during our permit operating hours, all traffic rules apply.

#### 22.7.4 *Heavy and Oversized Vehicles*

Road embargo transport notification alert is issued by the road traffic department, in such case our haulage will take precautions on such matters and ensure safety for all road users.

#### 22.7.5 *Existing Parking Facilities*

No parking facilities are provided along the highway, Western Cluster have a transitional plot, should a need arise parking can be allocated.

#### 22.7.6 Rail Crossings

There is no existing railroad crossing.

#### 22.7.7 Emergency Vehicle Access

Emergency vehicle always have a right of way, our haulage convoy shall give a right of way for any emergency vehicle. This includes presidential motorcade and other dignitaries. For the Presidential motorcade the transport / haulage trucks will stop and allow the motorcade to pass. The National Liberia Police (Tubmanburg detachment) shall advise Western Cluster Limited on the Presidential motorcade prior allowing sufficient time for the preparations.

### 22.8 Transit Plot

The transit plot site is in Vincent Town-Po-River, near the Chinese Timber Woods Company along the Montserrado-Bomi Highway, Dewion District #3, Bomi County. It is situated on 4.5 acres of land; the site is about 459ft away from the main Montserrado – Bomi Highway. The utilisation of the Transit Plot has been accessed on two scenarios in favour of the Road User Permit times to achieve maximum usage of the surface area for stocking of shippable iron ore.

- Scenario 1 – 22:00 hrs to 05:00 hrs (Using the Bomi Highway)
- Scenario 2 – 19:00 hrs to 06:00hrs (Using the Bomi Highway)

#### 22.8.1 Scenario 1 – Transit Plot Utilization

The calculated scenario indicates operations under extreme pressure as transportation starts 22:00 hrs to 06:00 hrs. Cost of operation is extremely high and the traffic increases by 40% doubling compared to the scenario 2, making it unavailable for sustainable business. Although this is also covered by the External Traffic Management Plan communicated to EPA, Minister of Public Works and Minister of Transport. This transportation arrangement is regulated by the GOL on RUP. All associated conditions are clearly stipulated on the permit. A separate traffic monitoring report and study is covered in detail on Chapter 22 of the ESIA, where all traffic volume is taken in considerations, social aspect and impact is assessed.

#### 22.8.2 Scenario 2 – Transit Plot Utilization

The calculated scenario indicates the transportation starting at 19:00 hrs to 06:00 hrs. The operations are covered by the External Traffic Management Plan communicated to EPA, Minister of Public Works and Minister of Transport. This transportation arrangement is regulated by the GOL on RUP. All associated conditions are clearly stipulated on the permit. A separate traffic monitoring report and study is covered

in details on Chapter 22 of the ESIA, where all traffic volume is taken in considerations, social aspect and impact is assessed.

## 22.9 Traffic Volumes Assessments

### 22.9.1 Road Infrastructure

The existing road from Freeport of Monrovia port North gate to Bomi Hills Mine gate is about 67 Km and of varying width. The width varies in different section of road is shown in Table:

Table 13: Road width description

| Distance Km   | Road Width m              | Description                                                    |
|---------------|---------------------------|----------------------------------------------------------------|
| 0 - 6.7km     | Varies from 9.0 to 10.4 m | Monrovia Port North gate to ROB to Africa Hotel Flyover Bridge |
| 6.7km to 67km | Varies - Approx 7.5 m     | ROB to Africa Hotels to PO River Bridge                        |
|               | Varies - Approx 7.5 m     | PO River Bridge to Entry gate of Bomi Mines                    |

There exist three (3) major bridges along the highway commencing from the Freeport of Monrovia

Table 14: Location of bridge and culverts along transport route

| No | Distance in Km | Details of Bridge and Culverts      |
|----|----------------|-------------------------------------|
| 1  | 0 km           | Port Gate to LMC Pier ( North Gate) |
| 2  | 5.8 Km         | St. Paul Bridge                     |
| 3  | 17.54 Km       | PO River Bridge (7.45mts width)     |
| 4  | 44.26 Km       | Klay Bridge (Bailey Bridge)         |
| 5  | 52.63 km       | Guie Town Bridge (Bailey bridge)    |
| 6  | 55.36 Km       | Mahe River Bridge. (7.45 M width)   |

The St Paul bridge is bypassed for the haulage trucks, this is a requirement of the RUP, there is a road diversion that Western Cluster Limited has arranged, all haulage trucks loaded or empty will be using the LMC train bridge designated for this purpose.



Figure 15: St. Paul Bridge Rail side (b)

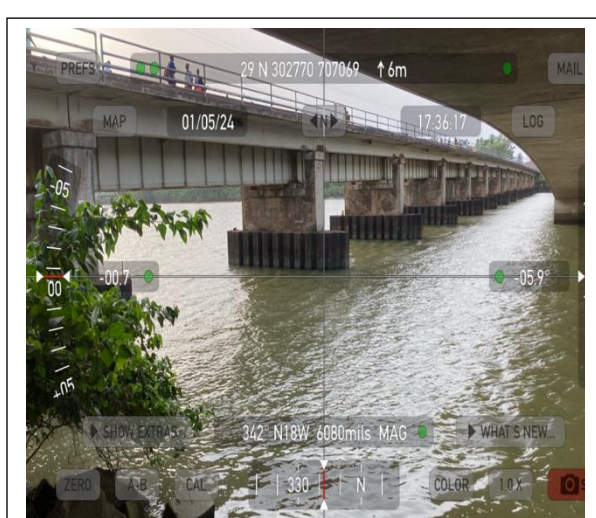


Figure 14: St. Paul Bridge Rail side (a)

In 2013 it found that the two bailey bridges namely Klay and Guie Town bridges were narrow and not suitable for heavy traffic and required to be replaced. Two RCC slab and girder bridges of span 16 m and 21 m were recommended for Klay and Guie Town bridges respectively. The girder bridges have been recommended considering flow of water through the channel during rains. The constructed girder bridges do not obstruct the flow of water. The actual construction of the channels was constructed during January to July in the dry season in 2013 - 2014. In the commencement of mining activities in 2022 the road infrastructure integrity was inspected by the Minister of Road Transport, all bridges were also surveyed for their integrity.



Figure 16: Klay and Gui Town bridges

The road geometry is generally good (no steep gradients or sharp curvilinear sections). No flood or other natural hazards are apparent. The present condition of the asphalt road appears to be good in many

stretches with occasional occurrence of potholes. Sizes of potholes seemed to vary roughly between 250mm to 1500mm in diameter with depths ranging from 40mm to 300mm. Stretches of road where the top bituminous layers are stripped off exposing the base/sub-base course for stretches ranging approximately from 2 metres to 12 metres will be re-laid as required. Western Cluster Limited has been doing ongoing roads maintenance for the period of the haulage to present. Western Cluster Limited has appointed a civil roads maintenance contractor that is using an advance technology call Polymer for the road repairs.

As most parts of the road pass through sparsely populated locations with vast areas of vegetation on either side, rainwater is drained naturally. Consequentially planned roadside drainage system is non-existent. Proper camber has not been observed also at different stretches. Waterlogging on either edge has also been seen at a few locations. Occasional patch repair at places and addition of the top surface over existing asphalt have been observed.



Figure 17: View of the road condition at Po River bridge



Figure 18: View of the condition of the Monrovia to Tubmanburg road

The mined material (DSO/Concentrate) extracted from the mines shall initially follow the existing non bituminous bypass road which starts from the mines area and meets the Tubmanburg town at a distance of about 4 km (approximate) position at E+298122.000 and N +7560000.000). This will avoid the existing route crossing though City of Tubmanburg to Bomi Hill Mine, thus avoiding congestion of Tubmanburg City and will not disturb the movement of traffic in the city of Tubmanburg. Beyond Tubmanburg it will follow the existing route to Monrovia Port.



Figure 19: Google Earth Map showing Bomi Highway bypass of Tubmanburg

#### 22.9.2 Traffic Volume Counting

Traffic count was taken on two strategic locations taking into account developments and activities that affect socio economics and behaviours.

1. Snowe Junction (4km road), to Iron Gate
2. Iron Gate to Freeport Gate

The traffic census was conducted without Western Cluster Limited fleet of haulage trucks due to no operation of the mine; assumptions are used where a fleet of 130 truck is assumed to be on the road at the specified time as per the current Road User Permit times (22pm to 5am) and previous Road User Permit time (18pm to 6am). Summary of the study is on the below tables.

Table 15: Traffic Count Data sheet (Snowe Junction to Iron Gate)

| Traffic Census                                           |            |            |                        |              |        |            |            |                               |        |
|----------------------------------------------------------|------------|------------|------------------------|--------------|--------|------------|------------|-------------------------------|--------|
| DAILY TRAFFIC SUMMARY (Snowe Farm Junction To Iron Gate) |            |            |                        |              |        |            |            |                               |        |
| Date: 18-11-2024 6.00 A.M. to 19-12-2024 6.00 A.M.       |            |            |                        |              |        |            |            |                               |        |
| Total Vehicle Count                                      |            |            |                        |              |        |            |            |                               |        |
| Count Hours                                              | Dirrection | Jeep & LDV | Private Vehicle / Cars | Taxi (Sedan) | Trucks | 3 Wheelers | Motorbikes | Specific WCL Fleet (Assumed ) | Totals |
| 06H00 to 07H00                                           | Up         | 124        | 110                    | 23           | 15     | 14         | 77         | 0                             | 363    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 07H00 to 08H00                                           | Up         | 144        | 155                    | 34           | 19     | 18         | 66         | 0                             | 436    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 08H00 to 09H00                                           | Up         | 165        | 188                    | 22           | 8      | 19         | 44         | 0                             | 446    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 09H00 to 10H00                                           | Up         | 210        | 173                    | 29           | 12     | 15         | 50         | 0                             | 489    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 10H00 to 11H00                                           | Up         | 234        | 160                    | 32           | 10     | 12         | 44         | 0                             | 492    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 11H00 to 12H00                                           | Up         | 224        | 320                    | 30           | 14     | 6          | 39         | 0                             | 633    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 13H00 to 14H00                                           | Up         | 190        | 234                    | 39           | 12     | 13         | 32         | 0                             | 520    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 14H00 to 15H00                                           | Up         | 177        | 220                    | 19           | 10     | 19         | 45         | 0                             | 490    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 15H00 to 16H00                                           | Up         | 255        | 150                    | 10           | 14     | 22         | 33         | 0                             | 484    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 16H00 to 17H00                                           | Up         | 220        | 133                    | 15           | 8      | 16         | 23         | 0                             | 415    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 17H00 to 18H00                                           | Up         | 187        | 144                    | 22           | 6      | 12         | 18         | 0                             | 389    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 18H00 to 19H00                                           | Up         | 166        | 128                    | 18           | 8      | 15         | 22         | 10                            | 367    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 19H00 to 20H00                                           | Up         | 133        | 110                    | 12           | 6      | 12         | 19         | 10                            | 302    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 20H00 to 21H00                                           | Up         | 124        | 122                    | 11           | 7      | 13         | 17         | 10                            | 304    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 22H00 to 23H00                                           | Up         | 44         | 77                     | 9            | 3      | 15         | 13         | 10                            | 171    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 23H00 to 00H00                                           | Up         | 33         | 56                     | 10           | 5      | 12         | 15         | 10                            | 141    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 00H00 to 01H00                                           | Up         | 16         | 26                     | 8            | 6      | 9          | 13         | 10                            | 88     |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 01H00 to 02H00                                           | Up         | 9          | 18                     | 0            | 3      | 11         | 14         | 10                            | 65     |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 02H00 to 03H00                                           | Up         | 12         | 19                     | 0            | 4      | 6          | 9          | 10                            | 60     |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 03H00 to 02H00                                           | Up         | 16         | 22                     | 0            | 0      | 0          | 6          | 10                            | 54     |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 03H00 to 04H00                                           | Up         | 18         | 31                     | 8            | 0      | 10         | 9          | 10                            | 86     |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 04H00 to 05H00                                           | Up         | 15         | 28                     | 12           | 8      | 13         | 32         | 10                            | 118    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 05H00 to 06H00                                           | Up         | 28         | 34                     | 18           | 12     | 15         | 44         | 10                            | 161    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| 06H00 to 07H00                                           | Up         | 33         | 22                     | 22           | 14     | 12         | 66         | 0                             | 169    |
|                                                          | Down       |            |                        |              |        |            |            |                               |        |
| TOTAL VOLUME For UP and Down                             |            | 2777       | 2680                   | 403          | 204    | 309        | 750        | 120                           | 7243   |

Table 16: Traffic Count Data sheet (Iron Gate to Freeport)

| Traffic Census                                            |            |            |                        |              |        |            |            |                               |        |
|-----------------------------------------------------------|------------|------------|------------------------|--------------|--------|------------|------------|-------------------------------|--------|
| DAILY TRAFFIC SUMMARY (Iron Gate to Freeport of Monrovia) |            |            |                        |              |        |            |            |                               |        |
| Date: 18-11-2024 6.00 A.M. to 19-12-2024 6.00 A.M.        |            |            |                        |              |        |            |            |                               |        |
| Total Vehicel Count                                       |            |            |                        |              |        |            |            |                               |        |
| Count Hours                                               | Dirrection | Jeep & LDV | Private Vehicle / Cars | Taxi (Sedan) | Trucks | 3 Wheelers | Motorbikes | Specific WCL Fleet (Assumed ) | Totals |
| 06H00 to 07H00                                            | Up         | 166        | 45                     | 28           | 4      | 36         | 114        | 0                             | 393    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 07H00 to 08H00                                            | Up         | 188        | 66                     | 33           | 16     | 44         | 123        | 0                             | 470    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 08H00 to 09H00                                            | Up         | 250        | 98                     | 38           | 18     | 38         | 133        | 0                             | 575    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 09H00 to 10H00                                            | Up         | 233        | 76                     | 39           | 14     | 28         | 109        | 0                             | 499    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 10H00 to 11H00                                            | Up         | 256        | 98                     | 33           | 22     | 44         | 88         | 0                             | 541    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 11H00 to 12H00                                            | Up         | 239        | 88                     | 42           | 28     | 18         | 66         | 0                             | 481    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 13H00 to 14H00                                            | Up         | 266        | 320                    | 30           | 14     | 6          | 89         | 0                             | 725    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 14H00 to 15H00                                            | Up         | 188        | 234                    | 39           | 12     | 13         | 102        | 0                             | 588    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 15H00 to 16H00                                            | Up         | 177        | 220                    | 26           | 10     | 19         | 122        | 0                             | 574    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 16H00 to 17H00                                            | Up         | 255        | 150                    | 10           | 14     | 22         | 139        | 0                             | 590    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 17H00 to 18H00                                            | Up         | 220        | 133                    | 15           | 8      | 16         | 107        | 0                             | 499    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 18H00 to 19H00                                            | Up         | 188        | 140                    | 39           | 12     | 13         | 102        | 10                            | 504    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 19H00 to 20H00                                            | Up         | 195        | 66                     | 33           | 16     | 44         | 88         | 10                            | 452    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 20H00 to 21H00                                            | Up         | 250        | 98                     | 38           | 18     | 38         | 76         | 10                            | 528    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 22H00 to 23H00                                            | Up         | 98         | 33                     | 21           | 11     | 22         | 44         | 10                            | 239    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 23H00 to 00H00                                            | Up         | 30         | 18                     | 12           | 9      | 12         | 16         | 10                            | 107    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 00H00 to 01H00                                            | Up         | 16         | 26                     | 8            | 6      | 9          | 13         | 10                            | 88     |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 01H00 to 02H00                                            | Up         | 9          | 12                     | 0            | 3      | 2          | 6          | 10                            | 42     |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 02H00 to 03H00                                            | Up         | 10         | 19                     | 0            | 6      | 0          | 0          | 10                            | 45     |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 03H00 to 02H00                                            | Up         | 7          | 22                     | 0            | 0      | 0          | 0          | 10                            | 39     |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 03H00 to 04H00                                            | Up         | 9          | 6                      | 5            | 2      | 3          | 6          | 10                            | 41     |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 04H00 to 05H00                                            | Up         | 14         | 10                     | 15           | 7      | 14         | 19         | 10                            | 89     |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 05H00 to 06H00                                            | Up         | 22         | 18                     | 13           | 6      | 26         | 22         | 10                            | 117    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| 06H00 to 07H00                                            | Up         | 44         | 22                     | 24           | 7      | 24         | 27         | 0                             | 148    |
|                                                           | Down       |            |                        |              |        |            |            |                               |        |
| TOTAL VOLUME For UP and Down                              |            | 3330       | 2018                   | 541          | 263    | 491        | 1611       | 120                           | 8374   |

From the Table **22.8.2 A & 22.8.2 B** above and Graphical representation of Traffic as per Charts **Chart 22.8.2 C & Chart 22.8.2 D** it can be observed that the average per day traffic of Cars, Heavy Commercial Vehicles (Truck) is ranging between **204** and **263** excluding Western Cluster Limited haulage fleet of assumed 80 to 120 trucks per day. With further examination of the data as Western Cluster Limited – current RUP mandate operation of the haulage fleet on the Bomi Highway from 22pm and 05am it is noted that the general traffic decline between 20pm and 21pm on both traffic census conducted.

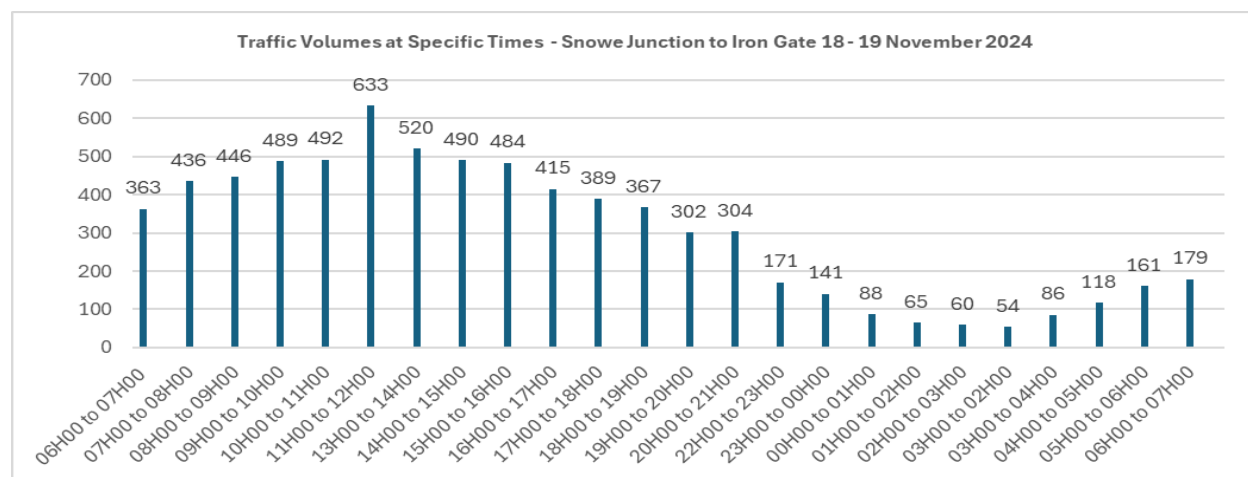


Figure 20: Graph representation of traffic Count at Snowe Junction

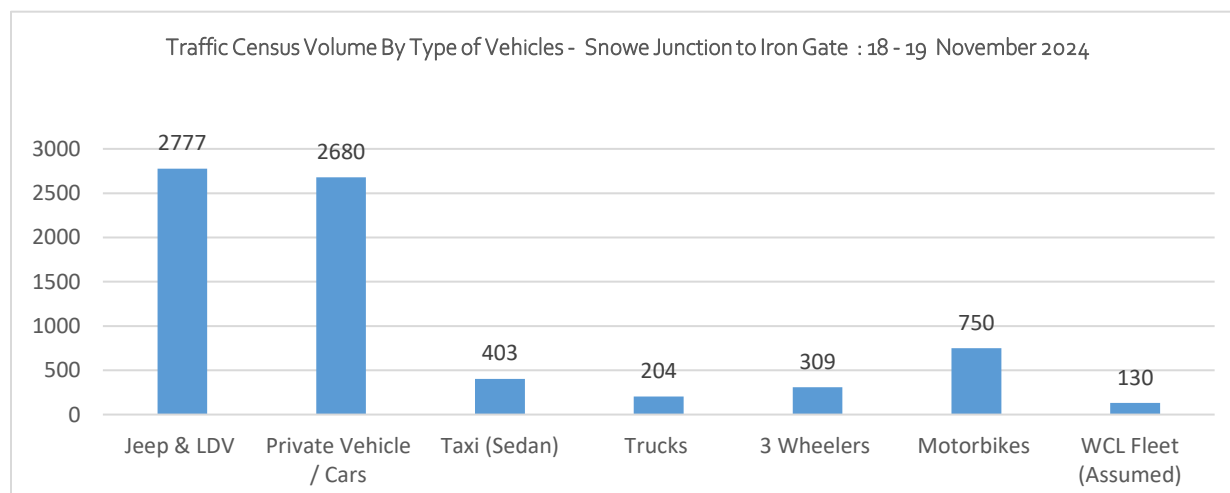


Figure 21: Traffic Census by vehicle volume Snowe Junction

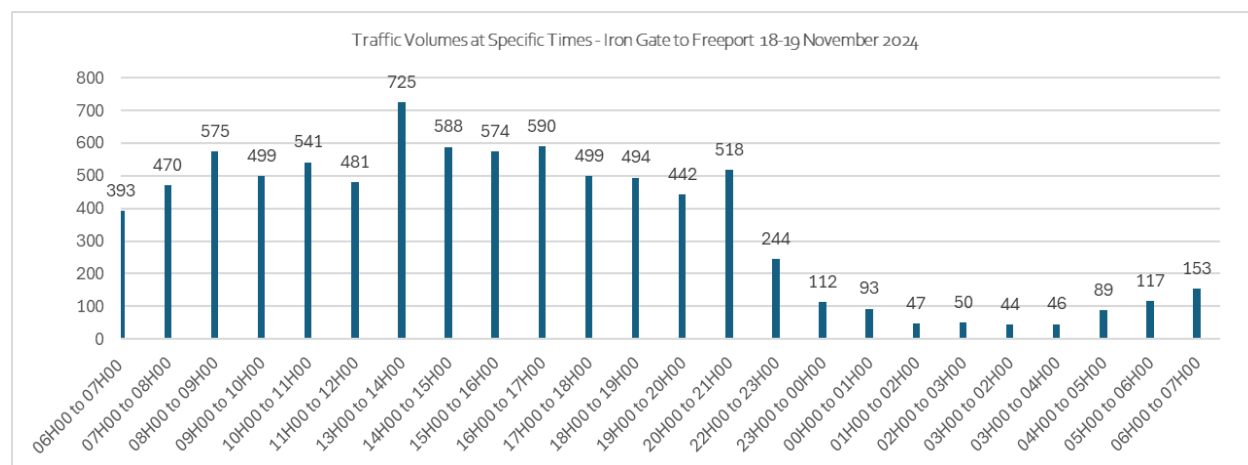


Figure 22: Iron Gate Traffic Census Graph

Very same observation dominance of high on the traffic count is the Jeep / LDV and Private vehicles, this has been observed between 06am to 18pm on the traffic count conducted between Iron Gate.

Montserrado and Freeport of Monrovia. On **chart 22.8.2 DD** it's been observed that traffic volume increased on Jeep & LDV but decrease on private vehicle this is due to traffic avoidance at the Dwala Market area. The private vehicles take the by-pass road via Monbe Town and Loggen Town avoiding traffic at Dwala, with increase on 3 Wheelers and motorbikes as this are easy transport for citizens accessing the market area. The traffic is noticed lowering at 20pm in the area.

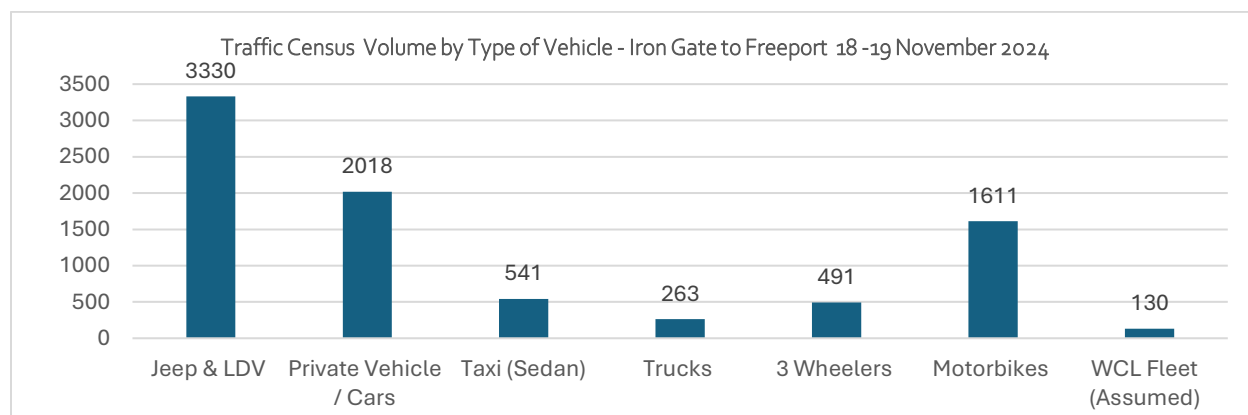


Figure 23: Iron Gate Traffic Census of vehicle by volume

## CHAPTER 23 CONCLUSION AND RECOMMENDATIONS

An Environmental and Social Impact Assessment (ESIA) has been undertaken to assess the potential environmental and social impacts associated with the proposed development of the Bomi Hills Mine in Liberia. Initial assessment was carried out in 2013 by Environmental Resource Management (ERM), and the EPA subsequently issued the necessary permits for the operations after it had reviewed and evaluated the submission. Since then, WCL has successively renewed its environmental permit in accordance with applicable environmental frameworks governing its operation.

The report has been prepared for **Western Cluster Ltd (WCL)** by **Mac-Africa Consultants, Incorporated**, an EPA certified environmental consultancy firm, it and presents the objectives, methodology and outcomes of the ESIA.

The purpose of the ESIA is to update the initial environmental and social impact assessment report done in 2013 by assessing the direct and potential impacts of the project and project-related activities on the biophysical and socio-economic environments, including public health. The ESIA process assimilates the Environmental Protection and Management Law of Liberia (EPML) 2002 requirements as well as the international standards, Vedanta's own sustainability standards and the best practices.

The major project components under this ESIA are the mine operations – the production of 4 million tons per annum (Mtpa) which is planned to be ramped up to 10 Mtpa in the next few years. The ore produced is being transported via the existing road between Bomi Hills and the Freeport of Monrovia, and the alternative ore haul road alignment from Tubmanburg to Bamboja along the coast in Bomi County from where the ore will be transported by sea using barges and transship load the vessel at sea or the barges will sail to Freeport of Monrovia and transship loading can be conducted, also should the GoL establish port in the Western Region, such port will be used as allocated.

The use of the Monrovia to Bomi highway for the transportation of ore has been assessed as the concern for the project considering WCL has been operating since 2018 and has met the requirements of its initial environmental permits.

WCL has remain engaged with the relevant Government entities such as the Ministry of Public Works and the EPA to address these concerns, and to undertake the necessary rehabilitation works and safety measures to ensure that the road is in a good pliable condition and safe for other road users considering that it is a national highway.

The ESIA identifies several potential impacts associated with the Project. The impacts were identified and assessed in accordance with the impact assessment methodology, and are designated as being of Minor, Moderate or Major impact significance.

Mitigation measures and enhancement measures were then identified to be implemented as part of the Project design, construction, operation and decommissioning phases. The impacts were then reassessed, with the implementation of the mitigation measures and a residual significance was assigned to each impact.

The table below provides a summary of the impact assessed in this ESIA. The premeditated impact and residual impacts are presented.

Table 17: Summary of impacts

| Impact                                                                                                                             | Impact Type | Duration   | Extent   | Receptor Sensitivity | Significance |
|------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|----------|----------------------|--------------|
| Increase in sedimentation and general environmental degradation due to erosion.                                                    | Direct      | Long-term  | Local    | Medium               | Minor        |
| Reduction in groundwater baseflow contribution to streamflow, owing to mine dewatering and potential impacts on receptors          | Direct      | Long-term  | Local    | Low                  | Negligible   |
| Potential groundwater quality impact associated with oil, fuel and chemical spills and leaks. This could pose a risk to receptors. | Direct      | Long-term  | Local    | Low                  | Negligible   |
| Soil erosion                                                                                                                       | Direct      | Long-term  | Local    | Low                  | Minor        |
| Loss of biodiversity                                                                                                               | Direct      | Long-term  | Local    | Low                  | Minor        |
| Loss of aquatic habitat.                                                                                                           | Direct      | Permanent  | Local    | Medium               | Moderate     |
| Impacts on water quality                                                                                                           | Direct      | Long-term  | Local    | Medium               | Moderate     |
| Change in hydrology                                                                                                                | Direct      | Long-term  | Local    | Low                  | Minor        |
| Impacts of Human Influx                                                                                                            | Indirect    | Permanent  | Regional | Medium               | Moderate     |
| Impact on air quality is direct.                                                                                                   | Direct      | Short-term | local    | Medium               | Moderate     |

This updated ESIA report has relied on the 2013 ESIA baseline study data and current monitoring data for parameters of concerns relative to iron ore exploitation. Baseline data were reported by ERM in the ESIA report for 2013, and WCL has been conducting its regular monitoring programs through an independent EPA certified environmental consultancy firm call Environmental Consultancy Incorporated (ENCO). These reports which are as recent as August of 2024 include monthly, quarterly and annual reports of air quality, ground and surface water qualities, and noise levels in accordance with EPA issued environmental permit conditions and the approved EPA parameters of concern guidelines. These results were compared to the existing Liberian standards as established by the EPA, but they have not been included in this document since they have been submitted to the EPA, and because of their page volumes. A review of these documents as summarized in the table above has not shown any significant negative impact or change in the environment at WCL's Bomi Hills Mine.

The updating of this 2013 ESIA report is intended to inform and disclose to the EPA aspects of the project which were initially proposed in the 2013 report but are no longer applicable to the project, the environmental assessment of alternatives for those aspects which are no longer applicable, and the assessment of the project planned expansion facilities to accommodate the 10 Mtpa production.

The assessment identified several associated impacts as well as potential risks as discussed in the preceding chapters for which mitigation and management measures have been developed to avoid, reduce or offset the impacts. WCL will need to ensure that these proposed mitigations and management measures are implemented during project's implementation and operations, and it will monitor the biophysical and social environment to ensure that these mitigations are effective.

The long-term sustainability of this project hinges not only on the efforts of WCL to conform to laws, regulations and guidelines as it relates to its operations but also the establishing of genuine partnerships with other stakeholders, in particular residents and local authorities of Bomi County and the Government of Liberia.

Finally, it is recommended that this updated ESIA report be use a by the EPA to assess and evaluate aspects of WCL under its Class A Mining License for this project, example is the ore transport by road to a jetty along the coast at Bamboja option. This will have to follow the 2021 Revised Environmental and Social Impact Assessment/Strategic Environmental Assessment (ESIA/SEA) Procedural Guidelines.

## REFERENCED DOCUMENTS

2021 Revised Environmental and Social Impact Assessment/Strategic Environmental Assessment (ESIA/SEA) Procedural Guidelines. 2022

The National Environmental Policy of the Republic of Liberia. Approved: November 26, 2002

An Act Creating the Environment Protection Agency of the Republic of Liberia. Approved: November 26, 2002

Noise Pollution Control & Standards Regulation, 2017. Instrument no: RI/C&E/002/04-17

Guidelines for the Operation & Monitoring of Drinking Water Production Instrument no: RI/C&E/001/02-17

Minerals and Mining Law of Liberia. 2000

**Legend**

- Dwellings
- Road Alignment
- Proposed Ore Transport Route
- Gravel Roads
- Old LMC Rail Corridor
- Proposed Rail
- Proposed Boundary Walls
- Perennial Rivers
- Non-perennial Rivers
- Mining Infrastructure
- Concession Area
- Pit
- Disused Mine Pit
- Wetlands

**Map: 2 - 2**

SCALE: 0 500 1 000 1 500 Meters

**TITLE:** Proposed Layout of Bomi Hills Mine Concession

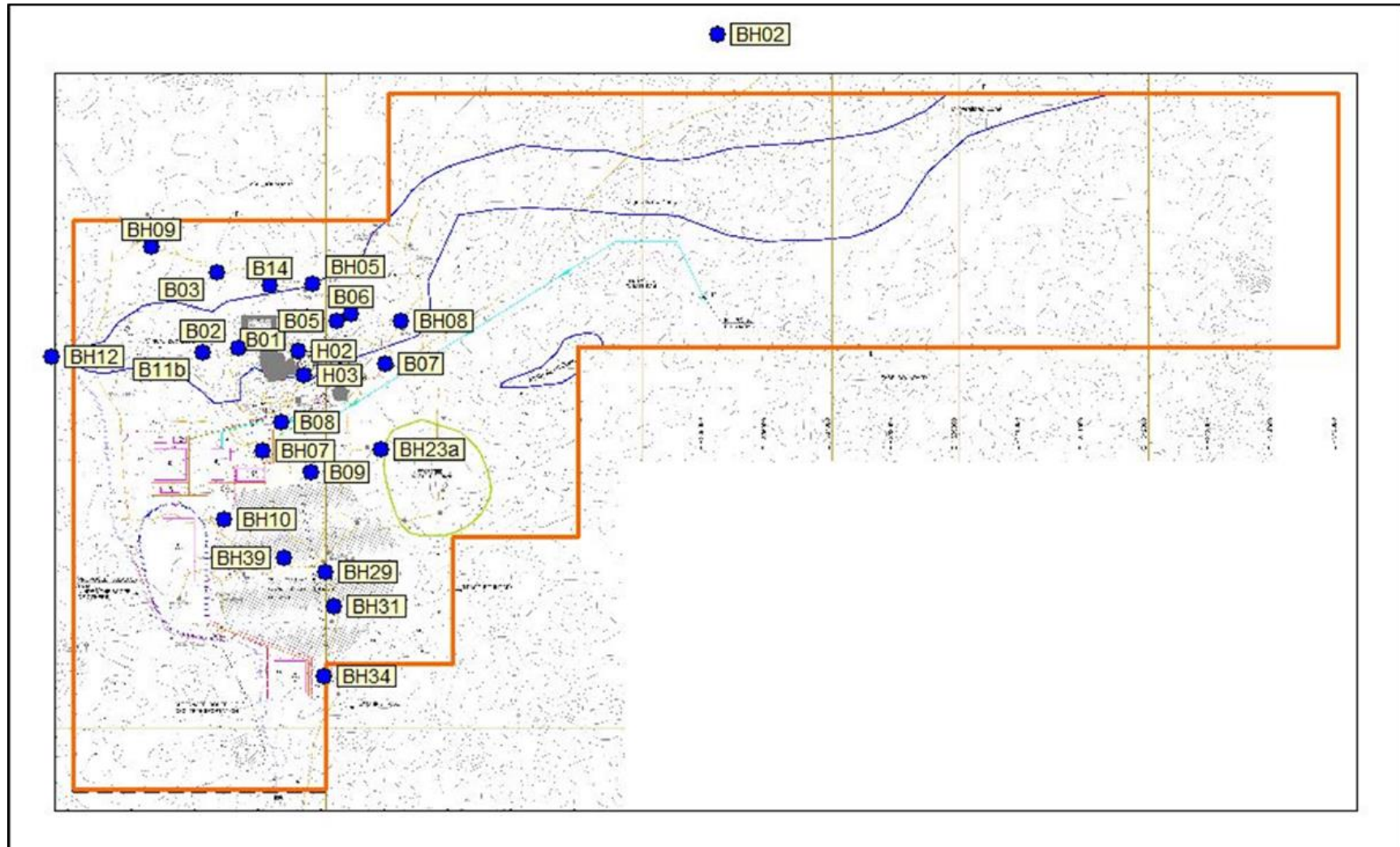
**CLIENT:** vedanta resources plc

**DATE:** April 2013 **CHECKED:** AC **PROJECT:** 0171041

**DRAWN:** AC **APPROVED:** SP **SCALE:** 1:30 000

**DRAWING:** 2-2 Proposed Layout of Bomi Hills Mine Concession.mxd

## ANNEX 2: Borehole Monitoring Location



## ANNEX 3: Stakeholders Engagement

### Summary Report of ESIA Stakeholders' Meeting for WCL Superintendent's Office, Tubmanburg, Bomi County

November 11, 2024

**Overview:** The meeting was convened by Mr. Sumo S. Momolu of the MacAfrica Consultants Inc. as part of the assessment process leading to the updating of an ESIA done for WCL before.

Attendees of the meeting included the affected communities, civil society, superintendent's office, Elders, women leadership, people with disability and the youths as well.

Key sectors were brought forth for discussion to gather views and recommendations from the community on environmental and social issues from the operation of WCL in Bomi. These sectors included:

#### EMPLOYMENT

- **Issues**
  - Insurance issues with almost all contractors.
  - Late monthly payment of contractors.
  - Effect of vibration for nearby town from drill and blast.
- **Recommendation(s)**
  - Recommends WCL to employ at least 100 residents of the affected communities for the upcoming intake.
  - Recommends WCL to also include people with disability.

Clarification was made by the PRO of WCL on the employment issues by stating that WCL is prioritizing the inclusion of the affected communities, a daughter of Suamaka now serves as the HR of WCL so as to foster this initiative.

#### EDUCATION

- **Issues**
  - In spite of the planned vocational school by WCL, they should do more in education.
  - Skill training for people with disability so as to enable them form part of the work force at WCL.

- **Recommendations**

- Recommends WCL to extent Gborla public school to a junior or senior high level.

The PRO OF WCL advised that the school be extended to a junior high level and feeder road be constructed to connect the nearby towns.

## **HEALTH**

- **Issues**

- A concern was raised to understand how the ores carried by WCL trucks affects the residents beside the road but it was clarified by Mr. Momolu who stated that this was more concerns with the issue of accidents then health because the health effect was to a very minimal or even non-existent, unless maybe over a very long period of time.

- **Recommendation(s)**

- Recommends WCL to construct a health facility at a centrally located point for affected communities.
- Recommends WCL to reactivate the mobile clinic that in existence before.

Clarification was made by the PRO of WCL that presently there exist two ambulances which is being fueled by them to assist in health emergencies. He stressed there is a need to investigate how frequent these ambulances reach the affected communities.

## **COUNTY DEVELOPMENT FUND**

- **Issues**

- That that have not receiving the 20% from the CDF.
- That there has been no county sitting in 2024 to implement the allocation of the 20% meant for affected communities.

- **Recommendation(s)**

- Recommends that 20% for affected communities be increased to at 40%.

Clarification was made by the PRO of WCL that they are setting up a committee soon that will include the National Bureau of Concession and the affected communities to address how the 20% for affected communities can be allocated to them directly.

## **DEVELOPMENT (ROADS)**

- **Issues**
  - Relocation of nearby towns from the concession area, especially Borbor and Zialakai Towns.
- **Recommendation(s)**
  - That there should be construction of roads between all affected and major communities.
  - That all constructed roads should be disable friendly

**Pictorial Evidence**



Figure 24: Bomi County Administration Reps at Engagement Meeting



Figure 25: Traditional Elders



Figure 26: Affected Community Leadership

WESTERN CLUSTER LIMITED (WCL) LIBERIA ENVIRONMENTAL IMPACT ASSESSMENT UPDATE STAKEHOLDERS'  
ENGAGEMENT MEETING HELD AT THE  
SUPERINTENDENT OFFICE, TUBMANBURG, BOMI COUNTY

| NO | NAME                 | COMMUNITY              | POSITION              | CONTACT NUMBER | SIGNATURE          |
|----|----------------------|------------------------|-----------------------|----------------|--------------------|
| 1  | Sando G. Johnson     | Acwein                 | Chief                 | 777541193      | <i>[Signature]</i> |
| 2  | Rachel Sah           | Tubmanburg             | County Council        | 0775590369     | <i>[Signature]</i> |
| 3  | Jackson Cannah       | Chief, Suchu Messa     | Chief                 | 077544415      | <i>[Signature]</i> |
| 4  | Mohammed S. Ankulay  | Suchu Messa youth      | YSOUTH Chair          | 0775150364     | <i>[Signature]</i> |
| 5  | Kanah D. Musa        | Joseph Town/Tubmanburg | AA "Sup. office       | 0770631103     | <i>[Signature]</i> |
| 6  | Nathanial A. Luke    | Vai Town 1, Tubmanburg | Sup. office           | 0880694849     | <i>[Signature]</i> |
| 7  | Lucia N. Thomas      | Tubmanburg             | Sup. office           | 0880672354     | <i>[Signature]</i> |
| 8  | Mohammed Massalay    | Tubmanburg             | ACCT. & Supt.         | 0776615376     | <i>[Signature]</i> |
| 9  | Jestina Ngeffuah     | T.C.C. / Tubmanburg    | Financial Officer     | 0770454839     | <i>[Signature]</i> |
| 10 | A.Y.E.A. Ngeffuah    | T.C.C. / Tubmanburg    | "                     | 077359464      | <i>[Signature]</i> |
| 11 | Amos Y. Kumei        | Vai Town #3            | N/A                   | 0775318615     | <i>[Signature]</i> |
| 12 | Kel. Joseph D. Davis | Fburg                  | Co. Chair-Bc          | 0772085287     | <i>[Signature]</i> |
| 13 | Albeta G. Goll       | Kumada Town            | youth chair           | 0774186921     | <i>[Signature]</i> |
| 14 | Armona L. Kumei      | Vai Town #1            | Health pr             | 0775853418     | <i>[Signature]</i> |
| 15 | Carlo S. Davies      | Vai Town II            | Youth Chair           | 0774664616     | <i>[Signature]</i> |
| 16 | Moumo Goll           | Kumada Town            | Town chair            | 0775663532     | <i>[Signature]</i> |
| 17 | Sarah Gindan         | Bola Town              | Youth Chair           | 022299555      | <i>[Signature]</i> |
| 18 | B. Sando Archie      | Kumada Town            | Dev. Officer          | 0771317232     | <i>[Signature]</i> |
| 19 | Alem B. Delvine      | Bala Town              | Chairman              | 0770365938     | <i>[Signature]</i> |
| 20 | Sam G. Marshall      | Bala Town              | Co-Chairman           | 0771945253     | <i>[Signature]</i> |
| 21 | Nadesc. Allison      | Nolamu Town            | MRNBER                | 0770696716     | <i>[Signature]</i> |
| 22 | Bernah Nassau        | "                      | Town Chief            | 0776838066     | <i>[Signature]</i> |
| 23 | Timneh Kaptelu       | "                      | Youth Chief           | 0776344793     | <i>[Signature]</i> |
| 24 | B. Harris Niam Sr.   | Goblah-Tubmanburg      | Concern citizen chair | 077074684      | <i>[Signature]</i> |
| 25 | Sumo m. Fallah       | Vai Town 1             | Chairman - Governor   | 077038894      | <i>[Signature]</i> |

WESTERN CLUSTER LIMITED (WCL) LIBERIA ENVIRONMENTAL IMPACT ASSESSMENT UPDATE STAKEHOLDERS'  
 ENGAGEMENT MEETING HELD AT THE  
 SUPERINTENDENT OFFICE, TUBMANBURG, BOMI COUNTY

| NO | NAME                | COMMUNITY          | POSITION           | CONTACT NUMBER | SIGNATURE  |
|----|---------------------|--------------------|--------------------|----------------|------------|
| 26 | Augustine S. Turner | Tarpah Town        | Secretary          | 0770763486     | Ampp       |
| 27 | Fredrick D. Kiele   | Yomeh Town         | CHA                | 0866765564     | F.D. Kiele |
| 28 | Dennis Sherif       | Baba Town Chief    | Town Chief         | 0720339528     | D.S.       |
| 29 | Sando v. Dawakai    | Tubmanburg         | G. Youth Chair     | 0176809897     | Sando      |
| 30 | Ronetta K. Lewis    | Health Complex     | Youth Chair        | 077851382      | R. Lewis   |
| 31 | Hereline S. Manku   | Madia Town         | Member             | 072015076      | J.C. Manku |
| 32 | Thomas S. Wood Jr   | TK Town            | Town Chief         | 0770961264     | Thomas     |
| 33 | John E. M. George   | Coffesuah Town     | H.F.D.C            | 0740337464     | John       |
| 34 | Philip Kollie       | Zalakai            | Youth Chairman     | 0727356074     | P. K.      |
| 35 | Jerry S. Roberts    | Zekekai Town       | Secretary          | 0170494614     | Jerry      |
| 36 | Amos Tamba          | Baba Town          | Elder              | 0725689927     | Amos       |
| 37 | Aron Sand O         | Ghazwah Town       | Youth Chairman     | 0727361044     | Aron       |
| 38 | Michele A.K. Manges | Tubmanburg         | Women leader       | 0776977209     | Michele    |
| 39 | Mary G. Varney      | Tubmanburg         | Women leader       | 0776350703     | Mary       |
| 40 | Foday D. Sesay      | Tubmanburg/Media   | D.O.P              | 0777008527     | Foday      |
| 41 | Melasho Roberts     | Media              | Manager            | 0774508067     | Melasho    |
| 42 | Mona Armah          | Gilman Town        | Elder              | 0778624248     | Mona       |
| 43 | Sarah T. Collee     | Berber Town        | Town Chief         | 077744772      | Sarah      |
| 44 | Bonanga S. Kollie   | Berber Town        | Citizen            | 0778627448     | Bonanga    |
| 45 | Esther Kollie       | Tarka Town         | Chairlady          | ---            | Esther     |
| 46 | Minnie James        | Baba Town          | Chief Lady         | ---            | Minnie     |
| 47 | Mogesa Sackie       | Baba Town          | Chief Lady         | 0776018559     | Mogesa     |
| 48 | Patricia F. Kamara  | Kondoh Community   | N.C.D. Coordinator | 077660304      | Patricia   |
| 49 | David O. Tommy      | Williams Community | N.C.D. Coordinator | 0778066535     | David      |
| 50 | Booker Power        | Kondoh             | G-77 Coord         | 0777855098     | Booker     |

WESTERN CLUSTER LIMITED (WCL) LIBERIA ENVIRONMENTAL IMPACT ASSESSMENT UPDATE STAKEHOLDERS'  
ENGAGEMENT MEETING HELD AT THE  
SUPERINTENDENT OFFICE, TUBMANBURG, BOMI COUNTY

| NO | NAME               | COMMUNITY        | POSITION         | CONTACT NUMBER | SIGNATURE    |
|----|--------------------|------------------|------------------|----------------|--------------|
| 1  | Ahamadu A. Suma    | Tubmanburg       | C.M.O            | 0775745149     | Ahamadu      |
| 2  | Isakamu Samuella   | Klayipara        | Paramount Chief  | 0776292839     | F. S. and Ka |
| 3  | Joseph K. Sekora   | Tubmanburg       | Elder            | 0779805564     | J. K. S      |
| 4  | Maiming Akie       | Kamada Town      | Chief Lady       | 0777396993     | M. A         |
| 5  | Edward B. Momolu   | Zalakai Town     | Town Chief       | 077505579      | E. B. M      |
| 6  | Cecilia Torpel     | Jawaja Town      | Asst. Chief Lady | 077505579      | C. P         |
| 7  | Tennah Torpel      | Dama Sibama Town | Chief Lady       | 0770279096     | T. T         |
| 8  | Anie Harris        | Zalakai Town     | Chief Lady       | 077544578      | A. R         |
| 9  | Harvey V. Johnson  | Jawaja Town      | Chief Lady       | 0776204826     | Harvey       |
| 10 | Anie Reed          | Tubmanburg       | Chief Lady       | 077647830      | Anie         |
| 11 | Daniel T. Kpakar   | Kat. 3           | H.R. Lia         | 0777147718     | Daniel       |
| 12 | Moses S. Nueh Jr.  | Radio Bomi       | Reporter         | 0770739465     | Moses        |
| 13 | Yusef M. Gray      | Klay District    | Rep. Committee   | 077033593      | Yusef        |
| 14 | Phelix M. Gbaryou  | Tubmanburg       | County Planner   | 0775171457     | Phelix       |
| 15 | Jarneh Sunkula     | Radio Bomi       | Manager          | 0770800481     | Jarneh       |
| 16 | Helena Wilson      | Tubmanburg       | Officer Lia      | 07715409       | Helena       |
| 17 | Muhammad Kanaka    | Tubmanburg       | DOT-1 CR         | 0779406852     | Muhammad     |
| 18 | James N. Kunda     | Jawaja Town      | Kiss. Giver      |                | James        |
| 19 | Morris W. Sanku    | Jawaja           | A.S. J. A.       |                | Morris       |
| 20 | Harvey Brown       | T-burg           | Cleaner mfa      |                | Harvey       |
| 21 | Alfred B.S. Zinnah | T-burg           | C.P.O            | 077754581      | Alfred       |
| 22 | Varney Aliru Doley | Bomi             | C.P.O            | 077570753      | Varney       |
| 23 | George Sanku       | Sup office       | C.O              | 0775926770     | George       |
| 24 |                    |                  |                  |                |              |
| 25 |                    |                  |                  |                |              |

73 person

3 - G.L. \* - 30 = 90  
4 - Sunk Mera \* 20 = 80  
2 - 7 = 40

7B

- 9

64 x 10 = 640

2

60

40

40 / 550

## ANNEX 4: Water Quality Results

| No. | Sample ID | Source              | Location      | GPS Coordinates |        |
|-----|-----------|---------------------|---------------|-----------------|--------|
|     |           |                     |               | UTM_E           | UTM_N  |
| 1   | WCL-SW1   | Mahel River         | Lamie Village | 295354          | 760240 |
| 2   | WCL-SW2   | Stream              | Tubmanburg    | 298101          | 760755 |
| 3   | WCL-SW3   | Lake                | Lake (Upper)  | 300190          | 763869 |
| 4   | WCL-SW4   | Pit-water Discharge | Mining Site   | 298106          | 763125 |
| 5   | WCL-GW1   | Hand Pump           | Zelekai       | 298793          | 763993 |
| 6   | WCL-GW2   | Hand Pump           | Borbor Town   | 300190          | 763374 |
| 7   | WCL-GW3   | Borehole            | WCL Camp      | 298206          | 763125 |
| 8   | WCL-GW4   | Hand Pump           | BCC           | 298101          | 760202 |



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|                    |                                    |                                 |                  |
|--------------------|------------------------------------|---------------------------------|------------------|
| Name of Project:   | Bomi Hills Iron Ore Mining Project | Client:                         | WCL              |
| Location:          | Tubmanburg, Bomi County, Liberia   | Date:                           | 28-Nov-24        |
| Sample ID:         | Multiple Sample Ids                | Technician:                     | Prince G. Kollie |
| Sample Site (UTM): | Multiple Sampling Sites            | Elements/Parameters Tested For: | Multiple         |

#### SURFACE WATER QUALITY RESULTS

Water Analysis Report Form: [Code: #ELS-WQR-WCL Bomi Hills-01-021iv-28-11-2024#]

| Parameters       | Analytical Method (Test Range)     | Analytical Result |         |         |         |             | Comments |
|------------------|------------------------------------|-------------------|---------|---------|---------|-------------|----------|
|                  |                                    | WCL-SW1           | WCL-SW2 | WCL-SW3 | WCL-SW4 | LWQS ClassI |          |
| pH               | DR/870 Colorimeter (5.0 to 9.0 pH) | 7.160             | 6.580   | 6.770   | 6.190   | 5.5-9.0     |          |
| TDS              | TDS meter                          | 12.050            | 12.170  | 9.630   | 40.060  | 1000        |          |
| TS               | DR/870 Colorimeter (0 to 750 mg/L) | 38.130            | 40.090  | 31.450  | 87.340  | 1030        |          |
| Magnesium        | Colorimetry                        | 27.100            | 15.060  | 16.580  | 11.200  | -           |          |
| Potassium        | Colorimetry                        | 27.350            | 30.670  | 25.990  | 21.470  | -           |          |
| Calcium          | Colorimetry                        | 23.600            | 20.780  | 21.570  | 14.800  | -           |          |
| Sodium           | Colorimetry                        | 20.300            | 21.570  | 18.700  | 17.650  | -           |          |
| Ammonia-Nitrogen | Colorimetry                        | 0.080             | 0.055   | 0.037   | 0.041   | 0.4         |          |
| Conductivity     | Conductivity Meter                 | 25.760            | 29.300  | 27.910  | 79.700  | -           |          |
| COD              | TNT 822 HR (20-1500 mg/L)          | 102.850           | 104.710 | 191.560 | 209.800 | 500         |          |
| BOD              | Lamotte (BOD Code 7420)            | 60.140            | 76.190  | 101.200 | 179.710 | 250         |          |

|                                                                                                                                                                                                                                                                                                  |                                                           |        |        |        |        |       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------|--------|--------|--------|-------|--|
| Dissolved Oxygen                                                                                                                                                                                                                                                                                 | Aqua probe (mg/L)                                         | 5.300  | 5.220  | 5.160  | 4.210  | 5     |  |
| Turbidity                                                                                                                                                                                                                                                                                        | DR/870 Colorimeter (0 - 1000 NTU)                         | 4.150  | 5.220  | 2.290  | 3.900  | -     |  |
| Mercury                                                                                                                                                                                                                                                                                          | Cold Vapor Mercury Concentration (0.0 - 2.5 µg/L)         | 0.005  | <0.001 | <0.001 | <0.001 | 0.005 |  |
| Cadmium                                                                                                                                                                                                                                                                                          | Dithizone Method (0 to 80 µg/L)                           | <0.001 | <0.001 | <0.001 | 0.001  | 0.001 |  |
| Arsenic                                                                                                                                                                                                                                                                                          | Arsenic Test Kit (0.00 to 0.5ppm)                         | <0.001 | <0.001 | 0.013  | 0.012  | 0.05  |  |
| Lead                                                                                                                                                                                                                                                                                             | Dithizone method (3 to 300 µg/L)                          | <0.001 | <0.001 | <0.001 | <0.001 | 0.01  |  |
| Chromium total                                                                                                                                                                                                                                                                                   | HACH Test Kit (0-1000 mg/L)                               | 0.021  | 0.018  | 0.021  | 0.020  | 2     |  |
| Copper                                                                                                                                                                                                                                                                                           | Bicinchoninate Method (0.04 to 5.0 mg/L)                  | 0.007  | 0.005  | 0.026  | 0.017  | 1     |  |
| Manganese                                                                                                                                                                                                                                                                                        | Periodate Oxidation Method (0.1- 20.0mg/L)                | 0.044  | 0.122  | 0.511  | 0.621  | 10    |  |
| Zinc                                                                                                                                                                                                                                                                                             | Zircon method (0.01 to 3.00 mg/L)                         | <0.005 | <0.005 | 0.01   | 0.012  | 2     |  |
| Total Acidity                                                                                                                                                                                                                                                                                    | Methyl-orange method (10 to 4000 mg/L CaCO <sub>3</sub> ) | 4.300  | 4.100  | 7.800  | 5.000  | -     |  |
| Total Alkalinity                                                                                                                                                                                                                                                                                 | Methyl-orange method (5 to 100 mg/L)                      | 10.600 | 11.000 | 13.500 | 23.500 | -     |  |
| Iron                                                                                                                                                                                                                                                                                             | Colorimetry                                               | 0.035  | 0.075  | 0.610  | 2.110  | 2     |  |
| Oil & Grease                                                                                                                                                                                                                                                                                     | Oil & Grease Meter                                        | 0.005  | 0.005  | 0.005  | 0.004  | -     |  |
| Chlorine                                                                                                                                                                                                                                                                                         | Colorimetry                                               | 0.01   | 0.021  | 0.005  | <0.001 | 0.1   |  |
| Sulfate                                                                                                                                                                                                                                                                                          | Colorimetry                                               | 2.880  | 3.700  | 14.700 | 11.040 | 250   |  |
| Nitrate                                                                                                                                                                                                                                                                                          | Colorimetry                                               | 0.555  | 0.309  | 0.370  | 0.311  | 60    |  |
| <p><b>Remarks:</b></p> <p>Sample collected by client</p> <div style="text-align: right;"> <br/> Environmental Laboratory Services, Inc<br/> P. O. Box 1891<br/> Benson Street<br/> Monrovia, Liberia </div> |                                                           |        |        |        |        |       |  |


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|                    |                                    |                                 |                  |
|--------------------|------------------------------------|---------------------------------|------------------|
| Name of Project:   | Bomi Hills Iron Ore Mining Project | Client:                         | WCL              |
| Location:          | Tubmanburg, Bomi County, Liberia   | Date:                           | 28-Nov-24        |
| Sample ID:         | Multiple Sample Ids                | Technician:                     | Prince G. Kollie |
| Sample Site (UTM): | Multiple Sampling Sites            | Elements/Parameters Tested For: | Multiple         |

**GROUNDWATER QUALITY RESULTS**
**Water Analysis Report Form: [Code: #ELS-WQR-WCL Bomi Hills-01-021iv-28-11-2024#]**

| Parameters       | Analytical Method (Test Range)     | Analytical Result |         |         |         |             | Comments |
|------------------|------------------------------------|-------------------|---------|---------|---------|-------------|----------|
|                  |                                    | WCL-GW1           | WCL-GW2 | WCL-GW3 | WCL-GW4 | LWQS ClassI |          |
| pH               | DR/870 Colorimeter (5.0 to 9.0 pH) | 6.550             | 6.600   | 7.190   | 6.770   | 5.5-9.0     |          |
| TDS              | TDS meter                          | 3.930             | 3.110   | 2.700   | 2.030   | 1000        |          |
| TS               | DR/870 Colorimeter (0 to 750 mg/L) | 5.220             | 6.880   | 3.100   | 3.050   | 1030        |          |
| Magnesium        | Colorimetry                        | 12.670            | 18.400  | 11.950  | 10.830  | -           |          |
| Potassium        | Colorimetry                        | 7.200             | 4.960   | 3.600   | 2.990   | -           |          |
| Calcium          | Colorimetry                        | 1.700             | 1.950   | 2.210   | 2.740   | -           |          |
| Sodium           | Colorimetry                        | 1.750             | 0.950   | 1.170   | 1.110   | -           |          |
| Ammonia-Nitrogen | Colorimetry                        | <0.005            | <0.005  | <0.005  | <0.005  | 0.4         |          |

|                  |                                                           |        |        |        |        |       |  |
|------------------|-----------------------------------------------------------|--------|--------|--------|--------|-------|--|
| Conductivity     | Conductivity Meter                                        | 13.050 | 11.130 | 13.090 | 10.830 | -     |  |
| COD              | TNT 822 HR (20-1500 mg/L)                                 | 1.700  | 0.910  | 0.940  | 0.870  | 500   |  |
| BOD              | Lamotte (BOD Code 7420)                                   | <0.001 | <0.001 | <0.001 | <0.001 | 250   |  |
| Dissolved Oxygen | Aqua probe (mg/L)                                         | <0.001 | <0.001 | <0.001 | <0.001 | 5     |  |
| Turbidity        | DR/870 Colorimeter (0 - 1000 NTU)                         | 0.001  | 0.001  | <0.001 | <0.001 | -     |  |
| Mercury          | Cold Vapor Mercury Concentration (0.0 - 2.5 µg/L)         | <0.001 | <0.001 | <0.001 | <0.001 | 0.005 |  |
| Cadmium          | Dithizone Method (0 to 80 µg/L)                           | 0.005  | 0.003  | 0.004  | 0.005  | 0.001 |  |
| Arsenic          | Arsenic Test Kit (0.00 to 0.5ppm)                         | 0.011  | 0.010  | 0.013  | 0.011  | 0.05  |  |
| Lead             | Dithizone method (3 to 300 µg/L)                          | 0.002  | 0.002  | 0.002  | 0.007  | 0.01  |  |
| Chromium total   | HACH Test Kit (0-1000 mg/L)                               | 0.030  | 0.011  | 0.027  | 0.022  | 2     |  |
| Copper           | Bicinchoninate Method (0.04 to 5.0 mg/L)                  | 2.560  | 4.100  | 2.320  | 2.640  | 1     |  |
| Manganese        | Periodate Oxidation Method (0.1-20.0mg/L)                 | 7.900  | 8.110  | 9.800  | 6.990  | 10    |  |
| Zinc             | Zircon method (0.01 to 3.00 mg/L)                         | 0.053  | 0.020  | 0.010  | 0.011  | 2     |  |
| Total Acidity    | Methyl-orange method (10 to 4000 mg/L CaCO <sub>3</sub> ) | <0.001 | <0.001 | <0.001 | <0.001 | -     |  |
| Total Alkalinity | Methyl-orange method (5 to 100 mg/L)                      | 0.013  | 0.005  | 0.012  | 0.010  | -     |  |
| Iron             | Colorimetry                                               | 2.080  | 0.810  | 1.720  | 1.220  | 2     |  |
| Oil & Grease     | Oil & Grease Meter                                        | 0.810  | 1.110  | 1.120  | 1.200  | -     |  |
| Chlorine         | Colorimetry                                               | 0.010  | 0.021  | 0.005  | <0.001 | 0.1   |  |
| Sulfate          | Colorimetry                                               | 2.880  | 3.700  | 14.700 | 11.040 | 250   |  |
| Nitrate          | Colorimetry                                               | 0.555  | 0.309  | 0.370  | 0.311  | 60    |  |

**Remarks:**

Sample collected by client

  
 Environmental Laboratory Services, Inc.  
 P. O. Box 1891  
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 Monrovia, Liberia

