

# **ENVIRONMENTAL MONITORING PLAN**

## 1 INTRODUCTION

This environmental monitoring plan is the mechanism by which Marampa Mines Ltd. (MML) shall monitor (and consequently manage) the significant environmental impacts/aspects associated with the MML Project and as identified in the MML Project Environmental and Social Impact Assessment (ESIA).

From a regulatory perspective, the requirements for an environmental monitoring plan are contained in:

- The Environment Protection Agency Act of 2008;
- The Environment Protection (Mines and Minerals) Regulations 2013, hereinafter referred to as the "Environmental Regulations" (Part VII and the Fifth Schedule); and
- Part XV of the Mines and Minerals Act 2009 that outlines the environmental protection requirements of a project.
- Commitments outlined in the MML Project ESIA.

The goal of this environmental monitoring plan is to implement monitoring systems designed to accurately and constantly monitor the project environmental impacts/aspects, and to apply these environmental performance data both to achieve continual environmental performance and also to avoid or minimise adverse significant environmental impacts.

These environmental monitoring and performance data will also support the environmental control and management measures/responsibilities identified in the environmental management plan.

Thus, the purpose of this environmental monitoring plan can be summarised as follows:

- measuring the state of the environment (i.e. monitoring);
- comparing data to performance criteria or targets (i.e. assessing compliance with regulatory requirements);
- identifying areas for improvement;
- implementing management changes to achieve the desired improvement; and
- further monitoring to assess the effectiveness of these changes.

In conclusion, this environmental monitoring plan has been established to identify the various monitoring requirements for the project and to assign persons responsible for ensuring they are performed when required and to the appropriate standard. The environmental monitoring plan is focussed on discrete tasks that can be scheduled, assigned and completed. As such, the term "monitoring" shall involve field work/ physical sampling and data collection.

## **1.1 SCOPE**

This environmental monitoring plan applies to the MML Project. This Plan applies to all activities undertaken by MML and its contractors working on the MML Project. This includes all activities within the mine concession area (plus any offsite infrastructure), concentrate haul road, Thofayim terminal, barging route and the transshipment point near Freetown.

As impacts can extend off the immediate project footprint (e.g. water, air, vibration and noise) due to transmission and transport, the MML monitoring program is designed to reflect this potential. In addition, the monitoring scope includes “reference” or “control” sites for assessment of natural variation not associated with the Project activities.

The operation will also extend to Area 2 in the original lease area held by Marampa Iron ore Limited. This will however be determined by the mine plan. Should this become necessary, the monitoring plan will extend to this area and new monitoring points for various indices will be determined.

## **1.2 OWNERSHIP AND MAINTENANCE**

During the life of mine, there will be modifications to the Project activities and the need to feedback results of ongoing monitoring work into the overall management approach taken by MML. Additional information on monitoring methods and requirements will also need to be incorporated over time as practices are updated and as a result of ongoing stakeholder consultation. The environmental monitoring plan must therefore be considered a dynamic document that will evolve with time as it is updated to reflect these changes.

The MML Environment Manager is the owner of this document and is responsible for its maintenance. As the project progresses and matures, this environmental monitoring plan will be updated and reissued for use every 12 months or sooner when:

- Changes or updates to Sierra Leone legislation or regulations occur;
- There have been significant changes to the Project activities or other project components that require a modification to the plan;
- There is significant new information to be integrated into the plan based on studies, reviews, monitoring, stakeholder consultation or lessons learned; or
- The frequency of monitoring should be reviewed to determine future monitoring requirements. Where consistent compliance with the air quality guidelines is shown, the frequency of monitoring may be reduced accordingly.

## **1.3 RESPONSIBILITIES**

The table below assigns responsibilities for the overall development and implementation of this environmental monitoring plan. Specific responsibilities are summarised in section of the Plan.

Responsible Party	Responsibilities
MML Managing Director	<ul style="list-style-type: none"> <li>• Provide the necessary resources (e.g. financial, manpower) to implement and complete the deployment and ongoing management of the environmental monitoring plan.</li> <li>• Provide visible support to environmental monitoring programs on site, ensuring all departments (i.e. Operations, Finance-Administration, Haulage-Export-Security, Human Resources/Community Relations, Health-Safety-Environment, Construction, Procurement-Materials-Commercial) are aware of their equal responsibility.</li> </ul>
General Manager HSE	<ul style="list-style-type: none"> <li>• Ensure that the environmental monitoring plan is developed in compliance with applicable regulatory requirements and is implemented accordingly.</li> <li>• Ensure that the project and its contractors/subcontractors operate in accordance with the requirements of the environmental monitoring plan i.e. the applicable regulatory &amp; company environment, health and safety requirements and plans.</li> <li>• Ensure effective communication of the appropriate aspects of the environmental monitoring plan with all internal/external stakeholders (where applicable).</li> <li>• Provide the necessary resources (e.g. financial, manpower) to implement and complete the deployment and ongoing management of the environmental monitoring plan.</li> </ul>
Environment Manager	<ul style="list-style-type: none"> <li>• Develop the environmental monitoring plan to ensure it remains in compliance with applicable regulatory requirements.</li> <li>• Responsible for the execution of the environmental monitoring plan and all legal/compliance issues therein.</li> <li>• Ensure the environmental monitoring plan is regularly reviewed and updated as required.</li> <li>• Provide ongoing oversight of the implementation of this environmental monitoring plan, ensuring it is executed in a timely manner. This includes communication of monitoring requirements to MML departments and contractors.</li> <li>• Provide technical oversight and assist with technical input into the project environmental monitoring plan i.e. resourcing, logistics, management controls and initiatives.</li> <li>• Responsible for ensuring any issues arising from the undertaking of monitoring activities are addressed in a timely manner and in accordance with EPASL and MML requirements.</li> <li>• Identify and communicate to MML senior management the resources (e.g. financial, manpower) required to effectively implement and complete the deployment and ongoing management of the environmental monitoring plan.</li> </ul>
Environmental Advisor	<ul style="list-style-type: none"> <li>• Support the environmental monitoring plan at the operational level and on a daily basis;</li> <li>• Perform monitoring and data collection/manipulation duties where directed; and</li> </ul>

Responsible Party	Responsibilities
	<ul style="list-style-type: none"> <li>Liaise with operational management &amp; personnel to ensure that duties and commitments in support of this environmental monitoring plan are expedited efficiently and in a timely manner.</li> </ul>
Managers of ALL DEPARTMENTS: Operations, Finance-Administration, Haulage-Export-Security, Health-Safety-Environment, Construction, Human Resources/Community Relations, Procurement-Materials	<ul style="list-style-type: none"> <li>Ensure monitoring requirements communicated by the MML Environmental department are executed as requested and in a timely manner.</li> <li>Clear communication to all staff and contractors of compliance requirements with the MML EMP, including this environmental monitoring plan.</li> <li>Communicate potential issues (e.g. gaps) in the monitoring programs so that changes are required.</li> </ul>
Contractor Leads and Contractor Project HSE	<ul style="list-style-type: none"> <li>Responsible for subcontractor technical performance and compliance monitoring.</li> <li>Ensure that environment, health and safety regulatory requirements are met and that environmental monitoring plan requirements are properly implemented and in a timely manner.</li> </ul>

#### 1.4 ENVIRONMENTAL MONITORING PLAN ORGANISATION

This environmental monitoring plan is divided into discrete sections and plans. For each type of environmental monitoring identified, the following attributes and criteria are addressed in the individual monitoring schemes.

- Document control and author/approver details.
- Rationale for the monitoring.
- A description of the monitoring required.
- Timing and frequency of the monitoring.
- Roles and responsibilities.
- Additional assurance details.
- Relevant project component.
- The specific monitoring/measuring requirement.
- Compliance limits/source where relevant.

The individual monitoring schemes/ plans will be used by the relevant parties to guide and assist the completion of the relevant monitoring task and will be updated and maintained as "live" documents as follows:

1. Individual monitoring plans are assigned to categories that group similar monitoring aspects together. These categories are:
  - a. Air Quality (AQ) – e.g. exhaust emissions, GHG, dust, climate monitoring
  - b. Chemicals (CH) – usage and spills
  - c. Ecology (EC) – monitoring of ecological indicators
  - d. Groundwater (GW) – levels, quantity and quality

- e. Noise and Vibration (NV)
  - f. Surface Water (SW) – surface water quality, mine site discharges
  - g. Waste (WA)– domestic, industrial, waste rock, tailing, sewerage
2. Individual monitoring plans have been assigned with a unique identifying code e.g. AE1 for 'Air Emissions #1'. These codes have been carried through to the schedule for reference purposes.
  3. Each monitoring plan has a designated 'Plan Owner' i.e. an individual accountable for the technical content, approval and maintenance of the plans.
  4. Plans will be updated following process, procedural or organisational changes on an as required basis. The responsibility for ensuring this occurs is the 'Plan Owner', irrespective of who provides technical content or approves the plan.
  5. The Environment Manager will review the Plans with relevant personnel on an annual basis to confirm they are fit for purpose and to make any changes necessary.
  6. Any new monitoring requirements identified during reviews, audits, etc shall follow this same protocol.

## 2 AIR QUALITY

### 2.1 AQ1: FUEL CONSUMPTION

AQ1: Fuel Consumption – Greenhouse Gas (GHG) Emissions					
<b>CODE</b>	AQ1	<b>PLAN OWNER:</b>			ENVIRONMENT MANAGER
<b>CATEGORY</b>	AIR QUALITY	<b>TECHNICAL CONTENT:</b>			ENVIRONMENT MANAGER
<b>REVISION DATE</b>	June 2021	<b>REV:</b>	01	<b>APPROVED BY:</b>	GM -HSE
<b>RATIONALE</b>	<p>Three main fuel types will be used by the project; diesel, marine gas oil and RME180. Diesel will be used by all land-based mobile equipment (i.e. haul trucks, mine fleet, light vehicles) on the project and RME180 will be used for power generation at the mine site and at Thofayim. Marine gas oil is required for both the barging and transshipment operations. Petrol may be used for minor equipment such as chain saws and brush cutters and gas for the kitchen areas.</p> <p>The objective of this requirement is to ensure greenhouse gas (GHG) emissions from mobile and fixed plant sources (e.g. powerhouse, mine fleet, tug fleet, haul fleet) are effectively monitored and managed. GHG emissions (i.e. CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and CO<sub>2</sub> equivalents) shall be calculated via mass balance calculation, following monitoring of fuel usage and other activities.</p> <p>Sulphur levels in fuel shall also be recorded. RME180 and Marine Gas Oil should have a maximum content of 1.5% sulphur (refer to IFC Thermal Power guidelines) and diesel, a maximum content of 0.1% sulphur. SO<sub>2</sub> emissions shall be estimated via mass balance calculation.</p> <p>The EPASL requires reporting of SO<sub>2</sub> emissions from the project and for monitoring against the project environmental standards.</p>				
<b>DESCRIPTION</b>	<p>The volume of each fuel used on the Marampa Mines project, including major contractors, is to be monitored and reported in litres consumed per month as follows:</p> <ul style="list-style-type: none"> <li>• Diesel – This fuel is used widely by the project and covers: <ul style="list-style-type: none"> <li>○ MML mobile plant including mine fleet, ancillary equipment (lighting plants, pumps, small generators), support equipment (i.e. cranes, ITs, forklifts), light vehicles, etc. located at the mine site, Thofayim and barging sites (i.e. front end loaders). Fuel is provided by MML.</li> <li>○ Concentrate haul fleet</li> <li>○ Any contract mobile or fixed plant where the fuel is not provided by MML.</li> </ul> </li> <li>• Marine Gas Oil – this fuel is used exclusively by the barging fleet and the transshipment vessels. Both are contractors of MML .</li> <li>• RME180 – this fuel is used in the power plants at the mine site and at Thofayim. Fuel is provided by MML.</li> <li>• Petrol – minor quantities purchased by MML for miscellaneous activities.</li> <li>• Gas – minor quantities are purchased by MML for miscellaneous activities</li> </ul> <p>The sulphur level in each of the fuel types is to be provided for each load of fuel received by either MML or its main contractors.</p> <p>For MML sourced fuel (i.e. RME180, petrol, gas and diesel), the quantities of fuel used will be based on financial records sourced from the MML Finance and Administration department.</p> <p>Main contractors who supply their own fuel (i.e. barging, transshipment and concentrate haulage) shall report total fuel consumed by type in their monthly reports.</p>				
<b>TIMING/ FREQUENCY</b>	Collection and collation of fuel use data on a monthly basis. This data is to be supplied to the HSE dept by no later than the fifth day of the following month.				

<b>REPORTING REQUIREMENTS</b>	GHG reporting, SO2 emissions and sulphur levels will be undertaken quarterly & annually to the EPA-SL i.e. during regulatory quarterly and annual reporting, as part of the EPA-SL reporting requirements.
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Export Operations Manager shall ensure the barging and transshipment contractors provide data on fuel usage and sulphur levels in their monthly reports to the HSE dept. by no later than the fifth day of the following month.</p> <p>The Export Manager shall ensure the concentrate haulage contractor shall provide data on fuel usage and sulphur levels in their monthly reports to the EHS dept by no later than the fifth day of the following month.</p> <p>The Finance Manager shall ensure the petrol, gas, diesel and RME180 fuel usage by MML is provided to the HSE dept by no later than the fifth day of the following month. The sulphur levels for any fuel received by MML by suppliers shall also be provided.</p> <p>The Procurement Manger is to ensure sulphur levels in fuel purchased by MML comply with Project requirements.</p> <p>Environmental Advisor is responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environment Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>The GHG calculations will follow the UK's Defra/DECC guidelines "Greenhouse gas conversion factors for company reporting," published in May 2012. A list of the applicable conversion factors is included in <i>Annex AQ1</i>. The GRI does not stipulate a method but requires the method be recognised.</p> <p>The SO2 calculations will follow the National Pollutant Inventory Emission estimation technique manual for Fossil Fuel Electric Power Generation Version 3.0 January 2012 from the Department of Sustainability, Environment, Water, Population and Communities, Commonwealth of Australia. The conversion calculation is included in <i>Annex AQ1</i> and assumes 100% of the S content is converted to SO2.</p>
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	Annual internal audit should check emissions calculations for errors and that the correct emissions factors and sulphur levels are used.



## 2.2 AQ2: AMBIENT AIR QUALITY MONITORING

AQ2: Ambient Air Quality Monitoring																							
<b>CODE</b>	AQ2	<b>PLAN OWNER:</b>		ENVIRONMENT MANAGER																			
<b>CATEGORY</b>	AIR QUALITY	<b>TECHNICAL CONTENT:</b>		ENVIRONMENT MANAGER																			
<b>REVISION DATE</b>	June 2021	<b>REV:</b>	01	<b>APPROVED BY</b>	GM-HSE																		
<b>RATIONALE</b>	<p>The objective of this requirement is to provide monitoring of ambient air quality in the project area. Specifically, ambient air quality includes Particulate Matter (i.e. dust) (PM10 and PM2.5), Sulphur Dioxide (SO<sub>2</sub>) and Nitrogen Dioxide (NO<sub>2</sub>).</p> <p>Ambient air quality monitoring is associated with the following project activities that may adversely affect air quality in the project area of influence:</p> <ul style="list-style-type: none"> <li>• Mine site and environs;</li> <li>• Transport corridor (haulage route);</li> <li>• Thofayim barge loading facility;</li> <li>• Barging route; and</li> <li>• Transshipment.</li> </ul> <p>The IFC General EHS Guidelines refers to WHO air quality guidelines (2006), which were used in the Marampa Project ESIA (Section 8.1.2) to identify ambient air quality at which Major impacts for the Marampa Project will occur.</p> <p>Threshold concentrations for ambient air quality Major impacts</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Averaging Period</th> <th>Threshold concentration (µg/m<sup>3</sup>)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">NO<sub>2</sub></td> <td>Annual mean</td> <td>40</td> </tr> <tr> <td>1 hour</td> <td>200</td> </tr> <tr> <td rowspan="2">SO<sub>2</sub></td> <td>24 hour</td> <td>125</td> </tr> <tr> <td>10 minute</td> <td>500</td> </tr> <tr> <td rowspan="2">PM<sub>10</sub></td> <td>Annual mean</td> <td>70</td> </tr> <tr> <td>24 hour mean</td> <td>150</td> </tr> </tbody> </table> <p>Note: Ambient weather conditions lead to dust levels in excess of standards during the dry season. During monitoring KPIs will be adjusted to take into considerations back ground levels. E.g background +25% for PM<sub>10</sub> monitoring.</p> <p>Deposited dust (i.e. particulate matter that rapidly settles from the air), if present at sufficiently high levels, can reduce the amenity of an area. With regards dust deposition, there is no clear consensus as to the level of dust deposition that is likely to result in nuisance issues. However, on the basis of consideration of the various guidelines used internationally (e.g. West Australia Nuisance Standard, UK recommended nuisance dust deposition rate, Malaysia air quality standard), the following magnitude criteria have been developed relating to dust deposition for the Marampa Project:</p> <ul style="list-style-type: none"> <li>• Not Significant: &lt;120mg/m<sup>2</sup>/day;</li> <li>• Minor: 120 - 200 mg/m<sup>2</sup>/day;</li> <li>• Moderate: 200 - 350 mg/m<sup>2</sup>/day; and</li> <li>• Major: &gt;350mg/m<sup>2</sup>/day.</li> </ul> <p>The dust deposition thresholds presented refer to levels that can potentially affect people. It is assumed that damage to vegetation due to dust deposition will occur at approximately the same rate as nuisance will occur for human receptors. On this basis, the same criteria have been used to determine nuisance levels for sensitive human receptors and damage to vegetation.</p>					Pollutant	Averaging Period	Threshold concentration (µg/m <sup>3</sup> )	NO <sub>2</sub>	Annual mean	40	1 hour	200	SO <sub>2</sub>	24 hour	125	10 minute	500	PM <sub>10</sub>	Annual mean	70	24 hour mean	150
	Pollutant	Averaging Period	Threshold concentration (µg/m <sup>3</sup> )																				
	NO <sub>2</sub>	Annual mean	40																				
		1 hour	200																				
	SO <sub>2</sub>	24 hour	125																				
		10 minute	500																				
	PM <sub>10</sub>	Annual mean	70																				
		24 hour mean	150																				

	Refer to Annex AQ3 for details.
<b>DESCRIPTION</b>	<p>The following parameters shall be monitored:</p> <ul style="list-style-type: none"> <li>• NO<sub>2</sub> (in µg/m<sup>3</sup>)</li> <li>• SO<sub>2</sub> (in µg/m<sup>3</sup>)</li> <li>• PM<sub>10</sub> (in µg/m<sup>3</sup>)</li> <li>• Dust Deposition (in mg/m<sup>2</sup>/day)</li> <li>• <b>PM<sub>10</sub>:</b> <ul style="list-style-type: none"> <li>○ An Osiris monitor TNO3206 will be permanently deployed at the HSE Building the mine site and measure PM<sub>10</sub> and PM<sub>2.5</sub> on a continuous basis. The unit takes measures every 15 minutes and is capable of logging 80 data samples (80 days). It has a Detection Limit (DL) of 0.001 µg/m<sup>3</sup>.</li> <li>○ A portable dust monitor, capable of measuring PM<sub>10</sub> and PM<sub>2.5</sub>, will be used for monitoring of dust at sensitive receptors at the mine, haul road and barging area. Until will have a detection limit of at least 1 µg/m<sup>3</sup>. The unit will be deployed for 24 hour periods as required during the dry season.</li> </ul> </li> <li>• <b>Dust deposition:</b> Bergerhoff dust deposition gauges will be deployed in the mine concession area and adjacent to the haul road. These are 1.5 litre containers with an aperture size of 93 mm and deployed on stands at a height of 2 m above ground. Collected dust is measured and results converted to the standard of mg/m<sup>2</sup>/day dry dust based on days deployed and aperture opening. Dust is reported as insoluble fraction. Determination of particulate matter - Deposited matter-Gravimetric method or equivalent method.</li> <li>• <b>NO<sub>2</sub> and SO<sub>2</sub>:</b> Diffusion tubes measuring NO<sub>2</sub> and SO<sub>2</sub>, with detection limits of 0.017 µgNO<sub>2</sub> and 0.03 µg SO<sub>2</sub> respectively. Diffusion tubes utilise the principle of targeted diffusion of gases onto a reagent, in this case NO<sub>2</sub> and SO<sub>2</sub>. In the laboratory the tubes are titrated to calculate a concentration in air, when taking into account exposure time.</li> </ul> <p>The monitoring locations for ambient air quality monitoring are presented in Annex AQ3.</p>
<b>TIMING/ FREQUENCY</b>	<ul style="list-style-type: none"> <li>• <b>PM<sub>10</sub>:</b> <ul style="list-style-type: none"> <li>○ The Osiris monitor will provide continuous monitoring data throughout the year. Data will be downloaded once per month.</li> <li>○ The mobile dust monitor is deployed for 24 hour periods per site. It will be deployed at various sites during the dry season as a comparison for deposition gauges.</li> </ul> </li> <li>• <b>Dust deposition:</b> The Bergerhoff dust deposition gauges are deployed throughout the dry season only as the wet season (i.e. July to September) creates issues for the deployment of these units (i.e. they fill up with water). Deployment periods should last from 28-31 days during the dry season, although deployments of as little as 14 days and as much as 40 days may be used if required.</li> </ul> <p>A monitoring schedule is detailed in Annex AQ3.</p>
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring that equipment is deployed and data collected is complete, reliable and submitted on time, both internally and externally where required.</p> <p>The Environmental Laboratory shall be responsible for analysing the dust deposition samples following recognised procedures.</p>

	<p>The Environment Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity, plus communicating results to the pertinent departments as required.</p>
<p><b>OPERATIONAL CONTROL/PROCEDURE</b></p>	<p>The Osiris and Mobile dust meters shall be operated as per manufacturers' recommendations, including calibration of the units.</p> <p>The Bergerhoff dust deposition gauges shall be deployed for no less than 14 days and no more than 40 days before replacement. The Environmental Advisor shall submit at least 1 blank per sample set for analysis.</p> <p>The Environmental Laboratory shall follow good laboratory practices when analysing samples, including calibration checks of scales used for weighing samples.</p> <p>Only personnel trained in the use of the equipment shall be used.</p> <p>Dust (PM10) monitoring will be undertaken using devices that are recognised by a suitable international standard as being suitable for purpose. There are a number of PM10 monitoring techniques available, however techniques based upon the principle of light scattering are recommended. Examples of light scattering devices include Topas, Osiris, Dust Trak, and AirQual. These have the benefit of providing short term real-time data upon which decisions around mitigation and control can be based. The use of filter based monitoring is not recommended as this technique requires the daily changing of filters, and there is a 'lag time' as the filters require analysis in a certified laboratory. The use of devices utilising Tapered Element Oscillating Microbalance (TEOM) is also not recommended as these require highly specialised servicing.</p> <p>Dust deposition gauging to follow internationally recognised techniques.</p>
<p><b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b></p>	<p>Personnel should be trained on the use of equipment. All equipment should be suitable for purpose and compliant with relevant international standards (e.g., method detection limits are below levels of concern). Results of any QA/QC undertaken to be kept on file and reviewed at least annually.</p> <p>Calibration of units as per manufacturer's recommendations.</p>

### 2.3 AQ3: CLIMATE

AQ3 - CLIMATE					
<b>CODE</b>	AQ3	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER	
<b>CATEGORY</b>	AIR QUALITY	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER	
<b>REVISION DATE</b>	June 2021	<b>REV</b>	01	<b>APPROVED BY</b>	GM-HSE
<b>RATIONALE</b>	<p>The objective of this requirement is to monitor the basic weather parameters that affect operations on site as well in spill situations.</p> <p>The Marampa mine is located in the seasonal wet tropics with high rainfall, humidity and dust. Rainfall, wind, humidity and sunshine hours affect a number of areas, including dust generation of site activities, ability to rehabilitate the site (e.g. planting season), runoff quality, return water from tailing storage areas, leachate potential, filling of pit lakes at closure, capacity of water courses passing through the mine concession area and mobilisation of materials that are spilled.</p>				
<b>DESCRIPTION</b>	<p>MML will operate two weather monitoring stations; one at the Marampa Mine site and one at Thofayim. These stations shall measure rainfall (tipping bucket rain gauge), wind speed, wind direction (anemometer), temperature, humidity, evaporation (by pan) and irradiation (via a pyranometer).</p> <p>Manual rain gauges may also be used to supplement the stations as required</p> <p>Monitoring equipment should be located at a site that is representative of Project conditions, but that are not subject to interference by the site itself, i.e. changes in wind patterns due to the interference of building structures.</p>				
<b>TIMING/ FREQUENCY</b>	<p>Continuous monitoring using logging system to be downloaded monthly.</p> <p>Manual systems to be checked daily and data recorded in logs</p>				
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>				
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring data collected and equipment maintained and monthly reports containing climatic data are being generated.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for the climate monitoring program and for identification of parameters and detection limits.</p>				
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>Monthly checks performed by the Environmental Advisor shall be the primary form of operational control.</p> <p>Rainfall from loggers to be compared to manual rain gauges.</p> <p>Calibration of equipment as per manufacturer's instructions.</p>				
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	<p>Annual audit to check energy usage reported is consistent with operational activities. Also to check that issues identified from monthly reports have been adequately addressed.</p>				

### 2.4 AQ4: EMISSIONS FROM BLASTING

AQ4: Blasting emissions - GHG					
<b>CODE</b>	AQ4	<b>PLAN OWNER:</b>		ENVIRONMENT MANAGER	
<b>CATEGORY</b>	AIR QUALITY	<b>TECHNICAL CONTENT:</b>		ENVIRONMENT MANAGER	
<b>REVISION DATE</b>	June 2021	<b>REV:</b>	01	<b>APPROVED BY:</b>	GM-HSE

<b>RATIONALE</b>	<p>The objective of this requirement is to calculate GHG emissions associated with blasting activities undertaken by MML Emissions shall be calculated via mass balance calculation.</p> <p>The EPASL requires reporting of GHG emissions from the project.</p>
<b>DESCRIPTION</b>	<p>This is a mass balance calculation that involves recording the quantity (t) of explosive used per month by type (e.g. ANFO vs emulsion).</p> <p>The total quantity of explosives used (t) is multiplied by the explosives emission factor of 0.17 for emulsion and ANFO and 0.18 for heavy ANFO to provide t CO<sub>2</sub> produced; from the Australian Government Dept of Climate Change (National Greenhouse Accounts (NGA) Factors 2008),</p>
<b>TIMING/ FREQUENCY</b>	Collection and collation of explosives consumed on a monthly basis. This data is to be supplied to the HSE department by no later than the fifth day of the following month.
<b>REPORTING REQUIREMENTS</b>	GHG reporting will be undertaken annually as part of the annual corporate reporting requirements on the UK financial year.
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Mining Manager shall ensure the monthly usage of explosives by type are recorded and filed.</p> <p>Environmental Advisor shall be responsible for calculating GHG emissions from data supplied and ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	Standard industry practices shall be used to track explosive usage and data from this process shall be used for providing total explosive use.
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	Ensure the latest version of the guidelines are used in each year.

## 2.5 ANNEX A Q1 – DEFRA GHG CONVERSION FACTORS

### GHG Fuel Consumption Conversion Factors (Source: Annex 1: Converting from fuel use to carbon dioxide equivalent emissions, Defra GHG Conversion Factors, 2012)

#### Annex 1 - Converting from fuel use to carbon dioxide equivalent emissions

Last updated: Apr-12

##### How to use this Annex

- 1) Identify the amount of fuel used for each fuel type
- 2) Identify the units. Are you measuring fuel use in terms of mass, volume or energy?
- 3) If you are measuring fuel use in terms of energy is your unit of measurement net energy or gross energy? (Please see paragraph below on net and gross energy. In the event that this is unclear you should contact your fuel supplier).
- 4) Identify the appropriate conversion factor that matches the unit you are using. If you cannot find a factor for that unit, Annex 12 gives guidance on converting between different units of mass, volume, length and energy.
- 5) Multiply the amount of fuel used by the conversion factor to get total emissions in kilograms of carbon dioxide equivalent (kg CO<sub>2</sub>e). The excel spreadsheet calculates this automatically following your entry of the amount of fuel used into the appropriate box.

**Note:** *In the UK biofuels are added to virtually all of the transport fuel sold by filling stations (and by most fuel wholesalers) and this has the effect of slightly reducing the greenhouse gas emissions of the fuel. This is reflected in the emission factors below. For fuel purchased at filling stations or obtained from private commercial refuelling you should use the factor labelled "average biofuel blend" unless you know the biofuel content is higher or lower than average. In this latter case, if you are purchasing pure petrol or diesel which you know has **not** been blended with biofuels then you should use the factor labelled "100% mineral fuel", or alternatively use the bespoke biofuel blend calculations provided in Annex 9, Table 9b.*

Four tables are presented here, the first of which provides emission factors by unit mass, and the second by unit volume. Tables 1c and 1d provide emission factors for energy on a Gross and Net CV basis respectively; emission factors on a Net CV basis are higher (see definition of Gross CV and Net CV in italics below). It is important to use the correct emission factor, otherwise emissions calculations will over- or under-estimate the results. If you are making calculations based on energy use, you must check (e.g. with your fuel supplier) whether these values were calculated on a Gross CV or Net CV basis and use the appropriate factor. Natural Gas consumption figures quoted in kWh by suppliers in the UK are generally calculated (from the volume of gas used) on a Gross CV basis - see Transco website: <http://www.transco.co.uk/services/cvalue/cvinfo.htm>. Therefore the emission factor in Table 1c (Gross CV basis) should be used by default for calculation of emissions from Natural Gas in kWh, unless your supplier specifically states they have used Net CV basis in their calculations instead.

*Gross CV or higher heating value (HHV) is the CV under laboratory conditions. Net CV or lower heating value (LHV) is the useful calorific value in typical real world conditions (e.g. boiler plant). The difference is essentially the latent heat of the water vapour produced (which can be recovered in laboratory conditions).*

##### Annex 1 Scopes & Boundaries:

**Scope 1:** Direct emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from the combustion of fuel.

**Scope 3:** Indirect emissions associated with the extraction and transport of primary fuels as well as the refining, distribution, storage and retail of finished fuels.

Emission factors are based on data from the JEC Well-To-Wheels study, for further information see the following links:

<http://iet.jrc.ec.europa.eu/about-jec/>

<http://iet.jrc.ec.europa.eu/about-jec/downloads>

##### How were these factors calculated?

For further explanation on how these emission factors have been derived, please refer to the GHG conversion factor methodology paper available here:

<http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/>

Table 1a

Scope 1							Scope 3	All Scopes	Scope 1				Scope 3	All Scopes
Converting fuel types by unit mass							Total Indirect GHG	Grand Total GHG	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Total Direct GHG	Total Indirect GHG	Grand Total GHG
Fuel Type	Amount used per year	Units	x	kg CO <sub>2</sub> per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	Total kg CO <sub>2</sub>	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	
Aviation Spirit		tonnes	x	3133.1	28.5	31.0	3192.6	635.2	3827.8					
Aviation Turbine Fuel <sup>1</sup>		tonnes	x	3149.7	1.6	31.0	3182.3	656.0	3838.3					
Biofuels				See Annex 9				See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	
Burning Oil <sup>1</sup>		tonnes	x	3149.7	6.8	8.6	3165.1	655.7	3820.8					
CNG <sup>2</sup>		tonnes	x	2718.8	4.0	1.6	2724.4	422.4	3146.8					
Coal (industrial) <sup>3</sup>		tonnes	x	2139.1	1.6	43.1	2183.8	400.5	2584.3					
Coal (electricity generation) <sup>4</sup>		tonnes	x	2238.2	0.4	19.5	2258.2	369.3	2627.5					
Coal (domestic) <sup>5</sup>		tonnes	x	2448.7	329.7	37.7	2816.2	442.0	3258.2					
Coking Coal		tonnes	x	3125.3	27.8	70.6	3223.7	452.4	3676.1					
Diesel (average biofuel blend) <sup>11,12</sup>		tonnes	x	3046.8	1.1	22.6	3070.5	693.7	3764.2					
Diesel (100% mineral diesel) <sup>14</sup>		tonnes	x	3164.3	1.1	22.7	3188.2	672.2	3860.4					
Fuel Oil <sup>6</sup>		tonnes	x	3216.4	2.8	8.9	3228.1	608.8	3836.9					
Gas Oil <sup>7</sup>		tonnes	x	3190.0	3.5	299.1	3492.6	672.3	4164.9					
LNG <sup>8</sup>		tonnes	x	2718.8	4.0	1.6	2724.4	954.5	3678.9					
Lubricants		tonnes	x	3171.1	1.9	8.5	3181.5	386.2	3567.7					
Naphtha		tonnes	x	3131.3	2.7	8.0	3142.1	444.9	3587.0					
Other Petroleum Gas		tonnes	x	2662.0	1.3	1.6	2664.8	324.2	2989.0					
Petrol (average biofuel blend) <sup>11,13</sup>		tonnes	x	3029.7	4.4	8.0	3042.1	644.4	3686.5					
Petrol (100% mineral petrol) <sup>14</sup>		tonnes	x	3135.0	4.5	8.1	3147.6	630.8	3778.4					
Petroleum Coke		tonnes	x	3227.8	2.3	78.5	3308.5	393.2	3701.7					
Recycled Fuel Oil <sup>15</sup>		tonnes	x	3171.1	1.9	8.5	3181.5	386.2	3567.7					
Wood				See Annex 9				See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	
<b>Total</b>									0	0	0	0	0	

Table 1b

Scope 1							Scope 3	All Scopes	Scope 1				Scope 3	All Scopes
Converting fuel types by unit volume							Total Indirect GHG	Grand Total GHG	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Total Direct GHG	Total Indirect GHG	Grand Total GHG
Fuel Type	Amount used per year	Units	x	kg CO <sub>2</sub> per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	Total kg CO <sub>2</sub>	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	
Aviation Spirit		litres	x	2.2205	0.0202	0.0220	2.2626	0.4502	2.7128					
Aviation Turbine Fuel <sup>1</sup>		litres	x	2.5258	0.0013	0.0249	2.5519	0.5261	3.0780					
Biofuels				See Annex 9				See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	
Burning Oil <sup>1</sup>		litres	x	2.5319	0.0055	0.0069	2.5443	0.5271	3.0714					
CNG <sup>2</sup>		litres	x	0.4758	0.0007	0.0003	0.4768	0.0739	0.5507					
Diesel (average biofuel blend) <sup>11,12</sup>		litres	x	2.5636	0.0009	0.0190	2.5835	0.5837	3.1672					
Diesel (100% mineral diesel) <sup>14</sup>		litres	x	2.6569	0.0009	0.0191	2.6769	0.5644	3.2413					
Gas Oil <sup>7</sup>		litres	x	2.7595	0.0030	0.2587	3.0213	0.5815	3.6028					
LNG <sup>8</sup>		litres	x	1.2302	0.0018	0.0007	1.2328	0.4319	1.6647					
LPG		litres	x	1.5301	0.0007	0.0018	1.5326	0.1918	1.7244					
Natural Gas		cubic metre	x	2.0280	0.0030	0.0012	2.0322	0.2100	2.2422					
Petrol (average biofuel blend) <sup>11,13</sup>		litres	x	2.2332	0.0033	0.0058	2.2423	0.4750	2.7173					
Petrol (100% mineral petrol) <sup>14</sup>		litres	x	2.3051	0.0033	0.0059	2.3144	0.4638	2.7782					
Wood				See Annex 9				See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	
<b>Total</b>									0	0	0	0	0	

Table 1c

Scope 1							Scope 3	All Scopes	Scope 1				Scope 3	All Scopes
Converting fuel types on an energy, Gross CV basis <sup>9</sup>							Total Indirect GHG	Grand Total GHG	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Total Direct GHG	Total Indirect GHG	Grand Total GHG
Fuel Type	Amount used per year	Units	x	kg CO <sub>2</sub> per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	kg CO <sub>2</sub> e per unit	Total kg CO <sub>2</sub>	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	Total kg CO <sub>2</sub> e	
Aviation Spirit		kWh	x	0.23785	0.00217	0.00235	0.24237	0.04822	0.29059					
Aviation Turbine Fuel <sup>1</sup>		kWh	x	0.24548	0.00012	0.00242	0.24802	0.05113	0.29915					
Biofuels				See Annex 9				See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	See Annex 9	
Burning Oil <sup>1</sup>		kWh	x	0.24562	0.00053	0.00067	0.24682	0.05113	0.29795					
CNG <sup>2</sup>		kWh	x	0.18483	0.00027	0.00011	0.18521	0.02871	0.21392					
Coal (industrial) <sup>3</sup>		kWh	x	0.28521	0.00021	0.00575	0.29117	0.05340	0.34457					
Coal (electricity generation) <sup>4</sup>		kWh	x	0.32360	0.00006	0.00282	0.32648	0.05340	0.37988					
Coal (domestic) <sup>5</sup>		kWh	x	0.29582	0.03983	0.00456	0.34021	0.05340	0.39361					
Coking Coal		kWh	x	0.36889	0.00328	0.00833	0.38051	0.05340	0.43391					
Diesel (average biofuel blend) <sup>11,12</sup>		kWh	x	0.24350	0.00010	0.00180	0.24540	0.05530	0.30070					
Diesel (100% mineral diesel) <sup>14</sup>		kWh	x	0.25167	0.00009	0.00181	0.25357	0.05347	0.30704					
Electricity				See Annex 3				See Annex 3	See Annex 3	See Annex 3	See Annex 3	See Annex 3	See Annex 3	
Fuel Oil <sup>6</sup>		kWh	x	0.26729	0.00023	0.00074	0.26826	0.05059	0.31885					
Gas Oil <sup>7</sup>		kWh	x	0.25372	0.00028	0.02379	0.27778	0.05347	0.33125					
LNG <sup>8</sup>		kWh	x	0.18483	0.00027	0.00011	0.18521	0.06489	0.25010					
LPG		kWh	x	0.21419	0.00010	0.00025	0.21455	0.02685	0.24140					
...		therms	x	6.27730	0.00300	0.00740	6.28780	0.78692	7.07472					
...		...	...	...	...	...	...	...	...					
<b>Total</b>									0	0	0	0	0	

Sources UK Greenhouse Gas Inventory for 2010 (AEA, 2012), available at: <http://naei.defra.gov.uk/>  
Digest of UK Energy Statistics 2011 (DECC), available at:  
<http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx>

Notes

- <sup>1</sup> Burning oil is also known as kerosene or paraffin used for heating systems. Aviation Turbine fuel is a similar kerosene fuel specifically refined to a higher quality for aviation.
- <sup>2</sup> CNG = Compressed Natural Gas is usually stored at 200 bar in the UK for use as an alternative transport fuel.
- <sup>3</sup> Average emission factor for coal used in sources other than power stations and domestic, i.e. industry sources including collieries, Iron & Steel, Autogeneration, Cement production, Lime production, Other industry, Miscellaneous, Public Sector, Stationary combustion - railways and Agriculture. Users who wish to use coal factors for types of coal used in specific industry applications should use the factors given in the UK ETS.
- <sup>4</sup> This emission factor should only be used for coal supplied for electricity generation (power stations). Coal supplied for domestic or industrial purposes have different emission factors.
- <sup>5</sup> This emission factor should only be used for coal supplied for domestic purposes. Coal supplied to power stations or for industrial purposes have different emission factors.
- <sup>6</sup> Fuel oil is used for stationary power generation. Also use these emission factors for similar marine fuel oils.
- <sup>7</sup> Gas oil is used for stationary power generation, by off-road and agricultural vehicles (for which use it is known as 'red diesel') and 'diesel' rail in the UK. Also use these emission factors for similar marine diesel oil and marine gas oil fuels.
- <sup>8</sup> LNG = Liquefied Natural Gas, usually shipped into the UK by tankers. LNG is usually used within the UK gas grid, however it can also be used as an alternative transport fuel.
- <sup>9</sup> Emission factors calculated on a Gross Calorific Value basis
- <sup>10</sup> Emission factors calculated on a Net Calorific Value basis.
- <sup>11</sup> In the UK biofuels are added to virtually all of the transport fuel sold by filling stations (and by most fuel wholesalers) and this has the effect of slightly reducing the greenhouse gas emissions of the fuel. For fuel purchased at filling stations or obtained from private commercial refuelling, you should use the factor labelled "average biofuel blend" unless you know the biofuel content is higher or lower than average. In this latter case, if you are purchasing pure diesel which you know has not been blended with biofuels then you should use the factor labelled "100% mineral fuel", or alternatively use the bespoke biofuel blend calculations provided in Annex 9, Table 9b.
- <sup>12</sup> The "average biofuel blend" emission factors calculated here for diesel supplied at public retail and private commercial refuelling stations factor in the biodiesel supplied in the UK as a proportion of the total supply of diesel+biodiesel (3.6% by unit volume, 3.3% by unit energy). These estimates have been made based on the most recently available reports on the Renewable Transport Fuel Obligation (RTFO), and renewable energy statistics. For more information see:  
<http://www.dft.gov.uk/topics/sustainable/biofuels/rtfo/> and  
[http://www.decc.gov.uk/en/content/cms/statistics/energy\\_stats/source/renewables/renewables.aspx](http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/renewables/renewables.aspx)
- <sup>13</sup> The "average biofuel blend" emission factors calculated here for petrol supplied at public retail and private commercial refuelling stations, factoring in the bioethanol supplied in the UK as a proportion of the total supply of petrol+bioethanol (= 2.9% by unit volume, 1.9% by unit energy). These estimates have been made based on the most recently available reports on the Renewable Transport Fuel Obligation (RTFO), and renewable energy statistics. For more information see:  
<http://www.dft.gov.uk/topics/sustainable/biofuels/rtfo/> and  
[http://www.decc.gov.uk/en/content/cms/statistics/energy\\_stats/source/renewables/renewables.aspx](http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/renewables/renewables.aspx)
- <sup>14</sup> The emission factors for 100% mineral fuel petrol or diesel should only be used if you are sure the fuel used does not contain biofuel.
- <sup>15</sup> Recycled fuel oils (processed fuel oils) are typically made up of a combination used engine oil, paintshop residues and other oils and are used to replace conventional fuel oils in some factories (e.g. asphalt manufacturers) and power stations. Recycled Fuel Oil is produced from waste oil and is classified by the Environment Agency as waste and so is subject to the Waste Incineration Directive (WID). Therefore only those companies who are compliant with WID are able to use it as a fuel. The WID can be found at:  
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:332:0091:0111:EN:PDF>



## Sulphur Dioxide Emissions

SO2 emissions will be calculated by the following:

$$E = Q_f \times C_i \times \left( \frac{MW_p}{EW_f} \right) \times 1E-06 \times OpHrs$$

where:

E = emissions of SO2, kg/yr

Q<sub>f</sub> = fuel use (kg/hr)

C<sub>i</sub> = SO2 concentration in fuel – ppm or mg/kg

MW<sub>p</sub> = molecular weight of SO2

EW<sub>f</sub> = elemental weight of S in fuel

OpHrs = annual operating hours

### **Example**

Q<sub>f</sub> = 2000 kg/hr of fuel used

C<sub>i</sub> = 15000 ppm SO2 in fuel

MW<sub>p</sub> = molecular weight of SO2 is 64

EW<sub>f</sub> = elemental weight of S is 32

OpHrs = 150 hours per year

Therefore E = 2,000 x 15,000 x (64 / 32) x 0.000001 x 150

= 7,020 kg SO2 per annum

Source: National Pollutant Inventory Emission estimation technique manual for Fossil Fuel Electric Power Generation Version 3.0 January 2012 The Department of Sustainability, Environment, Water, Population and Communities, Commonwealth of Australia

## 2.6 ANNEX A Q2 – AMBIENT AIR QUALITY GUIDELINES

One of the key aspects set out in the IFC guidelines, are ambient air quality standards based upon the World Health Organisation (WHO) Air Quality Guidelines for Europe 2000 and 2005 update. These are the principle air quality standards and guidelines utilised in the assessment to develop Project compliance concentrations. Reference should be made to the Marampa Project ESIA.

### *World Health Organisation (WHO) Air Quality Guidelines*

Pollutant	Averaging Period	WHO Guideline Value ( $\mu\text{g}/\text{m}^3$ )
SO <sub>2</sub>	24-hour maximum	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10-minute maximum	500 (guideline)
NO <sub>2</sub>	1-year mean	40 (guideline)
	1-hour maximum	200 (guideline)
PM <sub>10</sub>	1-year mean	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour assessed as the third highest 24 hour period (99 <sup>th</sup> percentile)	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
PM <sub>2.5</sub>	1-year mean	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour maximum	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)

With regards to dust deposition standards, there are several standards and guidelines published by various bodies. These are set out in the table below.

### *International Dust Deposition Nuisance Criteria*

Criteria definition	Measure of soiling ( $\text{mg}/\text{m}^2/\text{day}$ )	Data source
<b>National Guidelines</b>		
Possible Nuisance	350 (monthly mean)	TA-Luft (Germany)
Very Likely Nuisance	650	TA-Luft (Germany)
First Loss of Amenity	133 (monthly mean)	West Australia Nuisance Standard
Unacceptable reduction in air quality	333	West Australia Nuisance Standard

Criteria definition	Measure of soiling (mg/m <sup>2</sup> /day)	Data source
Serious nuisance	200	UK recommended nuisance dust deposition rate
Nuisance dust deposition	133	Malaysia air quality standard

Note: Source 1: Cites: Note: Source 1: Citing: Hancock, R. P., Esmen, N. A., and Furber, C. P. (1976) "Visual Response to Dustiness", *Journal of the Air Pollution Control Association*, 26 (1), 1976, pp54 -57; Beaman, A. L. and Kingsbury, R. W. S. M. (1981) "Assessment of Nuisance from Deposited Particles Using a Simple and Inexpensive Measuring System". *Clean Air*, 11, 1981; Bate, K. J. and Coppin, N. J. (1991) "Dust impacts from mineral workings", *Mine and Quarry*, 20 (3), 1991, pp31 - 35; Hofschreuder, P. and Vrins, E. L. M. (1992) "Nuisance from coarse dust", *Journal of Aerosol Science*, 23 (S1), 1992, pp691 - S694; Quality of Urban Air Research Group. (1996) "Airborne Particulate Matter in the United Kingdom: Third Report of the Quality of Urban Air Review Group", prepared at the request of the Department of the Environment. University of Birmingham, Birmingham.

The Environment Protection (Mines and Minerals) Regulations 2013 lists air quality criteria that the project must abide by. These include the following:

Air quality maxima listed in the Environment Regulations

Parameter	Limit at any moment
Arsenic (mg/m <sup>3</sup> )	5.0
Carbon monoxide (mg/m <sup>3</sup> )	29.0
Copper (mg/m <sup>3</sup> )	1.0
Free silica (mg/m <sup>3</sup> )	5.0
Hydrogen cyanide (mg/m <sup>3</sup> )	11.0
Hydrogen sulphide (mg/m <sup>3</sup> )	14.0
Lead - dust and fumes (mg/m <sup>3</sup> )	0.15
NO <sub>2</sub> (mg/m <sup>3</sup> )	6.0
Particulate (interior nuisance dust) (mg/m <sup>3</sup> )	10.0

SO<sub>2</sub> emission limits in t/day listed in the Environment Regulations

Sulphur input (t/day)	SO <sub>2</sub> emission limit (t/day)
<10	20
11-15	25
16-20	30
21-30	40
31-40	50
41-50	60
51-70	66
71-90	72
91-120	81

<b>Sulphur input (t/day)</b>	<b>SO<sub>2</sub> emission limit (t/day)</b>
121-150	90
151-180	99
181-210	08
211-240	117
241-270	126
271-300	135
301-400	155
401-500	175
501-600	195
601-900	201

## 2.7 ANNEXAQ3 – AMBIENT AIR QUALITY MONITORING SITES

The ambient air quality monitoring locations should be representative of sensitive human receptors in the vicinity of the mine site, haul road and barge loading facilities. Results of the Marampa Project ESIA showed that air emissions on the barging route and at the transshipment point are unlikely to impact human receptors or wildlife and are therefore not included as part of the air quality monitoring program.

Site code	Location	X Co-ordinates*	Y Co-ordinates	Pollutant	Equipment	Deployment Period	Frequency	Units deployed
AQ1	HSE Building - The site is likely to be impacted by emission from mining activities and from vehicle accessing the site.	774361	960058	PM <sub>10</sub> , PM <sub>2.5</sub>	OSIRIS	Continuous - monthly downloads	Continuous	Fixed unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ2	Maforki; Representative of air quality in villages on NE side of concession	775747	961781	PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ3	Gbom Limba; The site is likely to be impacted by emission from mining activities at Campbell Town Ridge.	774874	959087	PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ4	Lunsar Haul Road - affected by haul road activities	771204	959724	PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit @50m east
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit east of road @~50m
AQ5		755352	963571	PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit

Site code	Location	X Co-ordinates*	Y Co-ordinates	Pollutant	Equipment	Deployment Period	Frequency	Units deployed
	Rogbere Junction; The site is likely to be impacted by emissions from haul road.			NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit north of road @~50m
AQ6	New Thofayim - The site is potentially impacted by emission from haul road and barge loading facility.	736783	964398	NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ7	Konta Bana - The site is likely to be impacted by emission from haul road and mining at Ghafal Hill.	772189	957784	PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ8	Katick - reference site for monitoring rural background conditions	774106	956519	PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
				Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ9	Lunsar School; The site is representative of urban baseline conditions.	770586	961404	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ10	Rolath; likely to be impacted by emissions from the haul road.	763479	965121	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ11	Royaema; likely to be impacted by emissions from the haul road.	744048	964305	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ12	Magberie	776380	960470	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
AQ13	Mathukia - The site is likely to be impacted by emission from mining at Northern Extension.	773723	962808	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit

Site code	Location	X Co-ordinates*	Y Co-ordinates	Pollutant	Equipment	Deployment Period	Frequency	Units deployed
AQ14	SALWCO water treatment plant is located on the mine side of Lunsar and potentially affected by mining activities	772136	960470	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
				PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment
AQ15	Rotal- This site is likely to be impacted by emissions from mining the Ghafal deposit	770903	957676	Dust Deposition	Bergerhoff Gauges	28-30 days	November - May inclusive	1 unit
				PM <sub>10</sub>	Mobile dust	24 hr	1 per month	Mobile unit
				NO <sub>2</sub> & SO <sub>2</sub>	Diffusion Tubes	14-30 days	4 per year	2 tubes (NO <sub>x</sub> /SO <sub>x</sub> ) per deployment

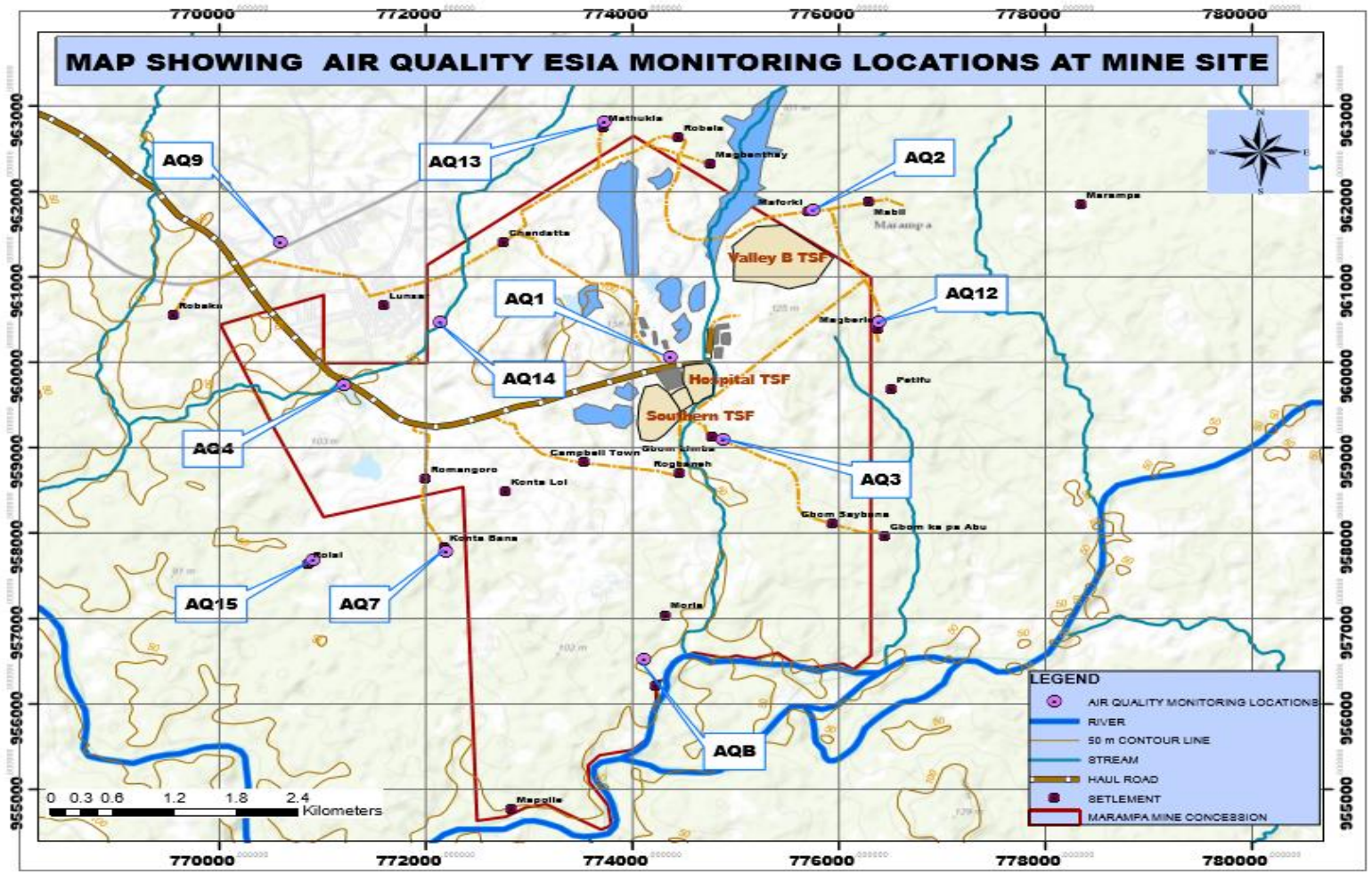


Figure AQ1: Marampa Air Quality Monitoring Sites



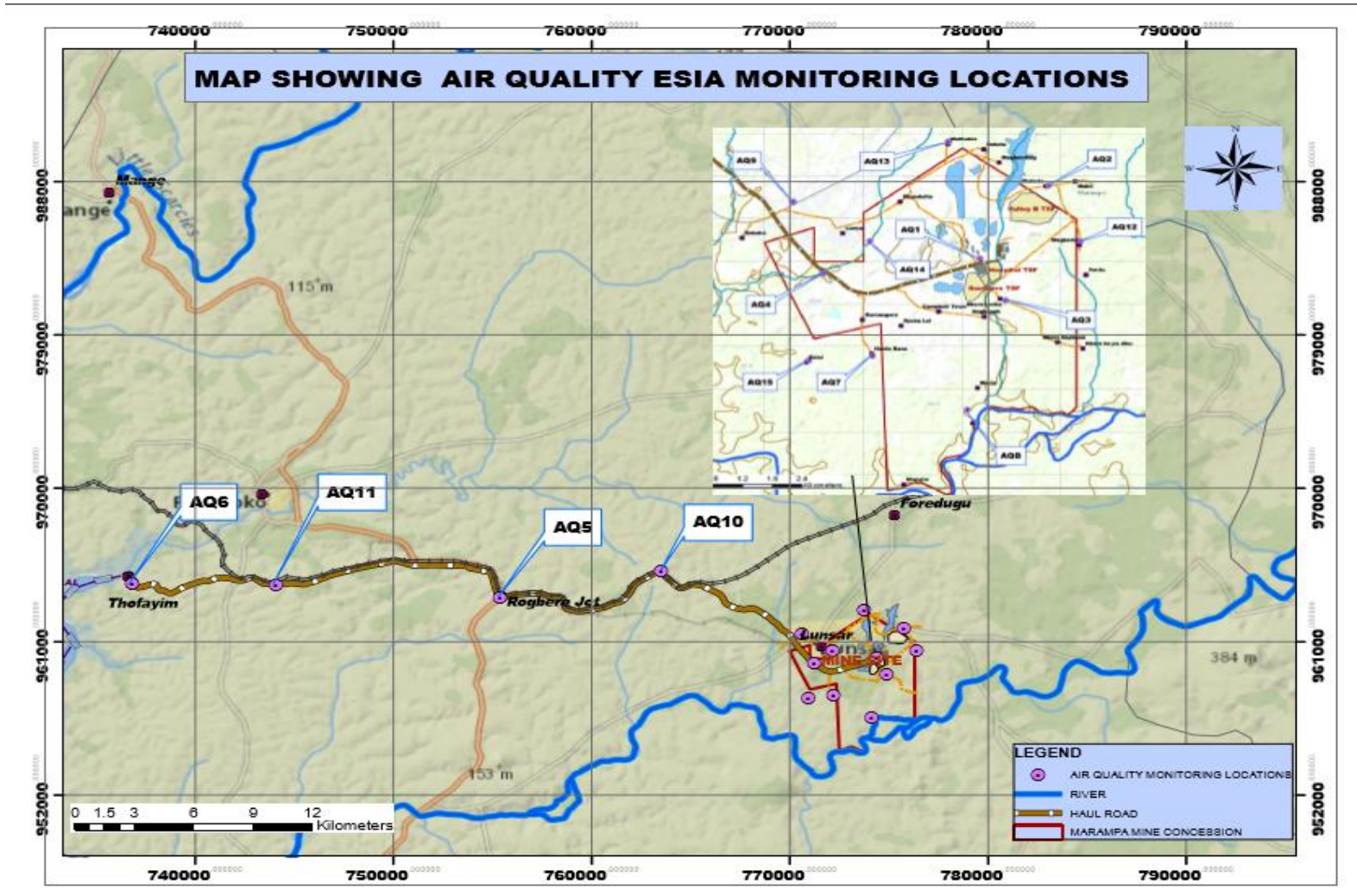


Figure AQ2: Haul Rad Air Quality Monitoring Locations



### 3 CHEMICALS

#### 3.1 CH1: CHEMICAL USE

CH1: Chemical Use				
CODE	CH1	PLAN OWNER		ENVIRONMENT MANAGER
CATEGORY	CHEMICALS	TECHNICAL CONTENT		ENVIRONMENT MANAGER
REVISION DATE	June 2021	REV	00	APPROVED BY GM-HSE
<b>RATIONALE</b>	<p>The objective of this requirement is to control chemical use and ensure the correct storage.</p> <p>EPA-SL does not specifically require reporting of chemical usage. However, the onus is on the operator to prove that any chemicals used onsite do not have a detrimental effect on the environment. Therefore, reporting on chemical usage by MML will reduce the possibility of misunderstandings.</p> <p>In the process plant, the only chemical additive used in a flocculent called Nalco 83385 which is an anionic acrylic polymer that is used in the process plant thickeners to aid water recovery. Nalco 83385 contains residual level of acrylamide monomer at &lt; 0.05% w/w. The WHO has set a guideline value of 0.5 µg/l for acrylamide in drinking water and EC50 concentrations for a variety of aquatic organisms range from 338 to 450,000 µg/l. At the dose MML will be using, tailing should contain &lt;0.05 µg/l acrylamide.</p> <p>Numerous lubricants are also used by site operations, including engine oils, hydraulic oil, grease, and transformer oils.</p> <p>Other chemicals that may be used by the operation in sufficient volumes to be of concern include:</p> <ul style="list-style-type: none"> <li>• Pesticides for mosquito control</li> <li>• Herbicides for weed control</li> <li>• Water conditioning agents at the power house; <ul style="list-style-type: none"> <li>○ Annually use a single 6-15t batch of conditioned water containing: <ul style="list-style-type: none"> <li>▪ Hydrazine - 0.01kg/t water</li> <li>▪ Sodium hydroxide - 2kg/t water</li> <li>▪ Tri-sodium phosphate - 2kg/t of water</li> <li>▪ Sodium carbonate - 2kg/t of water</li> </ul> </li> <li>○ A regular addition of AGK-100 will also be made to the boiler make-up water at rate of 3.5l per 1000l of water. It is anticipated that total usage for this chemical will be in the order of 500-1000l per annum.</li> </ul> </li> <li>• Conditioning agents for potable water treatment - including chlorine</li> <li>• Laboratory chemicals such as acids and alkalines</li> <li>• Dust suppression chemicals may also be used</li> </ul> <p>This applies to all MML operations including major contractors (e.g. concentrate road haulage, mining, power, barging and transshipment).</p>			
<b>DESCRIPTION</b>	<p>For all major chemicals used by , MML the following monitoring will be undertaken:</p> <ul style="list-style-type: none"> <li>• Quantity used in its operations (kg or L).</li> <li>• Quantity of major chemicals discharged (monitored either by calculation or direct measurement) (kg or L).</li> <li>• Concentration in the discharge (monitored either by calculation or direct measurement).</li> </ul>			

	<p>The following aspects are to be monitored:</p> <ol style="list-style-type: none"> <li>1. <b>Nalco 83385</b> - Total quantity used per month</li> <li>2. <b>Pesticides</b> - by pesticide type, concentration used when applied, areas where applied, total quantity used and total quantity in storage;</li> <li>3. <b>Herbicides</b> - by herbicide type, concentration used when applied, areas where applied, total quantity used and total quantity in storage;</li> <li>4. <b>Water conditioning agents</b> (powerhouse)- by type, total quantity used, total discharge of conditioned water, quality of conditioned water (pH, EC, PO4), and total quantity of chemical in storage;</li> <li>5. <b>Water conditioning agents</b> (potable water treatment)- by type, total quantity used and total quantity in storage;</li> <li>6. <b>Laboratory chemicals</b> - only applies to main chemicals used such as acids, specifically hydrochloric, sulphuric, nitric and hydrofluoric.</li> <li>7. <b>Lubricants and oils</b> - this applies to any oil or lubricant used on the MML project. By type, total quantity used, total quantity of waste oil/lubricant recovered/stored and total quantity in storage.</li> <li>8. <b>Dust suppression agents</b> - by type, total quantity used, concentration applied (g/m2).</li> <li>9. <b>Other</b> - Any chemical classified as hazardous and/or used in significant quantities to be monitored as listed at start of section.</li> </ol> <p>The location where chemicals are stored shall be inspected to ensure that the storage facilities are suited to the type of material, taking into regard potential for spills/leaks, incompatibility with other chemicals, and fire risk. Inspections shall also include general housekeeping, indicators of spills/leaks and the presence of appropriate spill response equipment.</p>
<p><b>TIMING/ FREQUENCY</b></p>	<p>Monthly reporting for chemical usage.</p> <p>Six monthly for inspections of chemical storage areas.</p>
<p><b>REPORTING REQUIREMENTS</b></p>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPA-SL as well as the MML annual report.</p>
<p><b>ROLES &amp; RESPONSIBILITIES</b></p>	<p>The Environmental Advisor shall be responsible for ensuring collection of data as per this plan from:</p> <ol style="list-style-type: none"> <li>1. Plant Process Manager, e.g. Nalco 83385, recovered water, process plant lubricants.</li> <li>2. The Mining Manager. Dust suppression chemicals, oil/lubricants used by mining contractors and MML mining equipment.</li> <li>3. The Haul Road Supervisor Dust suppression chemicals, oil/lubricants used by concentrate haulage contractors and haul road maintenance.</li> <li>4. Occupational Hygiene Manger for weedicides and pesticides</li> <li>5. Power Plant - oil/lubricants, water conditioning agents, transformer oils.</li> <li>6. MML Export Manager for oil/lubricants used at Thofayim, concentrate barging/transshipping contractors</li> <li>7. Environmental Manager - potable water conditioning chemicals e.g. chlorine</li> <li>8. Administration Manager - oil/lubricants for light vehicles</li> </ol> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Advisor shall be responsible for conducting inspections of the chemical storage areas.</p>

	The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.
<b>OPERATIONAL CONTROL/PROCEDURE</b>	Volumes reported to be compared to stock orders from warehouse records annually Chemical balances to be calculated annually to assess the quantity of each type purchased versus the fate of each chemical, i.e. quantity discharged/used/recovered as per the waste management plan.
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	For any purchase of chemicals not already listed to be approved by OHS and Environmental managers prior to purchasing. MSDS for all chemicals to be stored in Environmental office and kept up to date

### 3.2 CH2 - CHEMICAL SPILLS

CH2 - Spills				
<b>CODE</b>	CH-2	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER
<b>CATEGORY</b>	CHEMICALS	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b> GM-HSE
<b>RATIONALE</b>	<p>The objective of this requirement is to ensure that monitoring activities are undertaken to detect oil or chemical levels in the event of a spill.</p> <p>Reference should also be made to the routine monitoring programs.</p>			
<b>DESCRIPTION</b>	<p>This requirement applies to all aspects of the Marampa Project including the mine site, haul road, Thofayim, barging route and transshipment point.</p> <p>The following must be monitored:</p> <ol style="list-style-type: none"> <li>1. Type of material spilled;</li> <li>2. Location, date and time of spill;</li> <li>3. Date and time that spill was stopped</li> <li>4. Known / estimated volume spilled.</li> <li>5. Estimated volume of material recovered</li> </ol> <p>Data on spill volume should be gathered from two primary sources:</p> <ol style="list-style-type: none"> <li>1. Visual observation of leaks and spills (performed by on site personnel);</li> <li>2. Mass balance calculations indicating a loss (performed by plant and equipment technicians) where possible.</li> </ol> <p>If any substance enters the water, water quality samples should be taken both up-current and down current, noting time, location and direction of current at time of sampling. Sampling should take into account movement of spilled materials in currents so full extent can be identified.</p> <p>Data on tide cycle, current speed should be obtained as applicable.</p> <p>For hydrocarbon spills in water, it is preferred that samples be taken from near surface and sub-surface in clean amber glass bottles although any <u>clean</u> container (i.e. fresh water bottle emptied of contents) can be used in emergency. Analysis for Organics – total organic carbon (TOC), polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), naphthalene, phenanthrene and dibenzothiophene (NPD) or equivalent measures.</p> <p>Where hydrocarbons affect sediments (including muds in mangroves or mud flats), appropriate sampling to be undertaken to ascertain areas affected. Samples to be taken in wide mouth amber glass bottles or plastic clip lock bags. Analysis for Organics - TOC, PAH, TPH, NPD or equivalent measures.</p> <p>For non-hydrocarbon spills, standard water sampling protocols apply, i.e. field measurements (pH, DO, EC, turbidity) and water sampling (parameters to be analysed to reflect material spilled – refer to MSDS for particular material). Acrylamide to be included for any spills of tailing or tailing supernatant.</p>			
<b>TIMING/ FREQUENCY</b>	<p>Mass balance calculations in the event of a spill as soon as possible.</p> <p>All spills that enter the environment to be reported as soon as practicable by any means to MML Environmental Department.</p> <p>The requirement for monitoring of environment affected by spill to be decide on a case by case by the Environmental Manager and implemented as soon as possible and continued until pertinent parameters return to background levels</p>			

<p><b>REPORTING REQUIREMENTS</b></p>	<p>All spills to be reported via MML incident reporting system. The following data shall be reported:</p> <ul style="list-style-type: none"> <li>• Date and time of spill;</li> <li>• Location of spill and areas affected</li> <li>• Type and volume of material spilled (L/m<sup>3</sup> for liquids, kg/t for solids);</li> <li>• Volume of spill that reached the environment (i.e. outside bunding, pit, or plant area);</li> <li>• Volume of spill that did not reach the environment (i.e. outside bunding, pit, or plant area); and</li> <li>• Volume of spill/contaminated material recovered and date/time when recovery occurred.</li> </ul> <p>Summary data shall be reported to the EPASL every quarter of spills on site and reportable incidents within 24 hours.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>
<p><b>ROLES &amp; RESPONSIBILITIES</b></p>	<p>Env Laboratory to ensure amber glass bottles, clip lock bags and clean PP bottles ready to go at all times to monitor spills in water and soil.</p> <p>Area managers where spills occur are responsible for:</p> <ul style="list-style-type: none"> <li>• immediately responding to and reporting incidents</li> <li>• containing spill extent and flow</li> <li>• leading clean-up of spill and ensuring recovered material is appropriately disposed of as per MML waste management plan</li> <li>• providing resources to undertake full clean up</li> </ul> <p>Environmental Advisor responsible for ensuring appropriate samples taken of spill area and recording all data.</p> <p>Environment Manager responsible for taking lead on all spills to ensure monitoring implemented and clean-up activities are implemented and completed to appropriate standard.</p>
<p><b>OPERATIONAL CONTROL/ PROCEDURE</b></p>	<p>Reference should also be made to the MML Incident reporting procedure.</p>
<p><b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b></p>	<p>Annual Environmental audit to check that spill reports are being sent to the EPA in a timely manner.</p>

#### 4 ECOLOGY

<b>EC1: Batabana Creek Ecology</b>					
<b>CODE</b>	EC1	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER	
<b>CATEGORY</b>	ECOLOGY	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER	
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b>	GM HSE
<b>RATIONALE</b>	MML may impact the Batabana Creek through either runoff or routine discharge from the tailings facilities in the wet season. It is important to maintain ecological productivity and diversity in the Batabana Creek.				
<b>DESCRIPTION</b>	<p>To assess condition of the aquatic productivity within the creek channel, monitoring of bio-indicators (e.g. diatoms, fish, stream characteristics, sediment quality, water quality) will be undertaken to provide information on aquatic ecological response and the effectiveness of the mitigation measures proposed. This site should be compared to sites unaffected by mining activities (e.g. F2, F3 and F6 – refer to Figure SW1).</p> <p>Fish and diatom sampling to be undertaken via netting. Visual observation of fish also to be undertaken.</p> <p>A review of the habitat complexity provided is to be undertaken. This should include identification of pool and riffle zones in the channel, stability of bank, establishment of riparian vegetation, creek bed sedimentation.</p> <p>The riparian and gallery forest ecologies of the Katick &amp; Rokel River shoreline were identified during the environmental baseline as areas rich in biodiversity and containing several vulnerable species. These areas are to be monitored to ensure that mining activities are not having an adverse impact on the vulnerable species and habitat identified in the baseline studies.</p> <p>Water sampling – refer to Monitoring Plan SW1: Surface Water Quality</p>				
<b>TIMING/ FREQUENCY</b>	Annual sampling for first two years of operation and then review based on results				
<b>REPORTING REQUIREMENTS</b>	Summary data will be included in the annual report required for the EPASL as well as the MML annual report.				
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring water and sediment quality monitoring is undertaken. He/she shall also identify any anomalies and seek explanations for these.</p> <p>The Environmental Manager shall be responsible for ensuring ecological parameters are sampled and analysed.</p>				
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>Use sites similar to those used for the baseline</p> <p>Also see QA/QC requirements for water in SW1. The analysis of samples should be undertaken by a suitably certified laboratory</p>				
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	Ecological indicators is a specialised field and should be undertaken by a suitably qualified third party.				



## 5 GROUNDWATER

GW1: Groundwater				
<b>CODE</b>	GW1	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER
<b>CATEGORY</b>	Groundwater	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b> GM-HSE
<b>RATIONALE</b>	<p>The objective of this plan is to monitor the quality and water levels of ground water within and immediately adjacent to the mine concession area, including both the weathered aquifer and the fresh rock aquifer.</p> <p>Depth to groundwater of the weathered aquifer is generally between surface and 10m below ground level, but this depends on the topographic elevation. Along watercourses and in topographic lows, groundwater lies at surface. The fresh rock aquifer lies in the deeper unweathered lithologies of the Marampa Group below the weathered aquifer and extends to an unknown depth. Water is held within joints and fractures in the unweathered impermeable schist of this aquifer. Mining has the potential to affect the water quality of local aquifers.</p> <p>Groundwater abstracted for the purposes of pit dewatering will be used in the process plants. Dewatering has the potential to affect the wider water table level in the areas adjacent to the pits.</p> <p>Project infrastructure also has the potential to contaminate aquifers with hydrocarbons. MML fuel storage will be on hardstanding to minimise the risk of leakage to groundwater.</p> <p>Groundwater is used by local communities as a source of potable water.</p> <p>Groundwater quality shall be compared to:</p> <ul style="list-style-type: none"> <li>• World Health Organisation (WHO), 2011 Guidelines for Drinking Water quality, and</li> <li>• Baseline and reference site ground water quality.</li> </ul> <p>WHO values are presented in Table GW1.</p>			
<b>DESCRIPTION</b>	<p>Groundwater quality and groundwater levels will be monitored at the following sites:</p> <ul style="list-style-type: none"> <li>• Water supply wells used by local communities;</li> <li>• Boreholes that will be used for pit dewatering;</li> <li>• Monitoring boreholes strategically located on the mine concession area perimeter; and</li> <li>• Abandoned drill holes.</li> </ul> <p>It is important that both the weathered and fresh rock aquifers are monitored.</p> <p>Table GW2 provides a description of the monitoring locations. Such locations are also presented in Figure GW1.</p> <p>Table GW2 provides details of the water level and water quality monitoring program relative to timing and frequency of sampling. Sampling effort reflects the need to characterize waters and identify changes or trends in water level and water quality over time, including potential water quality problems.</p> <p>Groundwater parameters to be monitored include both field measurements of water quality (e.g. pH, DO, redox, EC, temperature) and water level, which should be monitored in situ whenever a water sample is taken for laboratory analysis.</p> <p>MML has identified key indicators that will be monitored as a measure of site compliance as listed in Table GW2</p>			

	<p>MML environmental laboratory will undertake the analysis of the water samples (unless otherwise indicated) using appropriate and recognised standard methodologies with sufficient detection limits.</p>
<p><b>TIMING/ FREQUENCY</b></p>	<p>Ground water levels should be measured on monthly basis as described in Table GW2.</p> <p>Water quality should be analysed on a quarterly basis to monitor seasonal changes in water quality (Table GW2).</p>
<p><b>REPORTING REQUIREMENTS</b></p>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>
<p><b>ROLES &amp; RESPONSIBILITIES</b></p>	<p>The Environmental Advisor shall be responsible for ensuring proper collection of samples/data as per this plan with the required equipment and materials.</p> <p>The Environmental Advisor shall be responsible for ensuring that ground water samples are forwarded to the laboratory with chain-of-custody documentation and within required holding time limits.</p> <p>The Environmental Advisor shall also be responsible for transferring laboratory data and water level data to the ground water Excel data file.</p> <p>The Laboratory Advisor is responsible for analysing water samples within required holding time limits, following appropriate QA/QC requirements and reporting all results in the required format. The Laboratory Advisor is responsible for calibration of the field equipment and laboratory equipment following good laboratory practices.</p> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for the ground water sampling program and for identification of parameters and detection limits.</p>
<p><b>OPERATIONAL CONTROL/ PROCEDURE</b></p>	<p>Groundwater sampling should be undertaken in accordance to internationally accepted standards, such as those described in the Water Research Commissions (WRC) Guide for Groundwater Sampling Methods (WRC, 2007). (Refer to Appendix B).</p> <p>Sample containers and preservatives are dependent on the parameters to be sampled. The laboratory analysing the samples should be contacted to determine the appropriate containers, filtration requirements, volume of sample, and preservation methods. Samples must be labelled with the appropriate sample identification (i.e. well ID), date and time of sampling, filtration and preservation techniques used, and parameters for analysis.</p> <p>Field equipment shall be calibrated daily prior to use and in line with manufacturer's instructions and appropriate calibration solutions.</p> <p>Laboratory samples shall be collected in accordance with laboratory method requirements for volumes, sample containers, duplicates and blanks.</p> <p>Field logistics and handling procedures shall allow for handling and shipping logistics to respect holding times and allow adequate time at the laboratory for analysis within the holding time.</p> <p>Some of the boreholes presented in Table GW2 and Figure GW1 will be destroyed during Phase 1, Marampa 2 &amp; 6 mining activities. Those boreholes designated with "MB" include monitoring boreholes proposed for longer term monitoring of groundwater along the mine concession area boundaries;</p>

	specifications for these boreholes are provided in Appendix A). Table GW2 and Figure GW1 be updated periodically to reflect these changes.
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	At least once per year, duplicate samples shall be collected from six sites and, along with field blanks, sent to both MML and an external laboratory to ensure laboratory procedures are correct (QA/QC).

**Table GW1: World Health Organisation (WHO), 2011 Guidelines for drinking-water quality, 4th Ed**

Parameter	Units	Guideline
pH		6.5-8.5
Total Dissolved Solids (TDS)	mg/l	600
Total Hardness	mg/l	200
Sulphate	mg/l	250
Total Aluminium	µg/l	100*
Total Arsenic	µg/l	10
Total Barium	µg/l	700
Total Cadmium	µg/l	3
Total Chromium	µg/l	50
Total Copper	µg/l	2000
Total Iron	µg/l	300*
Total Lead	µg/l	10
Total Manganese	µg/l	100*
Total Mercury	µg/l	6
Total Nickel	µg/l	70
Total Zinc	µg/l	3000*

\*Guideline value derived from taste and not health issues

**Table GW2: Groundwater Monitoring Program for Mine Concession Area**

ID	X	Y	Z	Area/ Village	Reasons	Ground water Level (m)	Analyte Suite 1	Analyte Suite 2	Analyte Suite 3
GW04	774454	959516	51.2	Rogbanneh Village	Community water supply	Monthly	Quarterly		Quarterly
GW10	775806	961788	74.2	Maforki Village	Main water supply to community	Monthly	Quarterly		Quarterly
GW02	774706	959211	59.4	Gomba Limba Village	Community water supply	Monthly	Quarterly		Quarterly
Labour Camp	772873	959000	61.1	Labour Camp Village	Water well Campbell Town Ridge pit	Monthly	Quarterly		Quarterly
Catholic School	772980	958610	70	Konta Lol	School water well Konta Lol	Monthly	Quarterly		Quarterly
GW14	771446	960220	51.3	Lunsar Town	School water supply well	Monthly	Quarterly		Quarterly
GW15	772212	957758	67.3	Konta Bana	Community water supply	Monthly	Quarterly		Quarterly
LMMP-PC-02	774716	962339	63.2	Magbenthay Village	Main water supply well on mine site	Monthly	Quarterly		Quarterly
GW08	773619	960315	130.6	Masaboin Hill	Fresh Rock Aquifer	Monthly	Quarterly		
GW09	773317	960563	92.7	Masaboin Hill	Fresh Rock Aquifer	Monthly	Quarterly		
PW-HS-01	773820	959497	62	Hamlet Swamp Tailing	Southern TSF - deep aquifer	Monthly	Quarterly		
PZ-HS-03	773824	959518	61.08	Hamlet Swamp Tailing	Southern TSF - shallow aquifer	Monthly	Quarterly		
HR-001	771654	959113	62.8	Hospital Ridge	Deep Fresh Rock Aquifer, close to a fault & within ultimate pit	Monthly	Quarterly		
PZ-GF-02	770925	959161	98.6	Ghafal Hill - North	Shallow Weathered Rock Aquifer, close to a fault & within ultimate pit	Monthly	Quarterly		
PW-GF-01	770933	959174	98.6	Ghafal Hill - North	Deep Fresh Rock Aquifer, close to a fault & within ultimate pit	Monthly	Quarterly		
GDD-020	771137	958800	90.3	Ghafal Hill - South	Deep Fresh Rock Aquifer, & within ultimate pit	Monthly	Quarterly		
GSE-01	771197	958508	59.4	Ghafal Hill - South	Deep Fresh Rock Aquifer, close to a Dyke & within ultimate pit	Monthly	Quarterly		
PZ-CH-02	773349	961120	71	Chendatta area	Tailings BH & give even spread over site	Monthly	Quarterly		
MB 1	77182	959805			Regional hydrology	Monthly	Quarterly	Quarterly	
MB 2	772369	958770			Regional hydrology	Monthly	Quarterly	Quarterly	
MB 3	775149	959927			Regional hydrology	Monthly	Quarterly	Quarterly	
MB 4	775845	960587			Regional hydrology	Monthly	Quarterly	Quarterly	
MB 5	774172	962548			Regional hydrology	Monthly	Quarterly	Quarterly	

Analyte Suite 1: EC ( $\mu\text{S}/\text{cm}$ ), pH, DO ( $\text{mg}/\text{l}$ ), REDOX, turbidity (NTU) and temperature using field meter plus sample set for K, Mg, Mn, Fe, Ca,  $\text{PO}_4$  ( $\text{mg}/\text{l}$ ),  $\text{SO}_4$ , Chloride, Alkalinity, Total Kjeldahl N, total and dissolved metals (Al, As (total), B, Ba, Ca, Cd, Co, Cr (total), Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Se, Zn, V) ( $\mu\text{g}/\text{l}$ ).

Analyte suite 2 <sup>1</sup>: Total Petroleum Hydrocarbons ( $\text{mg}/\text{l}$ ).

Analyte suite 3: Faecal coliforms (MPN/100ml).

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<sup>1</sup> Only in boreholes close to potential hydrocarbon sources such as refuelling bay, wash bays, maintenance facilities etc.

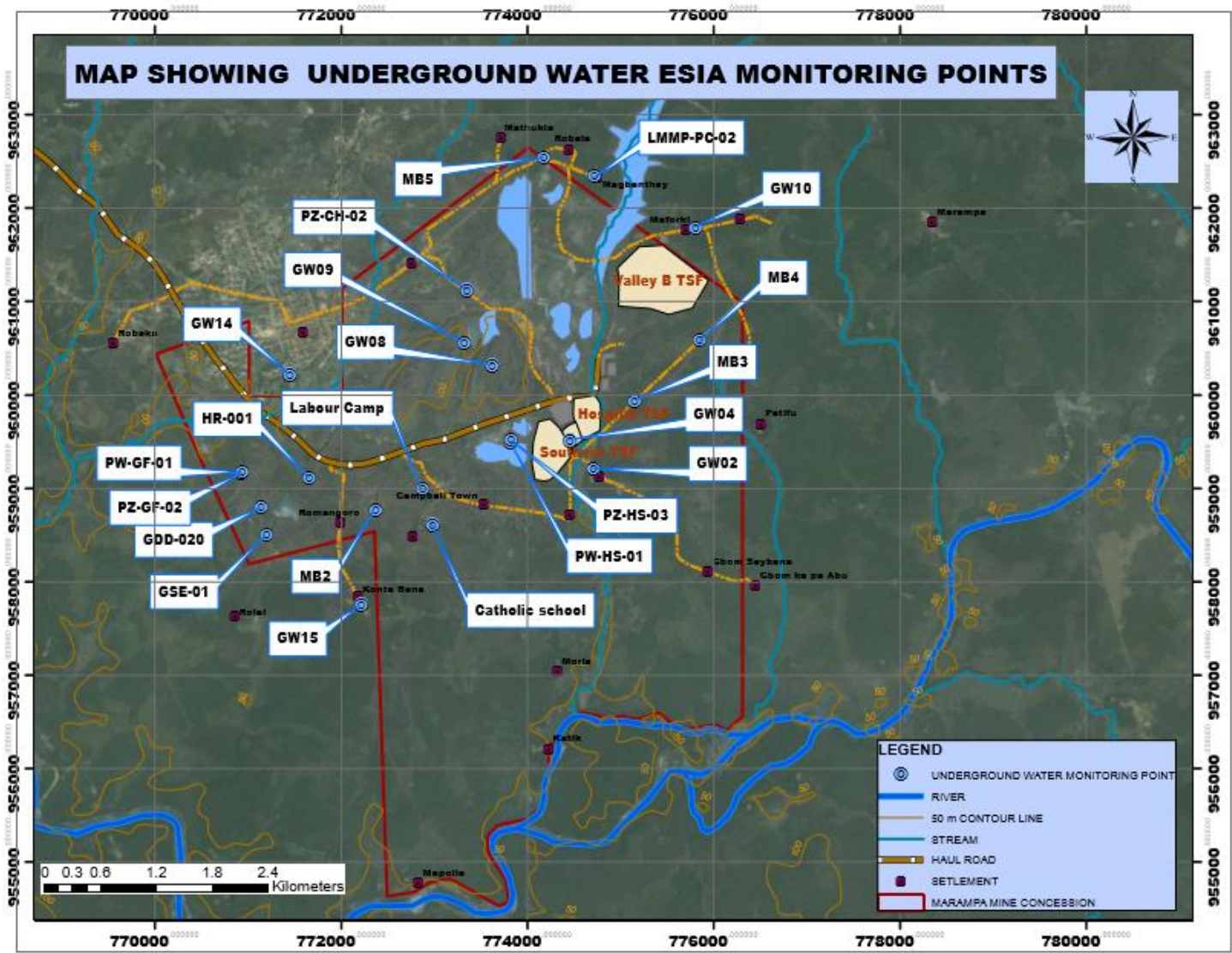


Figure GW1: Groundwater Monitoring Sites

## 6 NOISE AND VIBRATION MONITORING

### 6.1 NV1: AMBIENT NOISE MONITORING

NV1: Ambient Noise Monitoring					
<b>CODE</b>	NV1	<b>PLAN OWNER:</b>			ENVIRONMENT MANAGER
<b>CATEGORY</b>	Noise and vibration	<b>TECHNICAL CONTENT:</b>			ENVIRONMENT MANAGER
<b>REVISION DATE</b>	Aug 2017	<b>REV:</b>	01	<b>APPROVED BY:</b>	GM HSE
<b>RATIONALE</b>	<p>Noise monitoring is required for the purposes of both establishing the existing ambient noise levels in the area of the project and for verifying operational phase noise levels.</p> <p>The IFC General EHS Guidelines identifies noise levels (One Hour LA<sub>eq</sub> (dBA)) for residential and industrial areas for both daytime (07:00 to 22:00) and night time (22:00 to 07:00). For residential areas, the daytime noise maxima is 55dB and night time is 45dB (One Hour LA<sub>eq</sub>).</p> <p>Potential nuisance noise is associated with the following activities and locations:</p> <ul style="list-style-type: none"> <li>• Mine site and environs;</li> <li>• Transport corridor (haulage route); and</li> <li>• Thofayim barge loading;</li> </ul> <p>The Marampa ESIA evaluated noise associated with barging and transshipment and identified these as not being significant and are this not included in routine monitoring.</p>				
<b>DESCRIPTION</b>	<p>Noise monitoring shall be conducted at 14 stations as listed in Table NV1 – Ambient Noise Monitoring Sites.</p> <p>Noise monitoring should be conducted primarily by, but not limited to, operator attended noise monitoring.</p> <p>The measurements will be undertaken with a Casella CEL-63x Class 1 sound level meter capable of measuring the ‘A’-weighted Leq parameter (as described by IEC 60672 and ANSI S1.43) or equivalent.</p> <p>The following monitoring results shall be recorded:</p> <ul style="list-style-type: none"> <li>• LA<sub>eq,1hr</sub> Mine or “project” contributed noise level.</li> <li>• Statistical noise descriptors, LA<sub>90</sub>, LA<sub>10</sub>, LA<sub>max</sub>, LA<sub>eq</sub></li> </ul> <p>Noise level monitoring will include the following:</p> <ul style="list-style-type: none"> <li>• Maximum (LA<sub>Max</sub>) noise level in dB(A);</li> <li>• The energy equivalent (LA<sub>eq,1hr</sub>) noise level in dB(A); and</li> <li>• The background (LA<sub>90</sub>) noise level in dB(A).</li> </ul> <p>All monitoring data shall be downloaded using the Insight software and stored in the Environmental database on site.</p> <p>Noise level monitoring will be accompanied by measurements of prevailing local weather conditions, as well as the operator’s observations of any significant noise sources that are heard during the deployment period, including time. The location of mining activities at the time of the monitoring should also be sourced from the Mining Department.</p>				
<b>TIMING/ FREQUENCY</b>	Frequency of noise monitoring is described in Table NV1				
<b>REPORTING REQUIREMENTS</b>	Summary data will be included in the annual report required for the EPASL as well as the MML annual report.				

<p><b>ROLES &amp; RESPONSIBILITIES</b></p>	<p>The Environmental Advisor is responsible for the monitoring and reporting of noise levels as per this plan.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>
<p><b>OPERATIONAL CONTROL PROCEDURE:</b></p>	<p>All noise measurements shall be accompanied by both a qualitative description.</p> <p>Noise measurements should not be conducted during periods of rain or where wind speeds exceed 5 m/s.</p> <p>During the attended noise measurements, the operator shall record any significant noise sources.</p> <p>The sound level meter shall be calibrated using the CEL-120 dual level (114 and 94 dB at 1 kHz) Class 1 acoustic calibrator at 94 dB before each 24 hour deployment or start of the day for 1 hour monitoring. If the instrument fails calibration, refer to the unit instructions. Do not deploy an instrument that fails calibration.</p> <p>The frequency and deployment of monitoring shall be reviewed every 12 months of operation to determine future monitoring requirements.</p>
<p><b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b></p>	<p>The calibration of the sound level meter is required every 2 years by the manufacturer.</p> <p>Where consistent compliance with the noise limits is shown, the frequency of monitoring may be reduced accordingly.</p> <p>Calibration certificate for the noise level meter is to be maintained on file for QC/QA purposes.</p>



## 6.2 NV2: VIBRATION MONITORING

NV2: Vibration																			
<b>CODE</b>	NV2	<b>PLAN OWNER:</b>		ENVIRONMENT MANAGER															
<b>CATEGORY</b>	NOISE & VIBRATION	<b>TECHNICAL CONTENT:</b>		ENVIRONMENT MANAGER															
<b>REVISION DATE</b>	June 2021	<b>REV:</b>	01	<b>APPROVED BY:</b> GM HSE															
<b>RATIONALE</b>	<p>The objective of this plan is to monitor potential vibration associated with the movement of haul trucks along the haul road from the Marampa Mine to Thofayim. The two factors to be considered are potential structural damage and disturbance/ annoyance from vibration for those receptors within the proximity where the vibration may be detected. For activities where trigger/action thresholds are required, it is appropriate to provide guidance in terms of PPV as this parameter can be directly measured.</p> <p>The Marampa Project ESIA identified the likelihood of vibration related impacts from mining and processes activities as unlikely. However as conditions will change with upgrading of the road, this prediction must be verified.</p> <p>In the absence of quantitative local guidelines specific to mining, vibration criteria have been developed with reference to the following international structural damage and human annoyance guidelines:</p> <ul style="list-style-type: none"> <li>• German Institute for Standardisation DIN 4150 Part 3 - Structural Vibration: Effects of Vibration on Structures, February 1999 (DIN4150-3);</li> <li>• Department of Environment and Conservation NSW (Australia) – Assessing Vibration: a Technical Guideline (AVTG), February 2006;</li> <li>• British Standards Institution BS 6472: 2008, Guide to evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting</li> <li>• British Standards Institution BS 5228-2 - Code of Practice for Noise and Vibration Control on Construction and Open Sites, 2009 Part 2 - vibration.</li> </ul> <p>The table below summarises the structural damage and human annoyance vibration criteria applicable to residential premises, which have been adopted as the project-specific vibration criteria by which the magnitude of potential impacts may be quantified at vibration sensitive receptor locations in the vicinity of the site. The more stringent night time criteria (preferred) is the limiting values for project vibration.</p> <p><b>Vibration Impact Assessment Criteria (other than blasting)</b></p> <table border="1"> <thead> <tr> <th>Factor</th> <th></th> <th>Vibration Criterion</th> <th>Trigger Action Level, PPV</th> </tr> </thead> <tbody> <tr> <td>Structural Damage<sup>1</sup></td> <td></td> <td>3 mm/s PPV</td> <td>3 mm/s</td> </tr> <tr> <td rowspan="2">Human Disturbance Haul Road Vibration</td> <td>Daytime</td> <td>0.2 VDV, m/s<sup>1.75</sup></td> <td>3 mm/s</td> </tr> <tr> <td>Night time</td> <td>0.13 VDV, m/s<sup>1.75</sup></td> <td>1 mm/s</td> </tr> </tbody> </table> <p>1- In consideration of the structural integrity of local buildings, a conservative level has been adopted for this project.</p> <p><i>Note:</i> This monitoring plan does not cover vibration or noise from blasting; this is covered in monitoring plan NV3: Blast Monitoring.</p>				Factor		Vibration Criterion	Trigger Action Level, PPV	Structural Damage <sup>1</sup>		3 mm/s PPV	3 mm/s	Human Disturbance Haul Road Vibration	Daytime	0.2 VDV, m/s <sup>1.75</sup>	3 mm/s	Night time	0.13 VDV, m/s <sup>1.75</sup>	1 mm/s
Factor		Vibration Criterion	Trigger Action Level, PPV																
Structural Damage <sup>1</sup>		3 mm/s PPV	3 mm/s																
Human Disturbance Haul Road Vibration	Daytime	0.2 VDV, m/s <sup>1.75</sup>	3 mm/s																
	Night time	0.13 VDV, m/s <sup>1.75</sup>	1 mm/s																
<b>DESCRIPTION</b>	<p>Vibration monitoring will be undertaken along the haul road using an A1 Instantel Minimate Plus Series III 4 Channel unit seismograph, with tri-axial geophone and linear microphone.</p> <p>The following monitoring results shall be recorded:</p> <ul style="list-style-type: none"> <li>• PPV (Peak Particle Velocity) in mm/s</li> </ul>																		

	<p>Vibration levels should be measured at the nearest potentially affected residential receptor to the haul road, as compliance with the vibration limits at these receptors would ensure compliance at those receptors that are more distant from the road.</p> <p>For activities where trigger/action thresholds are required, the Peak Particle Velocity (PPV in mm/s) is appropriate, since this parameter can be directly measured and does not require post measurement calculations. An assessment threshold level or trigger action level of 1 mm/s would be considered appropriate for the assessment of the effects of vibration from sources other than blasting.</p> <p>Where monitoring demonstrates that the vibration Trigger Levels (of 1 mm/s) are exceeded, then additional long term monitoring should be conducted to determine the Vibration Dose Value (VDV) at the affected receptor location, or at an alternate location representative of a group of receptors.</p> <p>Vibration monitoring is to be conducted at the following sites:</p> <ol style="list-style-type: none"> <li>1. Haul road in Lunsar – refer to noise monitoring site NV4</li> <li>2. Rogbere Junction – refer to noise monitoring site NV5.</li> </ol> <p>Refer to Table NV1 – Ambient Noise Monitoring Sites.</p> <p>All monitoring data shall be downloaded using the InstanTel Blastware software and stored in the Environmental database.</p> <p>Vibration monitoring will be accompanied by observations of any significant noise/vibration sources that are heard during the deployment period, including time and type. Vibration monitoring should be conducted with noise monitoring as per NV1.</p>
<b>TIMING/ FREQUENCY</b>	Monitoring should be conducted quarterly in the first 12 months and reviewed.
<b>REPORTING REQUIREMENTS</b>	Summary data will be included in the annual report required for the EPA-SL as well as the MML annual report.
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring that monitoring is conducted and records are complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environment Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>Vibration measurement using a geophone is to be set up at the nearest receptor location and a connection to the ground must be achieved (either through the use of normal ground spikes or a more permanent method of connection, such as a concrete pad with base plate). The measurement location must be within 1.5 metres of the nearest building.</p> <p>Each monitor should be configured as follows:</p> <ul style="list-style-type: none"> <li>• The geophone (or vibration monitoring unit) should be orientated so that the longitudinal axis is directed towards the road.</li> <li>• All three channels of the geophone (longitudinal, transverse and vertical) and the microphone are to be enabled.</li> </ul> <p>The following data should be recorded for each event:</p> <ul style="list-style-type: none"> <li>• Number and type of vehicle passes;</li> <li>• Date of monitoring</li> <li>• Start and end time plus time of each vehicle pass;</li> <li>• Distance from the road;</li> <li>• PPV (in mm/s);</li> <li>• VDV (should the PPV be exceeded); and</li> <li>• Observations of overall road condition</li> </ul>
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	<p>Calculation of VDV should be done using a quality controlled calculation sheet.</p> <p>Calibration of equipment every 2 years.</p>



### 6.3 NV3: BLAST MONITORING

NV3: Blast Monitoring				
<b>CODE</b>	NV3	<b>PLAN OWNER:</b>		ENVIRONMENT MANAGER
<b>CATEGORY</b>	NOISE & VIBRATION	<b>TECHNICAL CONTENT:</b>		ENVIRONMENT MANAGER
<b>REVISION DATE:</b>	June 2021	<b>REV:</b>	01	<b>APPROVED BY:</b> GM HSE
<b>RATIONALE</b>	<p>Blasting-related emissions include vibration, overpressure, and fly rock that may extend beyond the boundary of the site.</p> <p>Blasting from mining activities can have impacts on surrounding residential receptors, ecological receptors, structural and infrastructure receptors including plant, machinery, buildings and pipelines with regard to airblast (overpressure) and ground vibration.</p> <p>Monitoring during all blasts is required to assess potentially significant impacts on sensitive receptors, during normal operations and upset conditions.</p> <p>In lieu of Sierra Leone or international blasting guidelines a review of the following blast emissions criteria has been conducted:</p> <ul style="list-style-type: none"> <li>• Ontario Limits for Quarries (Canada);</li> <li>• Office of Surface Mining Reclamation and Enforcement (OSMRE), USA;</li> <li>• Australian and New Zealand Environment and Conservation Council (ANZECC) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990);</li> <li>• British Standard BS6472: 2008 Guide To Evaluation of Human Exposure to Vibration in Buildings Part 2: Blasting Induced Vibration;</li> <li>• British Standard BS5228 (2009) Code of Practice for noise and vibration control on construction and open sites;</li> <li>• Minerals Technical Advice Note 2: Coal (MTAN), January 2009 (Wales);</li> <li>• Minerals Planning Guidance Note 9 (MPG), 1992 (UK) and Scottish Government Circular 26/1992; and</li> <li>• Australian Standard AS 2187. 2 Explosives – Storage, Transport and Use.</li> </ul> <p>From review of the various international standards and guidelines the following evaluation criteria was developed:</p> <ul style="list-style-type: none"> <li>• Overpressure airblast should not exceed 115 dB(Z) for 95 % of blasts over a 12 month period and should never exceed 125 dB(z) at any time; and</li> <li>• Ground vibration should not exceed 3 mm/s at any residence or sensitive receiver on privately-owned land.</li> </ul>			
<b>DESCRIPTION</b>	<p>Monitoring should be conducted at pre-determined locations to provide historical data and to allow the prediction of future blasts such that emissions are within the acceptable compliance with the criteria.</p> <p>Vibration and overpressure monitoring will be undertaken with seismographs deployed at either 500m from the blast or at the nearest sensitive receptors. MML has A1 InstanTel Minimate Plus Series III 4 Channel unit seismograph, with tri-axial geophone and linear microphone. Between 2-3 seismographs should be deployed per blast.</p> <p>As blasting will move according to the active mining areas, all units will be mobile in order to be utilised, as and when required.</p>			
<b>TIMING/ FREQUENCY</b>	All blasts are to be monitored for vibration and overpressure.			
<b>REPORTING REQUIREMENTS</b>	<p>Blast logs should be maintained for each blast. The purpose of this record is to assist in the design and optimisation of future events, planning and control of blasting emissions and to provide a traceable system of documentation in case of accident or complaint.</p> <p>Summary data shall be reported to the EPASL every quarter</p>			

	Summary data will be included in the annual report required for the EPASL as well as the MML annual report.
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Blasting foreman is responsible for the maintenance of blast logs and for monitoring each blast for overpressure and vibration.</p> <p>The Blasting foreman is responsible for downloading the data on each blast and compiling data for sending to the Environment Dept on a monthly basis.</p> <p>The Environmental Advisor is responsible for obtaining the data on each blast and compiling data for the quarterly and annual reports.</p> <p>The Environment Manager is accountable for ensuring the correct checks and balances are in place to assure data integrity.</p>
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>For the purposes of blast emission monitoring, the mine should be guided by the requirements of AS 2187.2-2006, "Explosive Storage, Transport and Use - Appendix J" to maintain a Blast Design and Emissions Record for each blast event.</p> <p>The following data should be recorded for each blast:</p> <ul style="list-style-type: none"> <li>• Blast Number.</li> <li>• Block or Area ID.</li> <li>• Date and Time of blast.</li> <li>• Shot Type.</li> <li>• Centroid of Blast (geo-referenced X,Y,Z coordinates).</li> <li>• Distance from the blast to the monitoring locations.</li> <li>• Maximum instantaneous charge (MIC) (kg).</li> <li>• Airblast overpressure level (dB Lin)</li> <li>• Peak Vibration Level, i.e. Peak Vector Sum (PVS) (mm/s).</li> </ul> <p>If vibration levels are greater than 3 mm/s are recorded, then additional measurements on structures should be undertaken to assess the potential for cosmetic and structural damage.</p>
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	<p>Calibration of equipment every 2 years by manufacturer</p> <p>Follow manufacturer instructions for use of monitors</p>

#### 6.4 TABLE NV1 – AMBIENT NOISE MONITORING SITES

The ambient noise monitoring locations should be representative of sensitive human receptors in the vicinity of the mine site, haul road and barge loading facilities. Results of the Marampa Project ESIA Impact Assessment showed that noise on the barging route and at the transshipment point are unlikely to impact human receptors or wildlife and are therefore not included as part of the noise monitoring program.

Site code	Location	X Co-ordinates	Y Co-ordinates	Deployment Period	Frequency
NV1	HSE Building - The site is likely to be impacted by noise from mining activities and from vehicle accessing the site.	774361	960058	24 hour deployment	Monthly
NV2	Maforki; The site is likely to be impacted by mining activities.	775747	961781	24 hour deployment	Quarterly
NV3	Gbom Limba; The site is likely to be impacted by NOISE from mining activities and haul road diversion.	774874	959087	24 hour deployment	Quarterly
NV4	Lunsar Haul Road – affected by haul road activities	771204	959724	24 hour deployment	Quarterly
NV5	Rogbere Junction; The site is likely to be impacted by noise from haul road.	755352	963571	Dayshift 1 hour deployment	Quarterly
NV6	New Thofayim - The site is potentially impacted by noise from haul road and barge loading facility.	736783	964398	Dayshift 1 hour deployment	Quarterly
NV7	Konta Bana - The site is potentially impacted by noise from haul road and mining.	772189	957784	Dayshift 1 hour deployment	Quarterly
NV8	Katick – Katick pump station	774106	956519	Dayshift 1 hour deployment	Quarterly
NV9	Lunsar School; The site is representative of urban baseline conditions.	770586	961404	Dayshift 1 hour deployment	Quarterly
NV10	Rolath - The site is likely to be impacted by noise from the haul road.	763479	965121	Dayshift 1 hour deployment	Quarterly
NV11	Royaema; likely to be impacted by emissions from the haul road.	744048	964305	Dayshift 1 hour deployment	Quarterly
NV12	Magberie; nearby mining activities	776380	960470	Dayshift 1 hour deployment	Quarterly
NV13	Mathukia ; nearby mining activities	773723	962808	Dayshift 1 hour deployment	Quarterly
NV14	SALWCO water treatment plant is located on the mine side of Lunsar and potentially affected by mining activities	772136	960470	Dayshift 1 hour deployment	Quarterly

Site code	Location	X Co-ordinates	Y Co-ordinates	Deployment Period	Frequency
NV15	Romangoro; This site is likely to be affected by mining activities in the Ghafal Hill area	772017	958847	Dayshift 1 hour deployment	Quarterly
NV16	Rolal - This site is likely to be affected by mining activities in the Ghafal Hill area	770903	957676	Dayshift 1 hour deployment	Quarterly

**FIGURE NV1: NOISE MONITORING SITES**

## 7 SURFACE WATER

### 7.1 3SW1: SURFACE WATER QUALITY

SW1: Surface water quality - Mine Concession Area					
CODE	SW1	PLAN OWNER			ENVIRONMENT MANAGER
CATEGORY	SURFACE WATER	TECHNICAL CONTENT			ENVIRONMENT MANAGER
REVISION DATE	June 2021	REV	00	APPROVED BY	GM HSE
RATIONALE	<p>The objective of this plan is to monitor the quality of surface waters within the mine concession area, including creeks, silt ponds and mine site discharges. Two creeks run through the Marampa Mine concession area, Baki and Batabana, both of which report to the Rokel River. Downstream uses of these creeks include agriculture, limited fishing, washing and in some cases drinking water. The creeks are also important to maintain connectivity between the Rokel River and upstream ecosystems.</p> <p>Project discharges shall comply with EPASL discharge limits as listed in <b>Table SW1</b> as a minimum standard. Water quality monitoring of the mine site discharges includes those from pits (i.e. dewatering, pit lakes), wastes dumps and tailing facilities (i.e. runoff, leachate) and general runoff from roads, plant site (i.e. wash bays, oily water separators) and general mine area.</p> <p>Water quality in creeks (i.e. Baki, Batabana, Rokel) and reference sites shall be compared to specific parameters from the:</p> <ul style="list-style-type: none"> <li>• World Health Organisation (WHO), 2011 Guidelines for drinking-water quality as downstream users may use surface waters as water sources or for recreational needs (including washing)</li> <li>• Baseline and reference site water quality.</li> </ul> <p>WHO standards are presented in <b>Tables SW2</b></p>				
DESCRIPTION	<p>Water quality will be monitored at the following sites:</p> <ol style="list-style-type: none"> <li>1. Permanent monitoring sites located in waterways both within and adjacent to the mine concession area. <b>Figure SW1</b> shows the locations that will be monitored.</li> <li>2. Old pit and tailings lakes that will be drained by the Marampa mine activities such as Ghafal North pit lake, GM pit lake and NorthSwamp tailing lake. Monitoring of these will cease once drained.</li> <li>3. Samples will also be collected at mine silt trap discharge points, TSF/waste dump runoff or leachate, plant site drainage (including wash bays and oily water separators) and pit dewatering discharge points once they are established.</li> <li>4. Ad hoc sampling may occur in response to grievances by communities or as a result of a particular incident. If warranted, ad hoc sites may become permanent monitoring sites.</li> </ol> <p><b>Table SW3</b> provides a description of the monitoring locations, the parameters that will be analysed and the timing/frequency of the sampling effort. Water quality sampling will include the use of field meters to collect field parameters (turbidity, temperature, pH, dissolved oxygen, and electrical conductivity) and samples for laboratory analysis of various physico-chemical parameters (e.g. TSS, total and dissolved metals).</p> <p>MML has identified key indicators that will be monitored as a measure of site compliance as listed in <b>Table SW3</b>. These have been identified with a review of the</p>				



	<p>baseline data set as well as identified potential impacts that may result from the Marampa Mines activities and include total and dissolved metals as well as total petroleum hydrocarbons.</p> <p>MML environmental laboratory will undertake the analysis of the water samples (unless otherwise indicated) using appropriate and recognised standard methodologies with sufficient detection limits.</p>
<b>TIMING/ FREQUENCY</b>	<p><b>Table SW3</b> provides details of the water quality monitoring program relative to timing and frequency of sampling. Sampling effort reflects the need to characterize waters and identify changes or trends in water quality over time, including potential water quality problems.</p> <p>Field parameters may be monitored as standalone indicators of water quality, and are mainly aimed at monitoring sediment loads in mine site discharges and in creeks at the mine concession boundary. Field parameters shall also be taken whenever a water sample is taken for laboratory analysis.</p> <p>Collection of water samples for routine laboratory analysis of the main indicator analytes will be conducted at frequencies ranging from weekly to semi-annually (once in wet season and once in dry season) depending on the site and associated potential impacts.</p>
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring proper collection of samples/data as per this plan with the required equipment and materials.</p> <p>The Environmental Advisor shall be responsible for ensuring that water samples are forwarded to the laboratory with chain-of-custody documentation and within required holding time limits.</p> <p>The Environmental Advisor shall also be responsible for transferring laboratory data to the water quality Excel data file.</p> <p>The Laboratory Advisor is responsible for analysing water samples within required holding time limits, following appropriate QA/QC requirements and reporting all results in the required format. The Laboratory Advisor is responsible for calibration the field meter and laboratory equipment following good laboratory practices.</p> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for the surface water sampling program and for identification of parameters and detection limits.</p>
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>Field equipment shall be calibrated daily prior to use and in line with manufacturer's instructions and appropriate calibration solutions.</p> <p>Laboratory samples shall be collected in accordance with laboratory method requirements for volumes, sample containers, duplicates and blanks.</p> <p>Field logistics and handling procedures shall allow for handling and shipping logistics to respect hold times and allow adequate time at the laboratory for analysis within the hold time.</p> <p>All laboratory samples shall have chain-of-custody documentation originated by the field sampling staff.</p> <p>Two times per year (including at least one dry and one wet season sample) a full sample suite are to be sent to an external certified laboratory with appropriate low level detection limits that allow external confirmation of results.</p>

**RECOMMENDED  
ADDITIONAL  
ASSURANCE  
REQUIREMENTS**

At least once a year, duplicate samples shall be collected from six sites and, along with field blanks, sent to both MML and an external laboratory to ensure laboratory procedures are correct (QA/QC).

## 7.2 SW2: PORT LOKO CREEK

SW2: Water quality - Port Loko Creek (barge terminal)					
CODE	SW2	PLAN OWNER			ENVIRONMENT MANAGER
CATEGORY	SURFACE WATER	TECHNICAL CONTENT			ENVIRONMENT MANAGER
REVISION DATE	June 2021	REV	00	APPROVED BY	GM HSE
RATIONALE	<p>The objective of this requirement is to manage and monitor water quality in the vicinity of the barge terminal at Thofayim. Resultant water quality data will be used to ensure that water quality in the vicinity of the barge terminal is consistent with conditions that support the existing uses of Port Loko Creek and Warf Creek (tributary to Port Loko Creek located upstream of the barge terminal).</p> <p>Project discharges shall comply with EPASL discharge limits as listed in <b>Table SW1</b> as a minimum standard. Water quality monitoring of the mine site discharges, includes those from pits (i.e. dewatering, pit lakes), wastes dumps and tailing facilities (i.e. runoff, leachate) and general runoff from roads, plant site (i.e. wash bays, oily water separators) and general mine area.</p> <p>Water quality in creeks shall be compared to specific parameters from the:</p> <ul style="list-style-type: none"> <li>World Health Organisation (WHO), 2011 Guidelines for drinking-water quality as downstream users may use surface waters as water sources or for recreational needs (including washing)</li> <li>Baseline and reference site water quality.</li> </ul> <p>Both WHO values are presented in <b>Tables SW2</b>.</p>				
DESCRIPTION	<p><b>Figure SW2</b> shows the locations that will be monitored under the project's water monitoring program. <b>Table SW4</b> provides a description of the monitoring locations, the parameters that will be analysed and the timing/frequency of the sampling effort.</p> <ul style="list-style-type: none"> <li>In the Port Loko Creek, two sites shall be monitored for water quality, 100m upstream and 100m downstream of the terminal area.</li> <li>A further two sample points will be used to monitor water quality of leachate arising from the dredge spoil piles at Thofayim and Magbamba.</li> <li>Warf Creek, from where water for dust suppression is abstracted, will also be monitored. Even though MML do not discharge here, there is the potential for runoff affecting the site.</li> <li>Water quality monitoring of the Thofayim site discharges, includes general runoff from the site and any silt ponds or wash bays.</li> </ul> <p>Water quality sampling will include the use of field meters to collect field parameters (turbidity, temperature, pH, dissolved oxygen, and electrical conductivity) and samples for laboratory analysis of various physico-chemical parameters (e.g. TSS, total and dissolved metals).</p> <p>MML has identified key indicators that will be monitored as a measure of site compliance as listed in <b>Table SW4</b>. These have been identified with a review of the baseline data set as well as identified potential impacts that may result from the Project activities and include total and dissolved metals as well as total petroleum hydrocarbons.</p> <p>MML environmental laboratory will undertake the analysis of the water samples (unless otherwise indicated) using appropriate and recognised standard methodologies with sufficient detection limits.</p>				
TIMING/ FREQUENCY	<p><b>Table SW4</b> provides details of the water quality monitoring program relative to timing and frequency of sampling. Field parameters will be collected at all sites whenever water quality sampling is performed. Collection of samples for laboratory</p>				

	analysis will be conducted at frequencies ranging from monthly to semi-annually (once in wet season and once in dry season).
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring proper collection of samples/ data as per this plan with the required equipment and materials.</p> <p>The Environmental Advisor shall be responsible for ensuring that water samples are forwarded to the laboratory with chain-of-custody documentation and within required holding time limits.</p> <p>The Environmental Advisor shall also be responsible for transferring laboratory data to the water quality Excel data file.</p> <p>The Laboratory Advisor is responsible for analysing water samples within required holding time limits, following appropriate QA/QC requirements and reporting all results in the required format. The Laboratory Advisor is responsible for calibration the field meter and laboratory equipment following good laboratory practices.</p> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for the surface water sampling program and for identification of parameters and detection limits.</p>
<b>OPERATIONAL CONTROL/ PROCEDURE</b>	<p>Field equipment shall be calibrated daily prior to use and in line with manufacturer's instructions and appropriate calibration solutions.</p> <p>Laboratory samples shall be collected in accordance with laboratory method requirements for volumes, sample containers, duplicates and blanks.</p> <p>Field logistics and handling procedures shall allow for handling and shipping logistics to respect hold times and allow adequate time at the laboratory for analysis within the hold time.</p> <p>All laboratory samples shall have chain-of-custody documentation originated by the field sampling staff.</p> <p>Twice per year (one dry and one wet season sample) a full sample suite are to be sent to an external certified laboratory with appropriate low level detection limits.</p>
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	See Monitoring Plan SW1

### 7.3 SW3: WATER FLOW – MINE CONCESSION AREA

SW3: Water flow and discharge – mine concession area					
<b>CODE</b>	SW3	<b>PLAN OWNER:</b>			ENVIRONMENT MANAGER
<b>CATEGORY</b>	SURFACE WATER	<b>TECHNICAL CONTENT:</b>			ENVIRONMENT MANAGER
<b>REVISION DATE</b>	June 2021	<b>REV:</b>	00	<b>APPROVED BY:</b>	GM HSE
<b>RATIONALE</b>	<p>The Marampa mine concession area is drained by two freshwater tributaries of the Rokel River; Baki Creek and Batabana Creek. The Baki Creek flows along the northern boundary of the mine concession area in a south-westwardly direction. The Batabana Creek originates from the Batabana lake in the north-east and flows almost directly south to the Rokel River.</p> <p>The objective of this requirement is to ensure that water flow in the Baki and Batabana creeks is maintained within the appropriate range (high and low) to support downstream uses, such as ecosystem function, agriculture, washing, etc.</p>				
<b>DESCRIPTION</b>	<p><b><u>Water Levels</u></b></p> <p>MML has established a monitoring site at Batabana Lake S1 (see Table SW1) to measure the level of the lake. The previous operator of the mine (LMC) had accusations of flooding levelled against it on numerous occasions causing reputational damage. Monitoring of lake water levels needed to protect against unfounded accusations and also to allow for remedial action to be taken in the event that lake levels rise above normal levels.</p> <p><b><u>Stream Gauging</u></b></p> <p>At site K3 and S11, stream gauging must be undertaken to allow stream flow to be measured. This is done using a HACH FH950 velocity meter mounted on a top-setting wading rod following practices of the US Geologic Survey. All settings are in metric and velocity measures are taken at 60% actual depth in water &lt;75cm depth. For water depth &gt;75cm depth, two readings are required per point; one at 20% and one at 80% depth. Velocity measures should be taken from at least 25 points over the full width of the stream.</p> <p><b><u>Dewatering</u></b></p> <p>Where pit dewatering or other discharge from the mine site occurs that is discharged to the environment, the quantity discharged shall be recorded using a totalising flow meter or equivalent system for monitoring discharge (e.g. pump hours when system pump rate is known).</p>				
<b>TIMING/ FREQUENCY</b>	<p>Stream gauging to occur at each site once a quarter.</p> <p>Creek cross-sections in area of monitoring stations to be taken annually in dry season.</p> <p>Water level in the Batabana Lake at site S1 should be taken monthly in the dry season and daily in the wet season.</p> <p>Daily records of pump hours with monthly totals</p>				
<b>REPORTING REQUIREMENTS</b>	<p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>				
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Mine Manager is responsible for ensuring all pit water discharge and dewatering activities are monitored and data recorded and provided to Environmental department as required</p> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>				

<b>OPERATIONAL CONTROL/ PROCEDURE</b>	
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	HACH FH950 velocity meter to be calibrated as per manufacturers requirements.  Automatic level logger be installed at S1, S11 & K3 to allow for long term continuous monitoring of water levels and stream flows.

#### 7.4 SW4: WARF CREEK

SW4: Warf Creek					
<b>CODE</b>	SW4	<b>PLAN OWNER:</b>		ENVIRONMENT MANAGER	
<b>CATEGORY</b>	SURFACE WATER	<b>TECHNICAL CONTENT:</b>		ENVIRONMENT MANAGER	
<b>REVISION DATE</b>	June 2021	<b>REV:</b>	00	<b>APPROVED BY:</b>	GM HSE
<b>RATIONALE</b>	<p>Water for dust suppression on the haul road is abstracted from Warf Creek during the dry season.</p> <p>The objective of this requirement is to ensure that water flow in the Warf Creek is maintained within the appropriate range (high and low) to maintain ecosystem function.</p>				
<b>DESCRIPTION</b>	<p>At Warf Creek, stream gauging must be undertaken to monitor overall stream flow. This is done using a HACHFH950 velocity meter mounted on a top-setting wading rod following practices of the US Geologic Survey. All settings are in metric and velocity measures are taken at 60% actual depth in water &lt;75cm depth. For water depth &gt;75cm depth, two readings are required per point; one at 20% and one at 80% depth. Velocity measures should be taken from at least 25 points over the full width of the stream.</p> <p>See <b>Figure SW2</b> and <b>Table SW4</b> for site information.</p>				
<b>TIMING/ FREQUENCY</b>	<p>Stream gauging to occur once per month during dry season.</p> <p>The total volume of water abstracted on a hourly basis is to be recorded whenever water is abstracted from this Creek.</p>				
<b>REPORTING REQUIREMENTS</b>	<p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>				
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Haul Road Supervisor is responsible for ensuring the volumes of water abstracted are monitored and data recorded and provided to the Environmental department as required.</p> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>				
<b>OPERATIONAL CONTROL/ PROCEDURE</b>					
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	HACH FH950 velocity meter to be calibrated as per manufacturers requirements.				

#### 7.5 SW6: WATER ABSTRACTION

<b>SW6: WATER USAGE AND ABSTRACTION</b>
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<b>CODE</b>	<b>SW6</b>	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER	
<b>CATEGORY</b>	SURFACE WATER	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER	
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b>	GM HSE
<b>RATIONALE</b>	<p>The objective of this plan is to monitor the quantity of water used by the Marampa Mines Project, including mine site, haul road and Thofayim terminal. Activities that use water include: process water at the plant, potable water used at the mine and Thofayim (including that supplied to the tugs), dust suppression water used on haul roads and mining areas, and incidental water for washing vehicles, gland pumps, fire water etc.</p> <p>Inefficient use of water by the Project can affect other users (e.g. water wells, stream flow) as well as ecosystem function in waterways downstream of the project.</p> <p>The total volume of water abstracted is to be recorded whenever water is abstracted. This can be done by totaliser flow meter, number of trucks where tanker volume is known or by pump hours where pump rate is known.</p> <p>The total water abstracted by the Marampa Project as well as quantities reused/recycle are to be reported by MML.</p> <p>Plan <b>WM4</b> covers water usage on the Transshipment vessels.</p>				
<b>DESCRIPTION</b>	<p>The Marampa Project will use the following sources of water:</p> <ol style="list-style-type: none"> <li>1. Rokel River pump station</li> <li>2. Pit dewatering</li> <li>3. Tailing/pit lake dewatering</li> <li>4. Bores</li> <li>5. Port Loko Creek</li> <li>6. Warf Creek</li> </ol> <p>Water usage for each water abstraction point is to be monitored and reported in m<sup>3</sup>/hour.</p> <p>It is preferred that a totalising flow meter be used for the main sources of water (i.e. Rokel R – Katick pump station). Other means of equivalent accuracy are also accepted.</p> <p>Pump hours where the pump discharge rate is known or number of tanks filled may be used on smaller, more remote locations such as Warf Creek.</p> <p>Water usage is to be reported by source and by application, including:</p> <ol style="list-style-type: none"> <li>1. Process Plant: <ol style="list-style-type: none"> <li>a. Make-up water</li> <li>b. Reused water (return water from tailing/thickeners/beltfilters, etc)</li> <li>c. Total water used</li> </ol> </li> <li>2. Potable water - Marampa and Thofayim</li> <li>3. Dust suppression – covers a number of uses such as bores, pit dewatering, Katick pump, Port Loko Ck and Warf Ck. <ol style="list-style-type: none"> <li>a. Recycled water to be listed</li> </ol> </li> <li>4. Other – covers vehicle washing, fire water, gland water etc.</li> </ol>				
<b>TIMING/ FREQUENCY</b>	Water usage is to be monitored continuously to provide monthly figures for abstraction and consumption.				
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>				
<b>ROLES &amp; RESPONSIBILITIES</b>	The Environmental Advisor shall be responsible for ensuring collection of data as per this plan from:				

	<ol style="list-style-type: none"> <li>1. Plant Process Manager is responsible for monitoring water use at the process plant.</li> <li>2. The Mining Manager is responsible for monitoring water used for dust suppression within the mine concession area, i.e. pits, waste dumps, haul road within inside concession area.</li> <li>3. The Haul Road Supervisor is responsible for monitoring water use for dust suppression on the haul road and Thofayim.</li> <li>4. The Water Plant Operator is responsible for monitoring potable water usage</li> </ol> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>
<p><b>OPERATIONAL CONTROL/PROCEDURE</b></p>	<p>The "other" category of water use and abstraction should not comprise more than 5% of total water use.</p> <p>A water balance to compare water abstracted versus water consumed should be calculated undertaken annually.</p>
<p><b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b></p>	<p>none</p>



**Table SW1: Effluent Guidelines EPA-SL Environmental Regulations**

Parameter	SL Environmental Regulations	
	Maximum at any moment	Annual average maxima
TSS	50 mg/L	25 mg/L
pH	6-9 pH units	6-9 pH units
COD	-	-
BOD5	-	-
Oil and Grease	10 mg/L	16 mg/L
Total Arsenic	0.1 mg/L	0.08 mg/L
Total Cadmium	0.05 mg/L	0.04 mg/L
Total Chromium (VI)	0.1 mg/L	0.08 mg/L
Total Copper	0.6 mg/L	0.4 mg/L
Iron (total dissolved)	2.0 mg/L	1.6 mg/L
Total Lead	0.2 mg/L	0.16 mg/L
Total Mercury	0.002 mg/L	0.0016 mg/L
Total Nickel	-	-
Phenols	-	-
Total Zinc	1.5 mg/L	1.2 mg/L

**Table SW2: World Health Organisation (WHO), 2011. Guidelines for drinking-water quality, 4th Ed.**

Parameter	Units	Guideline
pH	pH units	6.5-8.5
Total Dissolved Solids (TDS)	mg/l	600
Total Hardness	mg/l	200
Sulphate	mg/l	250
Total Aluminium	µg/l	100*
Total Arsenic	µg/l	10
Total Barium	µg/l	700
Total Cadmium	µg/l	3
Total Chromium	µg/l	50
Total Copper	µg/l	2000
Total Iron	µg/l	300*
Total Lead	µg/l	10
Total Manganese	µg/l	100*
Total Mercury	µg/l	6
Total Nickel	µg/l	70
Total Zinc	µg/l	3000*

**Table SW3: Water Quality Monitoring Program for General Mine Concession Area**

Site #	Coordinates		Brief Description of Site	Analyte Suite 1	Analyte Suite 2	Analyte Suite 3	Analyte Suite 4
	North	West					
S1	8° 41.383'	12° 30.180'	Batabana Lake		Weekly in wet season. Every 2 weeks in dry season.	Quarterly with at least one mid-dry season and one wet season sample per year	Monthly
S2	8° 40.923'	12° 30.159'	Batabana Ck - in mine concession				
S11	8° 40.500'	12° 32.135'	Baki Ck at haul road crossing	Daily			
S26	8°41'13.75" "	12°31'28.16"	Baki Creek (main channel) just inside north mine concession boundary				
K3	8° 40.041'	12° 30.359'	Batabana Creek at Katick Road (stream gaging location)	Daily			
K1	8°38'34.26" "	12°30'27.65"	Rokel River at Katick		Monthly		
K2	8° 39.124'	12° 30.451'	Batabana Creek Trib. on Katick Road		Monthly		
K4	8°38'43.42" "	12°30'5.25"	Rokel River upstream of Batabana Ck confluence		Monthly		
S4	8° 40.047'	12° 30.357'	Trib. to Batabana Creek from concession		Monthly		
S7	8° 41.344'	12° 31.084'	Baki Creek southern channel headwaters		Monthly		
S18	8° 40.910'	12° 32.483'	Trib to Baki Creek from Lunsar		Monthly		
S22	8° 40.446'	12° 32.075'	Ghafal Lake North				
S27	095981	0770124	Baki Creek downstream of S26, south of Lunsar		Monthly		
S29	8°39'2.46"	12°34'49.44"	Rokel R downstream of Baki Creek confluence				
F2	8°38'53.63" "	12°30'19.45"	Downstream Batabana Creek before confluence with Rokel R		Monthly		
F3	8° 39.433'	12° 29.108'	Downstream (southeast) of the mine concession - reference site				
F4	8° 40.915'	12° 28.592'	East outside the mine concession - reference site				

F5	8° 42.360'	12° 29.734'	Batabana Lake Upstream - reference site				
<b>Mine Site Silt Trap Discharge Points, to be located upon construction</b>				Weekly in wet season. Every 2 weeks in dry season, if discharging.	Weekly in wet season. Every 2 weeks in dry season, if discharging		
<b>TSF Discharge Points, to be located upon construction</b>							
<b>Pit Dewatering Discharge Points, to be located upon construction</b>							
<b>Discharge from wash bays and oily water separators</b>				Monthly			Monthly

**Analyte Suite 1:** TSS (mg/l), Turbidity (NTU), EC ( $\mu\text{S}/\text{cm}$ ), pH, DO (mg/l) using field meter.

**Analyte Suite 2:** Analyte Suite 1 plus K, Mg, Mn, Fe, Ca,  $\text{PO}_4$  (mg/l)

**Analyte Suite 3:** Analyte Suite 1 plus sample set for external analysis of  $\text{SO}_4$ , Chloride, Alkalinity, Total Kjeldahl N and  $\text{PO}_4$  (mg/l), total and dissolved metals (Al, As (total), B, Ba, Ca, Cd, Co, Cr (total), Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Se, Zn, V) ( $\mu\text{g}/\text{l}$ ).

**Analyte suite 4:** total petroleum hydrocarbons (mg/l)

**Table SW4: Water Quality Monitoring Program for Port Loko Creek**

Site #	Coordinates		Brief Description of Site	Analyte Suite 1	Analyte Suite 2	Analyte Suite 3	Analyte Suite 4
	North	West					
T1	8°43'42.39"	12°50'50.51"	Port Loko Creek ~100m upstream of Thofayim		Monthly	Quarterly with at least one mid-dry season and one wet season sample per year	Monthly
T2	8°43'23.24"	12°51'6.28"	Port Loko Creek ~100m downstream of Thofayim		Monthly		Monthly
T3	8°43'23.75"	12°50'44.59"	Thofayim dredge pond leachate		Monthly		
T4	8°43'23.64"	12°52'17.57"	Magbamba dredge pond leachate		Monthly		
T6	8°43'13.41"	12°48'41.78"	Warf Creek				Monthly
<b>Site Silt Trap Discharge Points, to be located upon construction</b>					Monthly		Monthly
<b>Discharge from wash bays and oily water separators</b>				Monthly		Monthly	

**Analyte Suite 1:** TSS (mg/l), REDOX, Turbidity (NTU), EC (µS/cm), pH, DO (mg/l) using field meter.

**Analyte Suite 2:** Analyte Suite 1 plus K, Mg, Mn, Fe, Ca, PO<sub>4</sub> (mg/l)

**Analyte Suite 3:** Analyte Suite 1 plus sample set for external analysis of SO<sub>4</sub>, Chloride, Alkalinity, Total Kjeldahl N and PO<sub>4</sub> (mg/l), total and dissolved metals (Al, As (total), B, Ba, Ca, Cd, Co, Cr (total), Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Se, Zn, V) (µg/l).

**Analyte suite 4:** total petroleum hydrocarbons (mg/l)

## 8 WASTE

### 8.1 WM1: GENERAL WASTE MANAGEMENT

WM1: General Waste Management					
<b>CODE</b>	WM-01	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER	
<b>CATEGORY</b>	Waste	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER	
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b>	GM-HSE
<b>RATIONALE</b>	<p>Waste management facilities will be established to aid in the management of the site's waste. This will include an incinerator, landfill area for non-hazardous waste types, bioremediation area for oiled dirt and storage area for waste types that will require longer term storage before accumulating a sufficient quantity to be managed (e.g. batteries, e-waste).</p> <p>MML's waste management plan (WMP) applies to all areas of the Project, including mine concession area, haul road, Thofayim, barging and transshipment.</p>				
<b>DESCRIPTION</b>	<p>The quantity waste produced and transferred from each area (i.e. Marampa mine site, Thofayim, barging, transshipment) will be recorded (L, kg or tonnes), as per the Waste Management Plan (WMP).</p> <p>For each waste stream the following data is required:</p> <ul style="list-style-type: none"> <li>• Quantity produced for reporting period</li> <li>• Quantity in storage for reporting period</li> <li>• Quantity sent for disposal for reporting period</li> <li>• Disposal method used for each waste type (including exported volumes and types)</li> </ul> <p>Waste management facilities will be audited to ensure compliance with the WMP, including storage, disposal, and segregation.</p>				
<b>TIMING/ FREQUENCY</b>	<p>Monthly reporting from all assets and Waste contractors to EHS Advisor, as per WMP.</p> <p>Waste management facilities will be audited every six months to ensure compliance with the WMP.</p>				
<b>REPORTING REQUIREMENTS</b>	<p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>				
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring that waste data collected is in compliance with the WMP. Data is to be complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Advisor shall be responsible for ensuring collection of data as per this plan from:</p> <ol style="list-style-type: none"> <li>1. The Haul Road Supervisor - concentrate haulage contractor.</li> <li>2. Doctor - medical waste produced for month</li> <li>3. Power plant - all waste types.</li> <li>4. MML Export Operations Manager all waste types for concentrate barging/transshipping contractors</li> <li>5. Administration Manager - oil/lubricants for light vehicles</li> </ol> <p>The Environmental Advisor shall be responsible for obtaining data from the <b>transhipper</b> via the Export Manager.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for the climate monitoring program and for identification of parameters and detection limits.</p>				

<b>OPERATIONAL CONTROL/ PROCEDURE</b>	Compliance with MML WMP
<b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b>	<p>Perform regular (at least monthly) inspections of waste storage areas on MML sites for compliance with project standards.</p> <p>Annual audit of third party waste treatment and disposal facilities for compliance with project standards.</p> <p>Annual review of waste data and comparative assessment of quantities produced.</p>

## 8.2 WM2: WASTE MANAGEMENT – MINING AND PROCESSING

WM2: Waste Management - mining and processing				
<b>CODE</b>	WM-02	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER
<b>CATEGORY</b>	Waste	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER
<b>REVISION DATE</b>	Aug 2017	<b>REV</b>	00	<b>APPROVED BY</b> GM HSE
<b>RATIONALE</b>	<p>Just under 130 Mt of waste rock will be mined to the end of 2026 as a result of the Marampa project. This material will be placed in the two waste rock dumps; Konta and Chendata.</p> <p>Topsoil and weathered material such as laterite will also be stored at various smaller stockpiles located around the site for use in site rehabilitation. Approximately 423Mtpa of tailings will be produced by the Marampa Project over a 30 year life of mine.</p> <p>The MML Mine Closure Plan states that:</p> <ul style="list-style-type: none"> <li>The site is left in a stable state, both physically and chemically, that prevents deterioration of natural resources;</li> <li>The site should be handed back to landholders in a productive and sustainable state that is both practicable and compatible with the surrounding landscapes</li> </ul> <p>To enable closure panning to be integrated into the overall project it is important that both sufficient topsoil/weathered material is stored and an understanding of the material type and quantities of waste rock and tailing placed in waste facilities that may affect nearby watercourses and that could affect mine site closure.</p>			
<b>DESCRIPTION</b>	<ol style="list-style-type: none"> <li>Tailing <ul style="list-style-type: none"> <li>Total quantity of tailing produced (Mt dry weight) by month</li> <li>Characteristics of ore feed by month: <ul style="list-style-type: none"> <li>Primary ore</li> <li>Weathered ore</li> <li>Tailings</li> </ul> </li> </ul> </li> <li>Waste rock <ul style="list-style-type: none"> <li>Total quantity of waste rock produced (Mt) by month</li> </ul> </li> <li>Topsoil/weathered material <ul style="list-style-type: none"> <li>Total quantity of topsoil/weathered material in stockpiles to date (Mt) by month.</li> <li></li> </ul> </li> </ol>			
<b>TIMING/ FREQUENCY</b>	Monthly reporting of tailing, waste rock and topsoil quantities			
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>			
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring that waste data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Advisor shall be responsible for ensuring collection of data as per this plan from the Mining Manager and Process Manager.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for this program and for identification of parameters and detection limits.</p>			
<b>OPERATIONAL CONTROL/ PROCEDURE</b>				

**RECOMMENDED  
ADDITIONAL  
ASSURANCE  
REQUIREMENTS**

Annual review of compiled monthly data against end of year survey data.



### 8.3 WM3: SEWERAGE AND BILGE WATER

Sewerage Discharge - terrestrial																															
<b>CODE</b>	WM3	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER																											
<b>CATEGORY</b>	WASTE	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER																											
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b> GM HSE																											
<b>RATIONALE</b>	<p>The IFC EHS guidance requires "Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety or the environment".</p> <p>The IFC EHS Mining Guidelines requires the maximum oil and grease discharge in mine discharge to be 10mg/l.</p> <p>The IFC General EHS Guidelines requires the following for sewerage effluent:</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Unit</th> <th>Guideline Value</th> </tr> </thead> <tbody> <tr> <td>pH</td> <td>pH</td> <td>6 - 9</td> </tr> <tr> <td>BOD</td> <td>mg/L</td> <td>30</td> </tr> <tr> <td>COD</td> <td>mg/L</td> <td>125</td> </tr> <tr> <td>Total nitrogen</td> <td>mg/L</td> <td>10</td> </tr> <tr> <td>Total Phosphorous</td> <td>mg/L</td> <td>2</td> </tr> <tr> <td>Oil and Grease</td> <td>mg/L</td> <td>10</td> </tr> <tr> <td>TSS</td> <td>mg/L</td> <td>50</td> </tr> <tr> <td>Total coliform number</td> <td>MPN*/100ml</td> <td>400</td> </tr> </tbody> </table> <p>This plan addresses sewerage produced by MML operations and contractors living on MML property. MML will have a number of sewerage treatment plants at the Marampa mine site plus a sewerage treatment plant and bilge water treatment plant at Thofayim that covers both the site operations as well as effluent transferred from the tugs/self-propelled barges.</p> <p>Water quality in runoff and oily water separators are covered by Environmental Monitoring Plan SW1: Surface Water Quality</p>				Parameter	Unit	Guideline Value	pH	pH	6 - 9	BOD	mg/L	30	COD	mg/L	125	Total nitrogen	mg/L	10	Total Phosphorous	mg/L	2	Oil and Grease	mg/L	10	TSS	mg/L	50	Total coliform number	MPN*/100ml	400
Parameter	Unit	Guideline Value																													
pH	pH	6 - 9																													
BOD	mg/L	30																													
COD	mg/L	125																													
Total nitrogen	mg/L	10																													
Total Phosphorous	mg/L	2																													
Oil and Grease	mg/L	10																													
TSS	mg/L	50																													
Total coliform number	MPN*/100ml	400																													
<b>DESCRIPTION</b>	<p>The following parameters are to be monitored at each treatment plant:</p> <ul style="list-style-type: none"> <li>Volume of treated effluent that is discharged. This can either be monitored by totalising flow meter (required for Thofayim) or by using potable water consumption (applies to Marampa site sewerage plants only).</li> <li>Sewerage effluent quality - BOD, COD, TSS, pH, EC, Total Kjeldahl N and PO<sub>4</sub> (mg/l), total oil and grease, total coliform number.</li> </ul>																														
<b>TIMING/ FREQUENCY</b>	<p>Sampling of effluent to be undertaken monthly.</p> <p>Volumes to be recorded daily and compiled to monthly total.</p>																														
<b>REPORTING REQUIREMENTS</b>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>																														
<b>ROLES &amp; RESPONSIBILITIES</b>	<p>The Environmental Advisor shall be responsible for ensuring proper collection of samples/data as per this plan with the required equipment and materials.</p>																														

	<p>The Environmental Advisor shall be responsible for ensuring that water samples are forwarded to the laboratory with chain-of-custody documentation and within required holding time limits.</p> <p>The Environmental Advisor shall also be responsible for transferring laboratory data to the water quality Excel data file.</p> <p>The Environmental Laboratory is responsible for analysing water samples within required holding time limits, following appropriate QA/QC requirements and reporting all results in the required format.</p> <p>The Environmental Advisor shall be responsible for ensuring that data collected is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity for the surface water sampling program and for identification of parameters and detection limits.</p>
<p><b>OPERATIONAL CONTROL/ PROCEDURE</b></p>	<p>Field equipment shall be calibrated daily prior to use and in line with manufacturer's instructions and appropriate calibration solutions.</p> <p>Laboratory samples shall be collected in accordance with laboratory method requirements for volumes, sample containers, duplicates and blanks.</p> <p>Field logistics and handling procedures shall allow for handling and shipping logistics to respect hold times and allow adequate time at the laboratory for analysis within the hold time.</p> <p>All laboratory samples shall have chain-of-custody documentation originated by the field sampling staff.</p>
<p><b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b></p>	<p>At least twice per year, duplicate samples shall be collected from the bilge water plant and sent to an external laboratory for comparison with internal analysis.</p>

## 8.4 WM4: TRANSSHIPMENT, BARGES AND TUGS

WM4: TRANSSHIPMENT BARGES AND TUGS				
<b>CODE</b>	WM4	<b>PLAN OWNER</b>		ENVIRONMENT MANAGER
<b>CATEGORY</b>	WASTE	<b>TECHNICAL CONTENT</b>		ENVIRONMENT MANAGER
<b>REVISION DATE</b>	June 2021	<b>REV</b>	00	<b>APPROVED BY</b> GM HSE
<b>RATIONALE</b>	<p>The objective of this plan is to monitor the discharges and waste from all vessels used by MML on its project, including tugs, self-propelled barges, transshipment vessels, and any other vessel on hire for at least a month (e.g. dredges).</p> <p>The <b>Marampa</b> ESIA states that:</p> <ul style="list-style-type: none"> <li>• <b>Cooling Water</b> (from Transshipment barges only) - The effluent should result in a temperature increase of no more than 3°C at 100 m from point of discharge as per IFC EHS Guidelines.</li> <li>• <b>Sewerage (black water)</b>. Discharge of treated sewerage allowed within the SL estuary below Tasso Island. Sewerage to be treated with approved marine sanitation unit as per MARPOL Annex IV; pH 6-8.5, BOD 25 mg/l max, COD 125 mg/l max, TSS 35 mg/l max, Thermotolerant (Faecal) Coliform number 100MPN max, Free chlorine residual &lt;0.5 mg/l. <ul style="list-style-type: none"> <li>○ No discharge above Tasso Island or within Port Loko Creek.</li> <li>○ Sewerage may be sent ashore for treatment at shore based facilities. No discharge of untreated sewerage.</li> <li>○ Grey water (ablutions, kitchen wash water) can be discharged at any point.</li> </ul> </li> <li>• <b>Food Waste</b>. Within the SL estuary below Tasso Island, food waste (no plastics or non-food items to be discharged) shall be macerated to &lt;25mm and discharged. <ul style="list-style-type: none"> <li>○ No discharge above Tasso Island or within Port Loko Creek.</li> <li>○ No discharge of any other waste, whether domestic or industrial; comply with MARPOL prohibitions on dumping trash and debris in the ocean. All other wastes to be sent ashore for management.</li> </ul> </li> <li>• <b>Bilge Water</b>. Treat to 15 ppm oil concentration as per MARPOL 73/78 Annex I requirements. <ul style="list-style-type: none"> <li>○ Discharge of treated bilge water within the SL estuary below Tasso Island.</li> <li>○ No discharge above Tasso Island or within Port Loko Creek.</li> <li>○ Bilge water may be sent ashore for treatment at shore based facilities. No discharge of untreated bilge water.</li> </ul> </li> <li>• <b>Ballast Water</b> - Discharge of segregated ballast water only.</li> <li>• <b>Deck Drainage</b>. Maximum of 15 ppm oil concentration as per MARPOL 73/78 Annex I requirements and 50 mg/l TSS for oil/concentrate barges and transshipment barges.</li> <li>• <b>Desalination brine</b>. Mix with other discharge streams if feasible.</li> <li>• <b>General Waste</b> - no discharge of any waste other than food to the marine/estuary. All to be shipped ashore for disposal and management</li> </ul> <p>MML are also to report the quantity of water consumed by the fleet to check against sewerage discharged.</p>			
<b>DESCRIPTION</b>	<p>The following aspects shall be monitored:</p> <ul style="list-style-type: none"> <li>• <b>Sewerage Effluent Quality - Black water</b> (applies to any vessel/barge that uses on-board sewerage treatment plants and discharges treated sewerage to the estuary). A sample of treated sewerage to be taken prior to discharge.</li> </ul>			

	<p>Samples to be analysed for pH, BOD, COD, TSS, thermotolerant (Faecal) coliform number, free chlorine residual, and temperature.</p> <ul style="list-style-type: none"> <li>• <b>Sewerage Effluent Quantity – Black water and grey water.</b> The total volume of sewerage (black and grey water) discharged from each vessel used by MML under contract is to be recorded. <ul style="list-style-type: none"> <li>○ Where no meter exists for quantifying discharges, the total volume of potable water consumed may be used as the measure.</li> <li>○ The location of discharge to be recorded, e.g. whilst underway below Tasso Island, discharged ashore at Thofayim, discharged ashore at Freetown, Other (specify).</li> </ul> </li> <li>• <b>Bilge Water.</b> <ul style="list-style-type: none"> <li>○ For vessels with bilge water treatment systems, total volume of treated water discharged and oil in water content of discharge.</li> <li>○ For vessels with no bilge water treatment systems, total volume of untreated bilge water sent ashore for disposal including location</li> </ul> </li> <li>• <b>Potable Water.</b> Total quantity of potable water consumed to be recorded for each vessel.</li> <li>• <b>Food Waste.</b> Estimated quantity of food waste macerated and discharged per ship per month.</li> <li>• <b>Waste sent ashore for disposal.</b> The quantity of hazardous and non-hazardous waste produced and transferred from each asset will be recorded (L, kg or tonnes), as per the Waste Management Plan (WMP). For each waste stream the following data is required: <ul style="list-style-type: none"> <li>○ Quantity</li> <li>○ Disposal method (including volumes and types) and contractor used</li> </ul> </li> <li>• <b>Persons on board.</b> Number of personnel on board each vessel.</li> </ul>
<p><b>TIMING/ FREQUENCY</b></p>	<p><b>Monthly</b> (<i>based on daily records</i>) reporting from all assets for:</p> <ul style="list-style-type: none"> <li>○ Potable water consumed/generated. If water generated, the volume and salinity of reject water to be included.</li> <li>○ Waste sent ashore for disposal by waste stream</li> <li>○ Bilge water discharge volumes and average oil in water content</li> <li>○ Food macerated and discharged</li> <li>○ Sewerage (black and grey) volume discharged by location</li> <li>○ Persons on board</li> </ul> <p><b>Six monthly</b> testing of sewerage effluent quality.</p> <p><b>Daily Inspections:</b></p> <p>Visual inspection of water surface for visible sheen on water surface, visible floating solids and discolouration - visual checks and observations recorded. Records should include up-current observations.</p>
<p><b>REPORTING REQUIREMENTS</b></p>	<p>Summary data shall be reported to the EPASL every quarter.</p> <p>Summary data will be included in the annual report required for the EPASL as well as the MML annual report.</p>
<p><b>ROLES &amp; RESPONSIBILITIES</b></p>	<p>The MML Export Operations Manager is responsible for ensuring collection of data as per this plan from:</p> <ol style="list-style-type: none"> <li>1. Tug/concentrate barge operators on monthly basis.</li> <li>2. Fuel barge operator on monthly basis</li> <li>3. Transshipment barge operators on a monthly basis</li> <li>4. Dredging vessels (when on hire) on a monthly basis</li> <li>5. Other vessels utilised by MML for at least a month.</li> </ol>

	<p>The Environmental Advisor shall be responsible for ensuring that data collected from MML Export Operations Manager is complete, reliable and submitted on time both internally and externally where required.</p> <p>The Environmental Advisor shall be responsible for ensuring that data is entered into the MML database systems and analysed as required for trends and exceedances.</p> <p>The Environmental Manager shall have overall accountability for ensuring the correct checks and balances are in place to assure data integrity.</p>
<p><b>OPERATIONAL CONTROL/PROCEDURE</b></p>	<p>A comparison of POB and water used/sewerage discharge should be made</p> <p>Ensure vessels are discharging wastes in appropriate methods for location of work and type of equipment on board.</p>
<p><b>RECOMMENDED ADDITIONAL ASSURANCE REQUIREMENTS</b></p>	<p>Calibration certificates for oily water separators to be provided for each vessel by captains prior to engagement and whenever re-calibration is required.</p> <p>Certification for sewerage treatment plants to be provided for each vessel and recertification to be undertaken as required by MARPOL.</p> <p>Copy of garbage record book to be inspected by MML personnel at least 6 monthly for each tug and monthly for transshipment vessels</p> <p>The vessel chief engineer shall ensure waste management systems (e.g. food macerator, sewerage plant, oily water separator, other as required) are included in preventative maintenance program and are working properly.</p>