8 Noise and Vibration

8.1 Introduction

This chapter presents an assessment of the impacts of the Simandou Port on the acoustic environment. It considers the effects of noise and vibration on people (1) and property during construction and operation of the port.

Potential sources of emissions during construction will include ground clearance of the site, earthmoving, drilling, assembly and erection of plant and infrastructure, piling and construction traffic. Sources during operation will include noise from train unloading, conveyor operation, stockpiling and loading of ore, power generation, material unloading and berthing operations, maintenance dredging, vessel and vehicle movements.

The following impacts have been considered but it was concluded that they are unlikely to be significant for the reasons noted below and they are not therefore considered further in the assessment:

- ground borne noise, as there are no underground noise sources;
- operational and construction related vibration, as potential sensitive (human) receptors are considerable distances (greater than 300 metres) from vibration sources;
- blasting emissions;
- construction materials quarrying and processing (covered by Rio Tinto (2011) Marine Offloading Facility Social and Environmental Impact Assessment (SEIA) November 2011); and
- air borne shipping noise both during construction and operation.

The remainder of the chapter is structured as follows.

- Section 8.2 describes the assessment methodology.
- Section 8.3 presents the baseline conditions.
- Section 8.4 presents the initial impact assessment of the port prior to mitigation.
  - Noise during construction (Section 8.4.2.).
  - Noise during operation (Section 8.4.3).
- Section 8.5 describes the planned approach to mitigation and the resulting residual impacts.
- Section 8.6 provides a summary of the assessment.

Detailed supporting information is provided in the following Annexes.

- Annex 8B - Noise and Vibration Impact Assessment Criteria and Methodology: Background to the development of the criteria used for evaluation of impacts including a review of current guidance and legislation, codes and policies used to prepare of Project specific noise and vibration criteria for the Simandou Project and noise and vibration from the port and description of the methods used to predict noise and vibration levels.
- Annex 8C - Noise Design Assumptions and Source Data: Project data including design parameters and assumptions relevant to noise emissions, from which source terms have been developed for the purpose of the assessment.

As some of the terminology used in noise assessment is technical in nature a brief introduction to some key terms is provided below. More details are provided in Annex 8A: Noise and Vibration Glossary.

(1) The responses of animals (eg mammals and birds) to noise and vibration can differ from those of people. The assessment in this chapter focuses on impacts on people and the differential effects of noise on animal species are discussed in Chapter 12: Terrestrial Biodiversity and Chapter 13: Marine and Littoral Biodiversity.
An Introduction to Noise Terminology

- **dBA**: Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA or A-weighted decibels. Decibels are units of sound measured on a logarithmic scale. This means that a step of 10 dB represents a ten-fold increase in intensity or sound energy. The A-Weighting scale is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. To the typical human ear an increase of 10 dBA actually sounds slightly more than twice as loud.

- **$L_{Aeq}$**: Time varying noise sources are often described in terms of statistical noise descriptors. $L_{Aeq}$ (the equivalent continuous A-weighted sound pressure level) is a value that, simply expressed, represents the average sound level over a period of time. The period of time (T) can be 1 hour, daytime hours (say 14 hours from 0600 to 2200), night time hours (8 hours from 2200 to 0600), all day (24 hours), or any other relevant period.

- **$L_{A90}$**: this is an alternative statistical descriptor calculated from the sound level exceeded for 90% of the time. For a noise environment with a fairly steady background noise level on which occasional noisy events are superimposed (such as occasional passage of trains through a rural area) it, simply expressed, represents the background noise level. Other percentile values are used to present different aspects of the noise environment such as $L_{A95}$ and $L_{A10}$.

- **$L_{Amax}$**: this is the maximum sound pressure level recorded during a measurement period.

### 8.2 Approach

#### 8.2.1 Study Area

The port will be located on the east bank of the Morebaya River, approximately 5 km upstream of the river mouth. The area occupied by the port is located in the Maféryniah Sub-Prefecture of Forécariah Prefecture and Kindia Region. The port is situated in a low-lying coastal plain bounded by the Morebaya River to the west and north and a tidal tributary to the south.

The assessment study area in this chapter is defined as the area within which people could be adversely affected by noise and vibration from construction or operation of the port, including the MOF (1), train unloading, stockpiles and ore loading area at the export wharf. Several settlements in the vicinity of the port have been identified as representative of locations within the area that could be adversely affected by noise and vibration and these are identified in Table 8.1. Their locations are shown in Figure 8.1. There are a number of other, mainly smaller settlements in the same area, but the identified villages are considered to be representative of the receptors likely to be affected by the port. The surrounding land is largely used for agriculture, particularly rice fields.

#### Table 8.1 Representative Noise Sensitive Receptors

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Senguelen</td>
<td>Touguiyiré</td>
<td>47</td>
<td>315</td>
<td>Fishing village, trade</td>
</tr>
<tr>
<td></td>
<td>Touguiyiré hamlets</td>
<td>17</td>
<td>114</td>
<td>Fishing village</td>
</tr>
<tr>
<td></td>
<td>Senguelen</td>
<td>176</td>
<td>1,179</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td></td>
<td>Bamboukhoun</td>
<td>62</td>
<td>415</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td></td>
<td>Sounganyah</td>
<td>77</td>
<td>516</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td>Madinagbé</td>
<td>Sougué Senni</td>
<td>123</td>
<td>824</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td></td>
<td>Fodeya $[3]$</td>
<td>65</td>
<td>436</td>
<td>Predominantly agriculture</td>
</tr>
</tbody>
</table>

(1) As part of the PARC process for the MOF, it has been determined that Maligya and Fandiema will be resettled due to their proximity to the port or their location within the MOF and long term port footprints, therefore this eliminates any impacts at these receptor locations and they are not considered further by the port noise assessment.
<table>
<thead>
<tr>
<th>District</th>
<th>Village</th>
<th>Number of Households</th>
<th>Total Population</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ile Kakossa (Makaya District)</td>
<td>Koniakhori [3]</td>
<td>20</td>
<td>134</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td></td>
<td>Fokou Fokou [4]</td>
<td>--</td>
<td>--</td>
<td>No description</td>
</tr>
<tr>
<td></td>
<td>Kiban [5]</td>
<td>9</td>
<td>121</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td></td>
<td>Yassoua [5]</td>
<td>43</td>
<td>327</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td></td>
<td>Sèrah [5]</td>
<td>5</td>
<td>129</td>
<td>Predominantly agriculture</td>
</tr>
<tr>
<td>Ile Kaback (Seydouyah District)</td>
<td>Sangbon [6]</td>
<td>--</td>
<td>--</td>
<td>Fishing centre and market</td>
</tr>
</tbody>
</table>

Notes:
[1] Number of households based on GPS house census, July 2011
[2] Total population estimate based on average household size of 6.7 persons (household questionnaire).
[3] Incomplete, includes only houses directly along the road.
[4] Village of Fokou Fokou was not surveyed, comprises approximately 11 huts, which may be seasonally occupied.
[5] Number of households on Ile Kakossa have not been surveyed. Some of the huts may be seasonally occupied.
[6] Number of households in Sangbon have not been surveyed. Some of the huts may be occupied only during market days when people leave or enter Ile Kaback.

8.2.2 Legal and Other Requirements

There are no national standards or guidelines for noise and vibration or blasting in Guinea. In the absence of national standards the assessment has therefore made reference to a range of guidelines including the International Finance Corporation (IFC) General Environmental Health and Safety (EHS) Guidelines and World Health Organization (WHO) Guidelines for Community Noise. A review of noise and vibration regulations, standards and guidance from other countries has also been conducted to inform the development of the evaluation criteria presented in Section 8.2.4. Details are provided in Annex 8B: Noise and Vibration Impact Assessment Criteria and Methodology.

The following RT Standard has also been taken into consideration:

- Rio Tinto HSE E6 – Noise and Vibration Control.

8.2.3 Prediction of Impacts

8.2.3.1 Construction Noise

Bruel & Kjaer’s Predictor V8.01, noise modelling software was used to calculate noise emissions from construction activities utilising the methods identified within British Standard BS5228 [1]. Further details are provided in Annex 8B: Noise and Vibration Impact Assessment Criteria and Methodology.

The following scenarios were modelled for construction:

- earthworks and site preparation including land clearance, materials transportation (light vehicles on public roads and heavy vehicles on dedicated haulage roads between the MOF and other construction areas), site levelling, dredging and associated activities;
- general construction activities such as conveyors assembly, fabrication and erection of structures, installation and commissioning of plant and equipment over all areas; and
- piling of the jetties and export wharf.

(1) BS5228:2009 Noise and Vibration Control on Construction and Open Sites.
Figure 8.1  Emplacements des récepteurs sensibles au bruit / Noise Sensitive Receptor Locations

Agglomération / Settlement
- Chef-lieu de préfecture / Prefecture Chief Town
- Chef-lieu de sous-préfecture / Sub-Prefecture Chief Town
- Village / Village
- Hameau / Hamlet
The following assumptions have been used to calculate noise emissions from the construction phase of the port:

- indicative noise source levels, expressed as sound power levels ($L_{WA}$) have been assumed for teams of construction equipment being spread evenly throughout the site; and

- screening of noise sources by existing on-site structures (e.g. vegetation) has been ignored, so in this respect the predictions represent a worst-case scenario.

Due to the information available regarding construction schedule, timing and details activities, the prediction method does not assess acute noise impacts – such as when construction activities are situated in close proximity to a receptor. It is likely that significant noise impacts will occur at those receptors within close proximity of a construction area or activity, particularly earthworks and piling.

### 8.2.3.2 Operational Noise

Bruel & Kjær's Predictor V8.01, noise modelling software was used to calculate noise levels from port operations utilising the widely used international standard ISO 9613-2 (1) combined with the meteorological effects as determined by the widely accepted CONCAWE (2) calculation method. Noise contours were predicted for four operating scenarios representing the different stages of port operations using noise source data detailed in Annex 8C: Noise Design Assumptions and Source Data.

The typical operational scenario for the port includes the following activities:

- unloading of trains at the car dumper;
- conveying material to the stockyard;
- stacking and reclaiming material from the stockyard;
- conveying the material to the export wharf;
- loading ships; and
- operation of the port.

The following assumptions have been used to calculate noise emissions from the operational phase of the port, for both the daytime and night time periods:

- 95 Mtpa of iron ore production rate (Saleable Ore Product);
- conventional overland conveyors from the stockyard to the port;
- all mobile equipment and fixed processing plant are assumed to achieve the design sound power levels in the noise model (Annex 8C: Noise Design Assumptions and Source Data);
- all acoustically significant plant and equipment operates simultaneously; and
- mobile noise sources, such as dock cranes, forklifts, trucks were modelled at typical locations and assumed to operate in repetitive cycles.

Four alternative meteorological scenarios were modelled as illustrated in Table 8.2.

---


### Table 8.2 Meteorological Conditions for Noise Modelling

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Temperature (°C)</th>
<th>Humidity (%)</th>
<th>Wind Speed (m/s)</th>
<th>Predominant Wind Direction</th>
<th>Pasquill – Gifford Atmospheric Stability Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime / Night time calm conditions</td>
<td>15 - 25</td>
<td>80</td>
<td>--</td>
<td>--</td>
<td>C</td>
</tr>
<tr>
<td>Wet Season / South West wind</td>
<td>20</td>
<td>80</td>
<td>3</td>
<td>225 SW</td>
<td>C</td>
</tr>
<tr>
<td>Dry Season / East wind</td>
<td>25</td>
<td>60</td>
<td>3</td>
<td>90 E</td>
<td>C</td>
</tr>
<tr>
<td>Night Time Temperature Inversion</td>
<td>15</td>
<td>80</td>
<td>0</td>
<td>--</td>
<td>F Class</td>
</tr>
</tbody>
</table>

### 8.2.4 Evaluation of Significance

#### 8.2.4.1 Overview

As discussed in Section 8.2.2 there are no Guinean standards or guidance for noise and vibration and reference is therefore made to international sources. All receptors are considered to be of equal sensitivity and receptor sensitivity is not therefore considered in the analysis.

#### 8.2.4.2 Evaluation of Construction Noise Impacts

A review of international standards and guidelines for construction noise is presented in Annex 8B: Noise and Vibration Impact Assessment Criteria and Methodology. These sources establish noise limits for construction noise at the façade of residential buildings ranging from 35 to 55 dBA at night to 65 - 75 dBA during the daytime.

IFC General EHS Guidelines also provide guidance on acceptable noise levels based on WHO standards and these are set out in Table 8.3.

### Table 8.3 IFC / World Bank Noise Level Guidelines

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Maximum Allowable Ambient Noise Levels, LAeq,1hr, dBA Free field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime</td>
</tr>
<tr>
<td></td>
<td>07:00 – 22:00</td>
</tr>
<tr>
<td>Residential, institutional, educational</td>
<td>55</td>
</tr>
<tr>
<td>Industrial, commercial</td>
<td>70</td>
</tr>
</tbody>
</table>

Source: IFC General EHS Guidelines Table 1.7.1

An LAMax of 85 dBA is a well-accepted action limit for occupational noise management as it is the threshold at which the potential for hearing damage starts to occur.

Based on these standards and guidelines, criteria for evaluating the significance of construction noise impacts are set out in Table 8.4. Different thresholds are set for day time and night time, and according to the duration of the impacts on the basis that short term noise (<1 month) will cause less impact than medium (1 - 6 months) or long term (>6 months) noise.
### Table 8.4 Evaluation Criteria for Construction Noise at Dwellings (façade levels)

<table>
<thead>
<tr>
<th>Operating Period</th>
<th>Daytime Noise Level, LAeq dBA</th>
<th>Night time Noise Level, LAeq dBA</th>
<th>All Periods LAMax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Rating</td>
<td>Not Significant</td>
<td>Minor</td>
<td>Moderate</td>
</tr>
<tr>
<td>Short term exposure</td>
<td>&lt;70</td>
<td>70-75</td>
<td>&gt;75-80</td>
</tr>
<tr>
<td>Medium term exposure</td>
<td>&lt;65</td>
<td>65-70</td>
<td>&gt;70-75</td>
</tr>
<tr>
<td>Long term exposure</td>
<td>&lt;55</td>
<td>55-60</td>
<td>&gt;60-65</td>
</tr>
</tbody>
</table>

### 8.2.4.3 Evaluation of Operational Noise Impacts

In accordance with IFC EHS Guidelines, two aspects of the change in noise climate during operations are considered in the assessment:

- firstly, the overall noise level caused by the port; and
- secondly, the difference between the noise level caused by the port and the background noise level in the environment.

The IFC / WHO guidance summarised in Table 8.3 is used to derive criteria for the first aspect.

For the second, the difference in noise levels can be measured either by considering the change in background noise levels as represented by the LA90 parameter, where IFC guidance indicates that the background level should not increase by more than 3dBA, or by considering the difference between the baseline LA90 and the LAeq from the Project. The latter approach is adopted here as more appropriate for a noise source of a generally continuous nature such as will arise from the Simandou Port, and reference is made in particular to guidance from the New South Wales Industrial Noise Policy and British Standard BS4142 Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas. These indicate that a difference between baseline LA90 and Project LAeq of +5 dBA is of marginal significance; at +10 dBA, complaints are likely (based on western European survey findings), and above this, the likelihood of complaints increases. Further details and full references are provided in Annex 8B: Noise and Vibration Impact Assessment Criteria and Methodology.

Based on these standards and guidelines, the criteria for evaluating the significance of noise impacts are set out in Table 8.5. When assessing the change in background noise levels and where existing noise levels are very low, a minimum baseline noise level of 30 dBA is adopted.
### Table 8.5 Noise Impact Significance for Residential Receptors

<table>
<thead>
<tr>
<th>Period</th>
<th>Daytime Noise Level, dBA</th>
<th>Night time Noise Level, dBA</th>
<th>All periods L'Amax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Significant</td>
<td>Minor</td>
<td>Moderate</td>
</tr>
<tr>
<td>LAeq,1hr</td>
<td>&lt;55</td>
<td>55-60</td>
<td>&gt;60-65</td>
</tr>
<tr>
<td>Increase above background (LAeq minus LA90)</td>
<td>10</td>
<td>&gt;10-15</td>
<td>&gt;15-20</td>
</tr>
</tbody>
</table>

### 8.3 Baseline

The baseline noise environment was determined by monitoring undertaken at the locations shown on Table 8.6. Measurement locations were chosen on the outskirts of settlements to capture the baseline noise level without it being unduly affected by localised sources such as people, vehicles or the movement of animals.

Fixed monitoring stations were used to measure the ambient noise on a continuous basis over a 24 hour period at each site. The noise measurements were taken with an integrating precision sound level meter of type 1 per ICE 651 standard (1979).

The noise surveys were conducted during November 2011 (during the dry season). The meteorological conditions were typical of the dry season, with a high ambient air temperature and low humidity in day time and high at night. The wind was not significant enough to have any impact on the noise measurements.

The baseline data provided to the SEIA was analysed, resulting in hourly LAeq and LA95 parameters, rather than the LA90 parameter, the typical background noise descriptor. Therefore, a standard correction of 1 dB has been applied to convert the measured LA95 noise levels to representative LA90 levels for the purpose of the assessment.

The ambient noise assessment results for each of the noise monitoring stations are summarised in Table 8.7 and Figure 8.3.

Ambient noise characteristics differ according to the villages. For example, wildlife noise from insects, frogs or birds is the predominant noise source in almost every village, with the exception of Ile Matakang. Insect, frog or bird noise is relatively high at higher-frequencies; and is characterised by a noticeable increase of the ambient noise level during the night time. Noise analyses show that the night time sound levels are higher than the daytime sound levels for half of the visited villages. The high night time sound levels are caused by wildlife activity in these villages. During the night time, at times when wildlife noise is not a significant source, typical sound levels are slightly over 40 dBA.

Human activities are reflected in the fluctuating sound levels observed during the daytime, covering a typical range of 25 dBA such as in Ynde and Matakang. In Ynde, the average daytime background sound level (LA95,1hr) was approximately 35 dBA. In Matakang, the average daytime background sound level (LA95,1hr) was approximately 40 dBA, reflecting a higher level of human activity than in Ynde on the day the measurement was taken.
### Table 8.6  Noise Measurement Locations and Characteristics

<table>
<thead>
<tr>
<th>Village</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaléa</td>
<td>Small village, part of Senguelen, along a frequently-used road.</td>
</tr>
<tr>
<td>Kobérato</td>
<td>Small, isolated village surrounded by woodland and shrub grassland.</td>
</tr>
<tr>
<td>Ynde</td>
<td>Large village with a low population density, distributed on each side of a frequently-used road.</td>
</tr>
<tr>
<td>Matakang</td>
<td>Large village with a population of ±3 000, located near the ocean. There are many motorcycles used to reach Ile Kaback.</td>
</tr>
<tr>
<td>Serdia</td>
<td>Small village near the coast with only a few houses.</td>
</tr>
<tr>
<td>Yankalaye</td>
<td>Small village near the coast with only a few houses.</td>
</tr>
<tr>
<td>Youlaya</td>
<td>Small village near the coast with only a few houses.</td>
</tr>
<tr>
<td>Sourkouye</td>
<td>Small village with only a few houses.</td>
</tr>
<tr>
<td>Kibéré</td>
<td>Village with a low population density crossed by a frequently-used road.</td>
</tr>
</tbody>
</table>

### Table 8.7  Summary of Hourly and Daily Noise Levels Measured at Villages

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Date (all measurements 24hr duration)</th>
<th>Hourly Level in Calm Period, dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day (7h00-22h00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LAeq, 1h</td>
</tr>
<tr>
<td>Kaléa</td>
<td>4 Nov. 2011</td>
<td>45</td>
</tr>
<tr>
<td>Kobérato</td>
<td>4 Nov. 2011</td>
<td>43</td>
</tr>
<tr>
<td>Ynde</td>
<td>4 Nov. 2011</td>
<td>45</td>
</tr>
<tr>
<td>Matakang</td>
<td>6 Nov. 2011</td>
<td>48</td>
</tr>
<tr>
<td>Serdia</td>
<td>7 Nov. 2011</td>
<td>47</td>
</tr>
<tr>
<td>Yankalaye</td>
<td>7 Nov. 2011</td>
<td>49</td>
</tr>
<tr>
<td>Youlaya</td>
<td>8 Nov. 2011</td>
<td>45</td>
</tr>
<tr>
<td>Sourkouye</td>
<td>8 Nov. 2011</td>
<td>43</td>
</tr>
<tr>
<td>Kibéré</td>
<td>8 Nov. 2011</td>
<td>45</td>
</tr>
</tbody>
</table>

Source: Social and Environmental Baseline Study (2011)
État initial du bruit du port et emplacement des sites de mesure / The Port Noise Baseline and Measurement Locations

Légende:
- Station de mesure du bruit ambiant / Ambient Noise Measurement Location
- Infrastructures portuaires / Port Infrastructure
- Tracé indiqué de la voie ferroviaire / Indicative Rail Alignment
- Chef lieu de préfecture / Prefecture Chief Town
- Chef lieu de sous-préfecture / Sub-Prefecture Chief Town
- Village / Village
- Hameau / Hamlet
- Route principale / Primary Road
- Route secondaire / Secondary Road
- Route tertiaire / Tertiary Route

Projection: WGS 1984 UTM Zone 29N
8.4 Assessment of Impacts

8.4.1 Overview

This section presents the results of an assessment of impacts from:

- noise during construction; and
- noise during operation.

8.4.2 Noise Impacts during Construction

Noise levels during construction were predicted using the method described in Section 8.2.3. Noise modelling has focused on the noisiest activities which are expected to occur during the initial earthworks and piling phases of construction, and the less intensive general construction activities. It is understood that general construction will take place 24 hours a day 7 days a week. Table 8.8 presents the predicted impacts from construction during the daytime and night time periods from all phases of construction to present the worst case assessment scenario (long term duration). Figures 8.3 to 8.6 present construction activities as noise contours.

### Table 8.8 Construction Noise Impact Assessment

<table>
<thead>
<tr>
<th>Description</th>
<th>Bamboukhoun</th>
<th>Sounganyah</th>
<th>Kiban (Ile Kakossa)</th>
<th>Touguiyiré</th>
<th>Senguelen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>64-54</td>
<td>52-42</td>
<td>30</td>
<td>36</td>
<td>56-48</td>
</tr>
<tr>
<td>Earthworks</td>
<td>65-54</td>
<td>54-45</td>
<td>37</td>
<td>42</td>
<td>57-50</td>
</tr>
<tr>
<td>Piling</td>
<td>45-42</td>
<td>42-36</td>
<td>53</td>
<td>58</td>
<td>48-44</td>
</tr>
<tr>
<td>All</td>
<td>65-55</td>
<td>57-49</td>
<td>53</td>
<td>58</td>
<td>57-55</td>
</tr>
</tbody>
</table>

**Impact Significance – Daytime**

<table>
<thead>
<tr>
<th>Description</th>
<th>Bamboukhoun</th>
<th>Sounganyah</th>
<th>Kiban (Ile Kakossa)</th>
<th>Touguiyiré</th>
<th>Senguelen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Moderate</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Minor</td>
</tr>
<tr>
<td>Earthworks</td>
<td>Moderate</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Minor</td>
</tr>
<tr>
<td>Piling</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Moderate</td>
<td>Not Significant</td>
</tr>
<tr>
<td>All</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Not Significant</td>
<td>Moderate</td>
<td>Minor</td>
</tr>
</tbody>
</table>

**Impact Significance – Night time**

<table>
<thead>
<tr>
<th>Description</th>
<th>Bamboukhoun</th>
<th>Sounganyah</th>
<th>Kiban (Ile Kakossa)</th>
<th>Touguiyiré</th>
<th>Senguelen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Major-Moderate</td>
<td>Minor</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Major</td>
</tr>
<tr>
<td>Earthworks</td>
<td>Major-Moderate</td>
<td>Moderate-Minor</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Major</td>
</tr>
<tr>
<td>Piling</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>Moderate</td>
<td>Major</td>
<td>Minor</td>
</tr>
<tr>
<td>All</td>
<td>Major-Moderate</td>
<td>Moderate-Minor</td>
<td>Moderate</td>
<td>Major</td>
<td>Major</td>
</tr>
</tbody>
</table>

Notes:

[1] As these villages are geographically spread, noise levels and impacts are presented as a range.
[2] Impacts are based on long term exposure.

In the absence of mitigation, based on long term duration:

- **minor to moderate** impacts are expected to occur from construction, earthworks and piling activities during the daytime; and
- **major** impacts are expected from construction, earthworks and piling activities during the night time period.
8.4.3 Noise Impacts during Operation

Noise levels from the operation of the port have been predicted using the method described in Section 8.2.3 for a typical operating scenario. The results are presented as noise contours in Figures 8.7 to 8.10. The noise impacts for the worst meteorological scenario at each of the representative settlements are presented in Table 8.9. It may be noted that the results take into account prevailing winds and occurrence of temperature inversions.

Predicted noise levels from the port have been compared to the impact assessment criteria outlined in Section 8.2.4. Noise impacts are identified at the representative settlements and are summarised according to the impact significance ratings. The results are presented for a typical operational scenario in Table 8.9 and as noise contours in Figures 8.7 to 8.10.

Table 8.9 Impact Assessment at Representative NSR

<table>
<thead>
<tr>
<th>NSR Village</th>
<th>Existing Background Noise Level LA90 [1]</th>
<th>Daytime</th>
<th>Night time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Impact Rating</td>
<td>Impact Rating</td>
</tr>
<tr>
<td>Fesse Madina</td>
<td>32</td>
<td>38</td>
<td>42</td>
</tr>
<tr>
<td>Bamboukhoun</td>
<td>72-55</td>
<td>Major - Minor</td>
<td>Major - Minor</td>
</tr>
<tr>
<td>Touguiyiré</td>
<td>46</td>
<td>Not Significant</td>
<td>Minor</td>
</tr>
<tr>
<td>Senguelen</td>
<td>50</td>
<td>Not Significant</td>
<td>Minor</td>
</tr>
<tr>
<td>Sene</td>
<td>44</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

Notes:
[1] Lowest recorded hourly LA95 noise level has been adopted as baseline noise levels for coastal villages.
[4] The baseline noise levels measured at Kibere have been considered representative of those at Kiban.
[5] These villages are geographically spread; noise levels and impact rating are presented as a range.

8.4.3.1 Daytime Noise Impact Assessment

In the absence of mitigation, noise levels from port operations are expected to exceed the 55 dB(A) LAeq, 1hr specific noise level at the following receptors over the lifetime of the operation resulting in:

- *minor* impacts at Sounganyah; and
- *major* impacts at, Bamboukhoun.

Noise levels from port operations are expected to result in the following impacts during the daytime period from the predicted change in baseline noise levels over the lifetime of the operation:

- *minor* Impacts at the villages of Fesse Madina, Senguelen and Touguiyiré;
- *moderate* and *major* Impacts at the villages of Sounganyah and Bamboukhoun, depending on their proximity to their project.
8.4.3.2 **Night Time Noise Impact Assessment**

In the absence of mitigation, noise levels from port operations are expected to exceed the 45 dB(A) LAeq, 1hr specific noise level during the night time period over the lifetime of the operation causing:

- **minor** impacts at Sene;
- **moderate** impacts at Touguiyiré and Senguelen; and
- **major** impacts at Sounganyah and Bamboukhoun.

Noise levels from port operations are expected to cause the following impacts during the night time from the predicted change in baseline noise levels over the lifetime of the operation:

- **minor** impacts are expected at Touguiyiré, and Senguelen;
- **moderate** and **major** Impacts at the villages of Sounganyah and Bamboukhoun, depending on their proximity to their project.

The significant contributing noise sources at Madinagbé and Fesse Madina are the rail loop, car dumper and to a lesser extent, the overland conveyors. Whereas the villages of Sounganyah and Bamboukhoun are more affected by the noise emitted from the overland conveyors. The villages of Senguelen, Kaléa and Sene are affected by noise from the stockyard, overland conveyor and rail loop. Noise at receptor locations on Ile Kakossa is mainly dominated by the port operations and ship loading.

<table>
<thead>
<tr>
<th>Daytime</th>
<th>Night time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major</strong> impacts will be experienced at:</td>
<td></td>
</tr>
<tr>
<td>• Bamboukhoun; and</td>
<td></td>
</tr>
<tr>
<td>• Sounganyah.</td>
<td></td>
</tr>
<tr>
<td><strong>Minor</strong> impacts will be experienced at:</td>
<td></td>
</tr>
<tr>
<td>• Senguelen;</td>
<td></td>
</tr>
<tr>
<td>• Touguiyiré;</td>
<td></td>
</tr>
<tr>
<td>• Madinagbé;</td>
<td></td>
</tr>
<tr>
<td>• Fesse Madina (South);</td>
<td></td>
</tr>
<tr>
<td>• Kiban (Ile Kakossa); and</td>
<td></td>
</tr>
<tr>
<td>• Sene.</td>
<td></td>
</tr>
<tr>
<td><strong>Major</strong> impacts will be experienced at:</td>
<td></td>
</tr>
<tr>
<td>• Bamboukhoun; and</td>
<td></td>
</tr>
<tr>
<td>• Sounganyah.</td>
<td></td>
</tr>
<tr>
<td><strong>Moderate</strong> impacts will be experienced at:</td>
<td></td>
</tr>
<tr>
<td>• Touguiyiré; and</td>
<td></td>
</tr>
<tr>
<td>• Senguelen.</td>
<td></td>
</tr>
<tr>
<td><strong>Minor</strong> impacts will be experienced at:</td>
<td></td>
</tr>
<tr>
<td>• Sene.</td>
<td></td>
</tr>
</tbody>
</table>
Figure 8.4

Courbe du bruit de construction du port, travaux de terrassement / Port Construction Noise Contours, Earthworks

Infrastructures portuaires / Port Infrastructure
Tracé indicatif de la voie ferrée / Indicative Rail Alignment
Dépôt terminus (indicatif) / Railhead Yard (indicative)
Agglomération / Settlement
Chef-lieu de préfecture / Prefecture Chief Town
Chef-lieu de sous-préfecture / Sub-Prefecture Chief Town
Village / Village
Hameau / Hamlet
Route principale / Primary Road
Route secondaire / Secondary Road
Route tertiaire / Tertiary Route

Légende:

Courbe de bruit (dBA) / Noise Contours (dBA)
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
>80

0 2 kilomètres

Projection: WGS 1984 UTM Zone
Date: 18/09/2012

Client: RioTinto
Taille: A4
Projet: 0131299
Echelle: Comme Barre d'échelle

Vérifié par: RL
Approuvé par: KR

Infrastructures portuaires / Port Infrastructure
Tracé indicatif de la voie ferrée / Indicative Rail Alignment
Dépôt terminus (indicatif) / Railhead Yard (indicative)
Agglomération / Settlement
Chef-lieu de préfecture / Prefecture Chief Town
Chef-lieu de sous-préfecture / Sub-Prefecture Chief Town
Village / Village
Hameau / Hamlet
Route principale / Primary Road
Route secondaire / Secondary Road
Route tertiaire / Tertiary Route

Légende:

Courbe de bruit (dBA) / Noise Contours (dBA)
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
>80

0 2 kilomètres
Figure 8.5
Courbe du bruit de construction du port, empilement / Port Construction Noise Contours, Piling
Figure 8.6
Courbe du bruit de construction du port, toutes sources / Port Construction Noise Contours, All Sources

Projection: WGS 1984 UTM Zone
File: 0131299SimandouGIS_IG_CK\Maps\ERM\Noise\Port\Option_A\po_A_Noise_ConstructionAllSources.mxd

Date: 18/09/2012
Vérifié par: RL
Approuvé par: KR
Projet: 0131299
Echelle: Comme Barre d’échelle

Infrastructures portuaires / Port Infrastructure
Tracé indicatif de la voie ferrée / Indicative Rail Alignment
Depôt terminus (indicatif) / Railhead Yard (Indicative)
Chef lieu de préfecture / Prefecture Chief Town
Chef lieu de sous-préfecture / Sub-Prefecture Chief Town
Village / Village
Hameau / Hamlet
Route principale / Primary Road
Route secondaire / Secondary Road
Route tertiaire / Tertiary Route

Légenda: Courbe de bruit (dBA) / Noise Contours (dBA)
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
>80

0 2
kilomètres
Figure 8.7

Courbe du bruit de l'exploitation du port, conditions calmes / Port Operation Noise Contours, Calm Conditions

Projection: WGS 1984 UTM Zone

Client: Rio Tinto

Date: 18/09/2012

Vérifié par: RL

Approuvé par: KR

Projet: 0131299

Échelle: Comme Barre d'échelle

Infrastructures portuaires / Port Infrastructure
Tracé indicatif de la voie ferrée / Indicative Rail Alignment
Dépôt terminus indicatif / Railhead Yard (Indicative)
Agglomération / Settlement
Chef-lieu de préfecture / Prefecture Chief Town
Chef-lieu de sous-préfecture / Sub-Prefecture Chief Town
Village / Village
Hameau / Hamlet
Route principale / Primary Road
Route secondaire / Secondary Road
Route tertiaire / Tertiary Route

Courbe de bruit (dBA) / Noise Contours (dBA)
35-40
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
>80
Figure 8.8
Courbe du bruit de l'exploitation du port, inversion de température / Port Operation Noise Contours, Temperature Inversion
Figure 8.9

Courbe du bruit de l'exploitation du port, vent d'Est 3m/s / Port Operation Noise Contours, East Winds 3m/s

Projection: WGS 1984 UTM Zone

Infrastructures portuaires / Port Infrastructure
Tracé indicatif de la voie ferrée / Indicative Rail Alignment

Agglomération / Settlement
Chef-lieu de préfecture / Prefecture Chief Town
Chef-lieu de sous-préfecture / Sub-Prefecture Chief Town
Village / Village
Hameau / Hamlet
Route principale / Primary Road
Route secondaire / Secondary Road
Route tertiaire / Tertiary Route

Légende:

Courbe de bruit (dBA) / Noise Contours (dBA)
35-40
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
>80

Client: RioTinto
Taille: A4

Date: 18/09/2012
Verifié par: RL
Projet: 0131209
Dessiné par: WB
Approuvé par: KR
Échelle: Comme Barre d'échelle

0 2
kilomètres

File: 0131209SimandouGIS_IG_CK\Maps\ERM\Noise\Port\Option_A\po_A_Noise_EastWind.mxd
Figure 8.10

Courbe du bruit de l'exploitation du port, vent de Sud Ouest 3m/s

Port Operation Noise Contours,
South West Winds 3m/s

Projection: WGS 1984 UTM Zone

Date: 18/09/2012

Client: RioTinto

Taille: A4

Échelle: Comme Barre d'échelle

Page 8
8.5 Mitigation Measures and Residual Impacts

Measures to mitigate significant impacts are discussed under the headings of:

- construction noise; and
- operational noise.

Additional measures for protection of wildlife are identified in Chapter 12: Terrestrial Biodiversity and Chapter 13: Marine and Littoral Biodiversity.

8.5.1 Mitigation of Construction Noise Impacts

To minimise potential impacts arising from the construction of the port, noise controls will be implemented during construction activities, wherever impacts are identified.

The following reasonable and practical measures will be considered during the detailed design process (having due regard for operational health and safety constraints) in developing ways to minimise the potential of unreasonable noise during the construction of the port.

- Locate mobile plant (e.g., compressors, generators) and other noisy construction plant such as concrete batching as far as practicable away from the nearest potential sensitive receptors.

- Noisy construction activities will be carried out during daylight hours, as far as is practicable.

- Where it is necessary for such activities to be carried out outside daylight hours the residents of nearby villages will be notified in advance.

- Direct principal noise sources (e.g., exhausts) away from noise-sensitive places as far as possible.

- Fitting of equipment with effective and properly maintained noise suppression equipment consistent with the requirements of the activity, where possible.

- Ensure equipment utilised is maintained and operated as per manufacturers’ specifications.

- The noise level of audible warning devices will be kept to the minimum necessary for the health and safety of employees.

- Noise performance will be considered in the selection of equipment and vehicles in accordance with Rio Tinto’s Buy Quiet Policy.

- Refine construction noise predictions (as necessary) once a construction methodology for detailed design has been determined and implement and manage further controls through development of a Construction Noise Management Plan which will form part of the Social and Environmental Management Plan (refer to Volume V: Social and Environmental Management Plan).

Impacts arising from piling operations in particular are relatively widespread and the following strategy will be undertaken to specifically manage and minimise impacts from piling: Piling operations will be managed and minimised through monitoring of noise levels to validate predictions and implementation of additional mitigation if and where noise limits are being exceeded.

After the process of validating the impacts through the detailed design phase, the overall mitigation strategy will call on a range of potential methods to reduce impact where applicable including:

- use of alternative piling methods;
- lower drop heights or energy levels for piling hammers;
- use of piling shrouds;
• temporary barriers or hoardings;
• re-scheduling the piling to a daytime period where possible; and
• temporary resettlement during the period of affectation where all reasonable engineering and management methods have been exhausted.

Implementation of the above is expected to:

• identify residual major impacts and where mitigation is deemed to be unfeasible; and
• reduce major and moderate impacts.

If, following the application of the required mitigation measures set out above it is considered that where major noise impacts will result at settlements, further consultation will be undertaken with the affected settlements and consideration will be given to the temporary relocation of these receptors during the period the impact is present.

With effective implementation of the mitigation strategies, major impacts should be eliminated and moderate impacts reduced to minor. Some moderate impacts may remain at properties in close proximity to construction works.

8.5.2 Mitigation of Operational Noise Impacts

The assessment has identified the potential for minor, moderate and major noise impacts during operation at some nearby settlements and during the port operation.

Minor impacts will be managed by adoption of good site practices during operation including:

• locating significant noise generating plant and equipment as far from the nearest potential sensitive receptors as possible, orienting it to direct emissions away from receptors as far as possible, and using on-site structures and terrain to screen sensitive locations wherever practicable;
• development of specifications for the noise emissions from conveyors, conveyor drives, stackers, reclaimers, locomotives, and rolling stock;
• operating strict speed limits for all vehicles moving around the port area and maintaining road surfaces to avoid increases in noise from vehicles travelling over uneven ground;
• regular maintenance of noisy equipment and vehicles in accordance with manufacturers specifications to prevent increases in noise emissions; and
• considering noise performance in the selection of equipment and vehicles in accordance with Rio Tinto’s Buy Quiet Policy.

During completion of the detailed design and prior to each new phase of operations, the predictions presented here will be verified with updated data on scheduling of activities and the locations and specifications for equipment, to confirm the need for mitigation of impacts. Monitoring will also be undertaken to determine actual noise levels during operation. If predictions or monitoring indicate that moderate or more significant impacts will occur at any dwellings, consideration will be given to the design of mitigation measures including:

• relocating noise sources so that there is no direct line of sight between the source and receptors;
• selection of alternative lower noise equipment;
• installation of noise shielding on noisy sources such as conveyors, conveyor drives; and
• use of noise barriers (berms or fences) located between the noise source and the receptor.

If avoidance of moderate impacts is not feasible using these measures, consideration will be given to the option of relocating the affected community. This will be explored in consultation with the affected people.
and will be planned and implemented in accordance with the Project Framework for Land Acquisition, Resettlement and Compensation (the PARC Framework). Further details are provided in Chapter 20: Land Use and Livelihoods.

With these measures the Project will ensure that impacts from operation of the port are of no more than *minor* significance.

### 8.5.3 Residual Impacts

#### 8.5.3.1 Noise Impacts During Construction

As outlined in Section 8.2.1 as part of the PARC process for the MOF, it has been determined that Maligya and Fandiema will be resettled due to their proximity to the port or their location within the port footprint, and would hence eliminate any impacts at these receptor locations.

Consequently, without development of suitable mitigation measures, the villages of Senguelen, Bamboukhoun and Touguiyiré are expected to experience *major* impacts during the night time and *moderate* impacts during the daytime. The impacts at Senguelen, Bamboukhoun are due to general construction activities, whereas piling is the dominant contributing noise source at Touguiyiré.

Temporary resettlement, where feasible or desirable, of the affected areas of villages will eliminate *major* impacts. Where resettlement (temporary or permanent) is not feasible, identification of noise impacts through monitoring, implementation of the SEMP would ensure that noise impacts are minimised.

#### 8.5.3.2 Noise Impacts During Operation

Significant impacts predicted to occur at the port are based on:

- exceedances of noise thresholds during the daytime at Sounganyah, Bamboukhoun;

- increase in background noise levels during the daytime at all NSR's;

- exceedances of noise thresholds during the night time at all NSR's except Fesse Madina, Kiban and Sene; and

- increase in background noise levels during the night time at, Sounganyah, Bamboukhoun, Senguelen and Touguiyiré.

The increase in daytime background noise levels and exceedance of the night time threshold levels at the identified NSRs impacted are primarily due to their proximity to either the rail loop and car dumper (Fesse Madina) or the overland conveyors and ship loading areas. The predicted noise levels vary slightly over the life of the Project, mainly due to the slight variations in operations and meteorological conditions that enhance noise propagation.

The increase in background noise levels is more prevalent during the daytime period as background noise levels in the coastal regions are higher during the night time, however, exceedance of the IFC threshold levels are the primary indicator of the predicted impacts.

Resettlement of Fandiema and Maligya and the affected receptors of Bamboukhoun and Sounganyah within 100 metres of the overland conveyor in those villages will eliminate these impacts. Optimisation of the conveyor alignment and design will minimise the impacts at those NSRs outside the 100 metre clearance zone from the conveyor in the villages of Sounganyah and Bamboukhoun. Similarly, optimisation of the design and layout of the car dumper and transfer conveyors will minimise impacts predominantly at Souguesegni, Senguelen and Fesse Madina. This design optimisation process will have some minor noise reductions at Sene and Touguiyiré. Implementation of these mitigation measures and the residual noise impacts are summarised in Table 8.10. At this stage, it is not possible to clearly understand the reduction achieved by any single mitigation measure or design change. During the detailed design phase iterative
modelling of combinations of mitigation measures will to evaluate the reduction achieved from the overall
design, rather than the individual reductions achieved by each design change.
### Table 8.10 Residual Impact Assessment - Operation

<table>
<thead>
<tr>
<th>NSR Village</th>
<th>Existing Background Noise Level LA90 [1]</th>
<th>Daytime</th>
<th>Night time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted Port Noise Level LAeq, 1hr [2]</td>
<td>Impact Rating</td>
<td>Impact Rating</td>
</tr>
<tr>
<td></td>
<td>Specific Noise Level</td>
<td>Change in Baseline [3]</td>
<td>Specific Noise Level</td>
</tr>
<tr>
<td></td>
<td>Predicted Port Noise Level LAeq, 1hr [2]</td>
<td>Change in Baseline [3]</td>
<td></td>
</tr>
<tr>
<td>Fesse Madina</td>
<td>32 38</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>67-55</td>
<td>Major - Minor</td>
<td>Major - Minor</td>
</tr>
<tr>
<td></td>
<td>58-47</td>
<td>Moderate - Not Significant</td>
<td>Moderate - Not Significant</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Kiban [4]</td>
<td>42</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Touguliyre</td>
<td>45</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>53</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Senguelen</td>
<td>47</td>
<td>Not Significant</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>52</td>
<td>Not Significant</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sene</td>
<td>42</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

Notes:
1. Lowest recorded hourly LA9S noise level has been adopted as baseline noise levels for coastal villages.
2. Worst case scenario noise level from prevailing winds and temperature inversion.
3. Assessment of the change in background noise (Port Specific LAeq, 1hr – LA90).
4. The baseline noise levels measured at Kibere have been considered representative of those at Kiban.
5. These villages are geographically spread, noise levels are presented as a range, and the highest impact rating.
6. Major residual impacts are expected for receptors within 200m of the conveyor without partial resettlement, residual rating reflects resettlement and other measures as required to achieve moderate.

There are no other significant noise impacts on people. As noted in Section 8.1 impacts on animals are discussed in Chapter 12: Terrestrial Biodiversity and Chapter 13: Marine and Littoral Biodiversity.
8.6 Summary of Findings

Noise and vibration impacts from construction and operation of the Simandou Port are presented in Table 8.11 and Table 8.12.

8.6.1 Construction

To minimise potential impacts arising from the construction of the port, noise controls will be implemented during high noise generating activities, or when construction activities are required to be undertaken outside of the daytime working hours.

Implementation of the SEMP or restricting works to daytime hours would ensure that noise impacts are minimised.

As part of the PARC process for the MOF, it has been determined that Maligya and Fandiema will be resettled due to their proximity to the MOF or their location within the MOF and port footprint, and would hence eliminate any impacts at these receptor locations.

Consequently, without suitable mitigation, the villages of Senguelen, Bamboukhoun and Touguiyiré are expected to experience major impacts during the night time and moderate impacts during the daytime. The impacts at Senguelen, Bamboukhoun are due to general construction activities, whereas piling is the dominant contributing noise source at Touguiyiré.

Temporary resettlement of the affected areas of villages will eliminate major impacts. Where resettlement (temporary or permanent) is not feasible, having considered factors such as practicality, cost, community views and expectations, or deemed appropriate, identification of noise impacts through monitoring and implementation of the SEMP will be required to ensure that noise impacts are minimised.

Table 8.11 Impact Assessment Summary – Construction

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Pre Mitigation Significance Rating</th>
<th>Dominant Source(s) and Key Mitigation</th>
<th>Residual Impact Significance Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Night</td>
<td></td>
</tr>
<tr>
<td>Fesse Madina</td>
<td>Not Significant</td>
<td>Not Significant</td>
<td>n/a</td>
</tr>
<tr>
<td>Bamboukhoun</td>
<td>Moderate</td>
<td>Major</td>
<td>General Construction and Earthworks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sounganyah</td>
<td>Not Significant</td>
<td>Minor</td>
<td>General Construction and Earthworks</td>
</tr>
<tr>
<td>Maligya</td>
<td>Minor</td>
<td>Major</td>
<td>General Construction and Earthworks</td>
</tr>
<tr>
<td>Kiban</td>
<td>Not Significant</td>
<td>Moderate</td>
<td>Piling</td>
</tr>
</tbody>
</table>
8.6.1.1 Operation

Resettlement of specifically affected NSRs identified by monitoring will eliminate impacts where reduction of the noise source is not feasible. Design optimisation during the detailed design phase will minimise impacts at other receptors. Noise monitoring upon commencement of operations will validate any further impacts which will be managed in accordance with the SEMP and Resettlement plan.

### Table 8.12 Impact Assessment Summary – Operation

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Pre Mitigation Significance Rating</th>
<th>Dominant Source(s) and Key Mitigation</th>
<th>Residual Impact Significance Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Night</td>
<td>Resettlement of identified major impacts</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Resettlement of identified major impacts and source reductions (&gt; 5 dB) or reduction in duration</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Rail loop noise barrier</td>
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<td></td>
<td></td>
<td></td>
<td>Partial Resettlement</td>
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<td>Partial Resettlement</td>
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<td></td>
<td>MOF, shipping Design Optimisation, SEMP</td>
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<td>MOF, shipping Design Optimisation, SEMP</td>
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<td></td>
<td>Overland conveyor, MOF Design Optimisation, SEMP</td>
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<td></td>
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<td></td>
<td>Overland conveyor</td>
</tr>
</tbody>
</table>

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**Receptor**

- **Pre Mitigation Significance Rating**
  - Day
  - Night

- **Dominant Source(s) and Key Mitigation**
  - Conveyors, rail loop, car dumper
  - Rail loop noise barrier
  - Partial Resettlement
  - Overland conveyor
  - Partial Resettlement
  - MOF, shipping Design Optimisation, SEMP
  - MOF, shipping Design Optimisation, SEMP
  - Overland conveyor, MOF Design Optimisation, SEMP
  - Overland conveyor
  - Conveyor Optimisation