Hagler Bailly Pakistan

DIGBY WELLS ENVIRONMENTAL

Appendix D: Noise Assessment

Hagler Bailly Pakistan

Environmental and Social Impact Assessment of Reko Diq Mining Project

Noise Study

Final Report

HBP Ref.: D4NS9RKI

January 21, 2025

Reko Diq Mining Company

Quetta

Executive Summary

Barrick Gold Corporation (hereafter Barrick) through its subsidiary Reko Diq Mining Company (RDMC), in a Joint Venture partnership with the Government of Pakistan and the Government of Balochistan, is completing a feasibility study for the Reko Diq Mining Project (also referred to as the 'Project') in the western part of Balochistan Province of Pakistan. As part of the feasibility study, an Environmental and Social Impact Assessment (ESIA) has been conducted, including specialist studies. The ESIA will be part of the environmental permitting process and will provide a basis for the integration of environmental and social considerations into the Project design. RDMC appointed Digby Wells Environmental (hereafter Digby Wells) and Hagler Bailly Pakistan Pvt. Ltd (hereafter HBP) to carry out the proposed environmental and social studies and permitting process for the Project. This Specialist Report presents baseline soil and sediment quality where the Project facilities will be situated, potential Project related impacts on soil and sediments measures that will be implemented to mitigate the impacts and monitoring that will be carried out to assess the effectiveness of mitigation.

The Project is a Copper-Gold mining operation with an onsite processing plant to produce a high-quality copper-gold concentrate (the Concentrate) that will be exported for final processing into various products. The current Life-of-Mine (LoM) is 38 years in terms of defined resources (resources that have been identified already) with significant exploration upside.

The construction phase is anticipated to take approximately 40 months, including pre-stripping. The mine will be a truck-and-shovel open pit mining operation with processing facilities that include crushing, grinding, and flotation. The final Concentrate will be railed to Port Qasim for final export by ship.

The mine will be developed in two phases, Phase 1 is expected to have a capacity of 45 Mt per annum (Mtpa) and Phase 2 is expected to have a combined processing capacity of 90 Mtpa. Phase 1 operations are anticipated to commence towards the end of 2027 and Phase 2 operations in 2030.

Baseline Noise Levels

The noise monitoring was carried out at 17 different locations along various Project components spanning in Sindh and Balochistan provinces of Pakistan. These included noise monitoring at 2 locations at the Reko Diq Mine Site, 2 locations along the Road Transport Route, 12 locations along the Rail Transport Route, and 1 location at Port Qasim to assess the baseline conditions prior to construction and operations of the proposed Project.

The baseline noise levels exceeded the limits prescribed in National Environmental Quality Standards (NEQS), Sindh Environmental Quality Standards (SEQS), and International Finance Corporations (IFC) General Environmental Health and Safety (EHS) Guidelines for both daytime and nighttime averaging periods at most of the locations. The results of noise monitoring along with their comparison with the

applicable limits are provided in **Section 5** of the Noise Study. A brief description of the common source contributing towards the elevated baseline noise levels is provided below:

- *Reko Diq Mine Site:* High-speed winds over 8 m/s and dust storms were the primary sources of elevated baseline noise levels at the Reko Diq Mine Site. Other noise sources at this component included vehicular movement at National Highway 40 (N-40).
- *Road Transport Route:* The common noise sources along the Road Transport Route included high-speed winds, ongoing construction activities, and vehicular movement, primarily Heavy Transport Vehicles (HTV) movement for cross-border trade.
- *Rail Transport Route:* Elevated noise levels along the Rail Transport Route were predominantly associated with movement of railway traffic. As the railway track is parallel to roads at most of the locations, elevated noise levels along the Rail Transport Route can also be attributed with vehicular movement.
- *Port Qasim:* Elevated noise levels within the Port Qasim can be attributed with industrial operations within the port area as well as vehicular movement for staff commute and material movement.

Impact Assessment

The following impacts were assessed as part of this Noise Study:

- Noise generated from construction of the Reko Diq Mine Site
- Noise generated during road transportation
- Impulse noise from blasting
- Elevated noise levels due to operations of the mining equipment
- Occupational health and safety
- Elevated noise levels due to movement of additional railway traffic
- Noise generated during decommissioning activities, and
- Impact on noise levels due to changing climate

For assessing noise-related impacts from the Reko Diq Mine Site, the onsite accommodation and Humai settlement were selected as sensitive receptors while the onsite personnels were taken as receptors for assessing Occupational Health and Safety (OHS) impacts. Most of the impacts were either minor or negligibly significant due to the receptors located at relatively large distances, more than 10 km from the proposed location of open-pit. Therefore, the elevated noise levels from the construction and operations of Reko Diq Mine Site will not be perceptible to the receptors at Humai settlement, while these will be barely perceptible to the receptors at onsite accommodation camp. A screening of noise-related impacts is provided in **Section 6** while the detailed impact assessment is provided in **Section 7** of the Noise Study.

Key Recommendations

Key recommendations of the Noise Study are provided below.

- Noise protection PPEs will be provided to the onsite personnel for working near the equipment having high noise levels (>85 dBA). The exposure periods of the staff will also be reduced while working near high noise equipment to reduce the potential of noise-induced illness.
- Workers will be provided with noise protection if their occupational areas are within 3,000 m distance from the location of explosives detonation.
- Along the Rail Transport Route, continuous noise monitoring will be conducted at sensitive receptors to ensure that noise levels remain within the applicable limits. In case of any exceedances, Pakistan Railways will be consulted to assess noise control/mitigation options for reduction of noise levels.

The proposed mitigation measures are listed in detail as part of the Environmental and Social Management Plan (see **Section 8**) and the associated noise monitoring requirements are provided in the Monitoring Plan (see **Section 9**).

Acronyms

BEQS	Balochistan Environmental Quality Standards
CFR	Code of Federal Regulations
DWE	Digby Wells Environmental
EHS	Environmental, Health, and Safety
ESIA	Environmental and Social Impact Assessment
FRA	Federal Railroad Administration
HBP	Hagler Bailly Pakistan
HTV	Heavy Transport Vehicles
IFC	International Finance Corporation
NEQS	National Environmental Quality Standards
RDMC	Reko Diq Mining Company
SEQS	Sindh Environmental Quality Standards

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Appendices

Exhibits

1. Introduction

Reko Diq Mining Company (RDMC), a joint venture between Barrick Gold Corporation (hereafter Barrick), the Government of Pakistan and the Government of Balochistan, is undertaking a feasibility study for the Reko Diq Mining Project (also referred to as the 'Project') in the western part of Balochistan province of Pakistan. As part of the feasibility study, an Environmental and Social Impact Assessment (ESIA) has been conducted, including a number of detailed specialist studies. The ESIA forms part of the environmental permitting process and will provide a basis for the integration of environmental and social considerations into the Project design. RDMC appointed Digby Wells Environmental (hereafter Digby Wells) and Hagler Bailly Pakistan Pvt. Ltd (hereafter HBP) to carry out the proposed environmental and social studies and permitting process for the Project.

This report details the baseline noise levels recorded for all components of the Project, including the mine site, road transport route and port facility. The potential Project related impacts on noise levels, possible mitigation measures and monitoring have also been investigated and recorded below.

1.1 Objectives

The objectives of this Specialist Study were to:

- Establish and assess pre-Project baseline noise levels for the various Project components including the Reko Diq Mine Site, Road Transport Route, Rail Transport Route, and Port Qasim through primary data collection.
- Compare the baseline noise levels with applicable noise limits prescribed in Pakistan national legislation as well as international standards to assess potential exceedances by the various components of the Project.
- Determine potential Project-related impacts on receptors.
- Provide mitigation measures, along with monitoring and reporting requirements, for various phases of the Project to ensure that the noise impacts are mitigated or managed.

2. Project Description

The Project is a Copper-Gold mining operation with an onsite processing plant to produce a high-quality copper-gold concentrate (the Concentrate) that will be exported for final processing into various products. The current Life-of-Mine (LoM) is 38 years in terms of defined resources (resources that have been identified already) with significant exploration upside.

The construction phase is anticipated to take approximately 40 months, including pre-stripping. The mine will be a truck-and-shovel open pit mining operation with processing facilities that include crushing, grinding, and flotation. The final Concentrate will be railed to Port Qasim for final export by ship.

The mine will be developed in two phases, Phase 1 is expected to have a capacity of 45 Mt per annum (Mtpa) and Phase 2 is expected to have a combined processing capacity of 90 Mtpa. Phase 1 operations are anticipated to commence in 2028 and Phase 2 operations in 2030.

2.1 Reko Diq Mine Site and Associated Facilities

Exhibit 2.1 provides an overview of the RDMS and the major proposed infrastructure.

The core infrastructure that will be established at the RDMS includes:

- Two main pits, Western Porphyry and Tanjeel (**Exhibit 2.1**). The mining method of these pits will be a 24-hour open-pit shovel and truck operation;
- Two designated Waste Rock Dumps (WRD) for the waste rock from the Western Porphyries pit. The Tajeel Pit will have a separate WRD in its proximity.
- Tailings storage facility (TSF).
- A processing plant.

2.1.1 Supporting Infrastructure

The proposed supporting infrastructure at the RDMS includes:

- Several sources for power supply will be utilised for the Project. The Project's estimated peak power requirements will be 183 megawatts (MW) in Phase 1 and 348 MW in Phase 2:
  - Diesel generators during the early works and construction phases until the establishment of the Heavy Fuel Oil (HFO) power station;
  - A Solar Photovoltaic (PV) system with an installed capacity of 183 MW in Phase 1 and 384 MW in Phase 2;
  - It is anticipated that the Project's energy requirements will be met through a grid connection from Year 15 (operational phase).
- Diesel, HFO and other sources of fuel will be railed to the site from Port Qasim and stored in bunded contained atmospheric tanks at the designated storage areas.

- Accommodation Facility to provide on-site accommodation for all employees and contractors;
- Security infrastructure;
- Waste management facilities:

2.1.2 Water Supply and Management

Water for the Construction Phase, Phase 1 and Phase 2 of the Project will be sourced from a sedimentary groundwater system located approximately 70 km to the northwest of the mining area referred to as the Northern Groundwater System (**Exhibit 2.1**). The system represents a small and isolated part of a much larger basin and there are no communities or community water sources located within the proposed borefield and its area of influence.

Water in the system is saline and challenging to access, and as such is not suitable for human consumption or most agricultural or industrial uses without significant treatment and abstraction infrastructure. There are currently no planned developments or users of the target groundwater system, and the scope of the Project would not preclude future use of the broader basin by others. Independent international best practice environmental and social impact assessment and hydrogeological studies, using physical surveying and remote sensing techniques, have demonstrated that there are no surface expressions of the groundwater system and no known dependent biodiversity.

This groundwater system is considered capable of enabling development and sustaining operation of the Project, which is expected to add significantly to the socio-economic advancement within the region and country through employment, infrastructure, and services.

2.2 Transport and Marine Port

The Project will use the existing road and rail networks to transport materials during construction and operational phases and utilise the air transportation option for personnel. The main Project transport routes (Road Transport Route and Rail Transport Route) are shown in **Exhibit 2.2**.

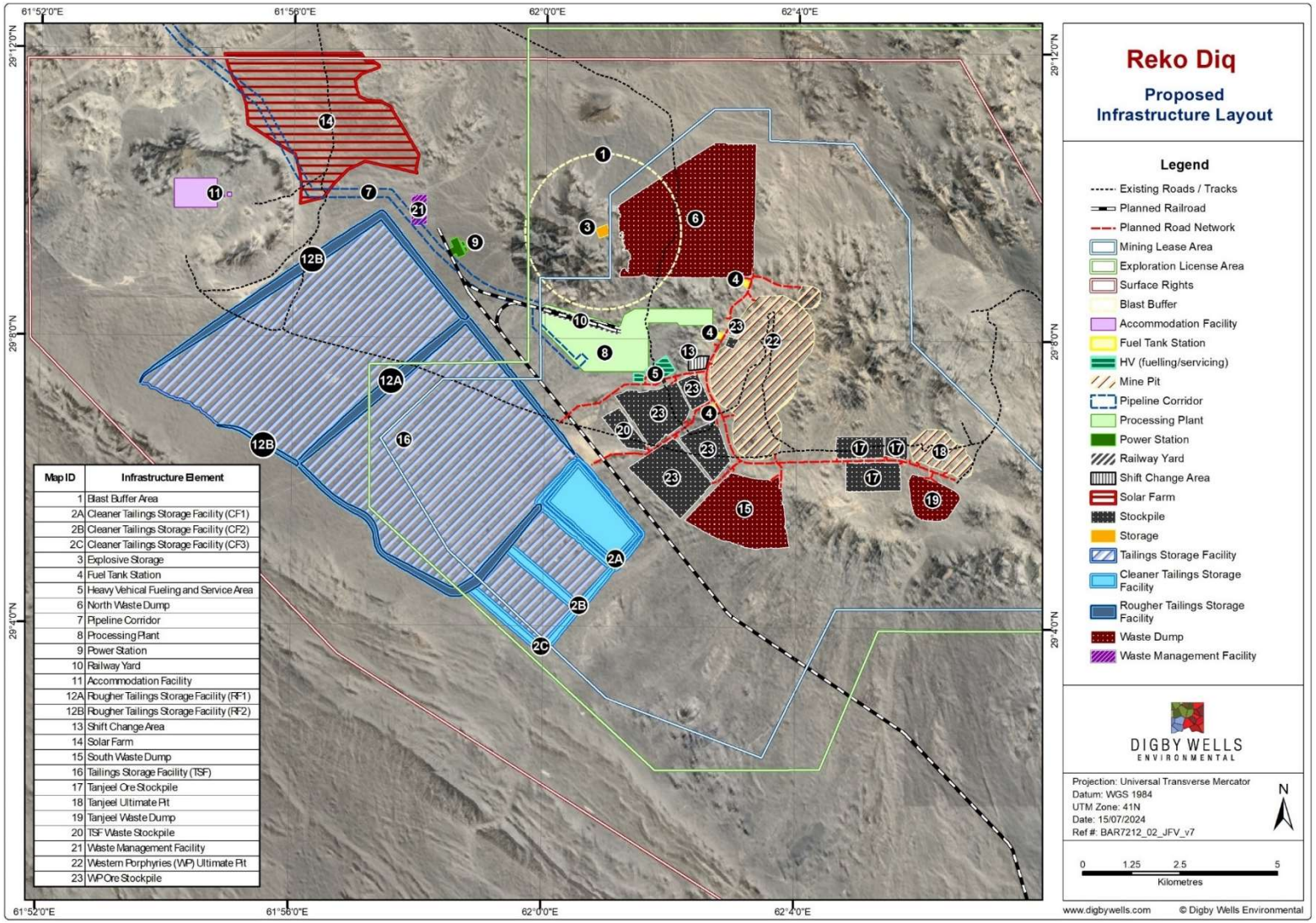
2.2.1 Transport of Concentrate to Port Qasim

The Concentrate will be transported from the RDMS processing plant to Port Qasim via an existing railway line, passing through the Balochistan and Sindh provinces. The existing rail route is approximately 1,350 km in length as outlined in **Exhibit 2.2**.

The Project will make use of the existing PIBT Terminal where all facilities are owned and operated by PIBT. An area will be leased to RDMC for the construction of a Concentrate storage shed.

An extract of the onshore and offshore layout is shown in **Exhibit 2.4**.

Exhibit 2.1: Proposed Reko Diq Mine Site Layout



Map ID	Infrastructure Element
1	Blast Buffer Area
2A	Cleaner Tailings Storage Facility (CF1)
2B	Cleaner Tailings Storage Facility (CF2)
2C	Cleaner Tailings Storage Facility (CF3)
3	Explosive Storage
4	Fuel Tank Station
5	Heavy Vehical Fueling and Service Area
6	North Waste Dump
7	Pipeline Corridor
8	Processing Plant
9	Power Station
10	Railway Yard
11	Accommodation Facility
12A	Rougher Tailings Storage Facility (RF1)
12B	Rougher Tailings Storage Facility (RF2)
13	Shift Change Area
14	Solar Farm
15	South Waste Dump
16	Tailings Storage Facility (TSF)
17	Tanjeel Ore Stockpile
18	Tanjeel Ultimate Pit
19	Tanjeel Waste Dump
20	TSF Waste Stockpile
21	Waste Management Facility
22	Western Porphyries (WP) Ultimate Pit
23	WP Ore Stockpile

Exhibit 2.2: Reko Diq Spatial Extent and Transport Routes (Rail Transport Route and Road Transport Route)

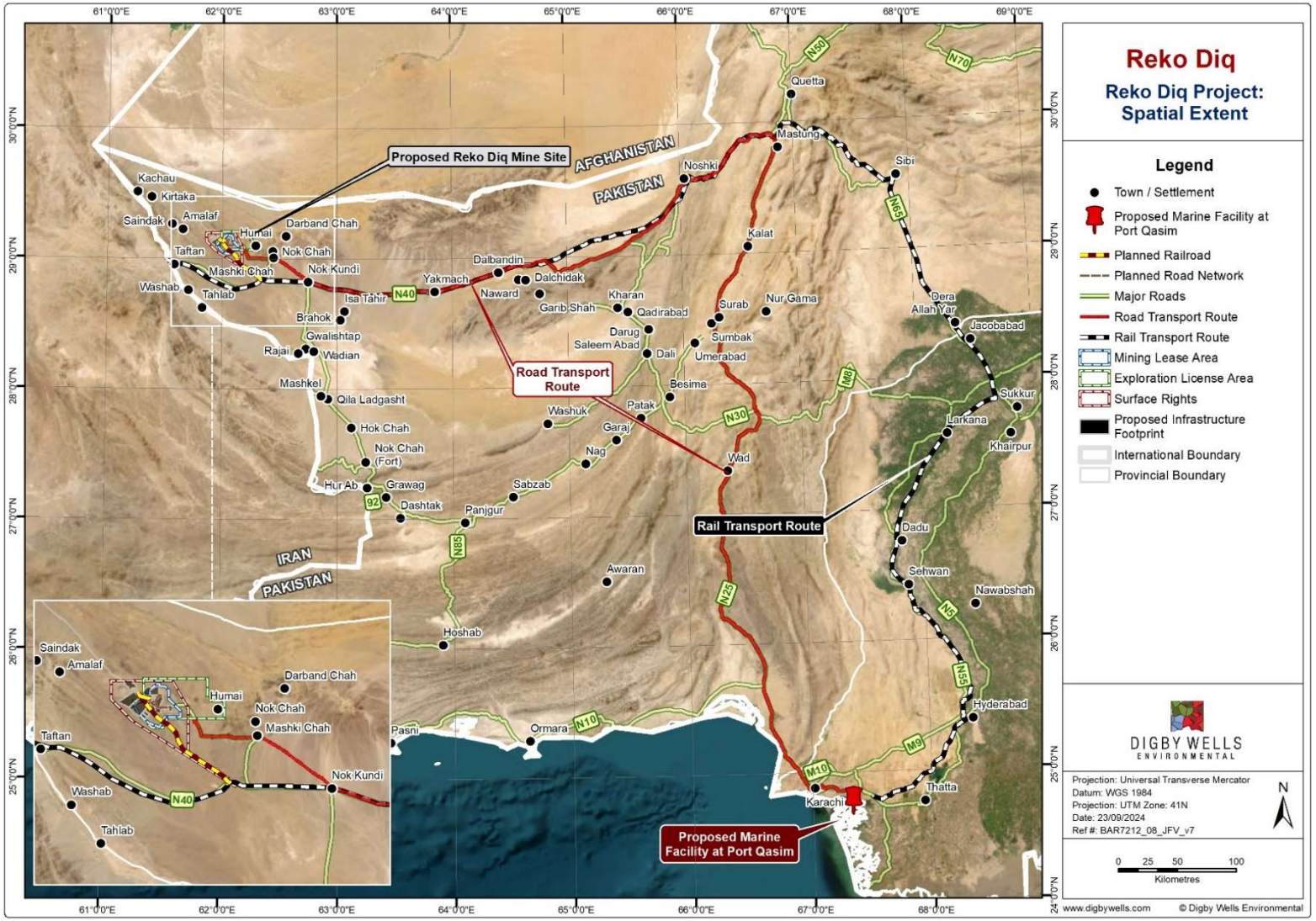


Exhibit 2.3: Proposed Rail Yard Layout at Port Qasim

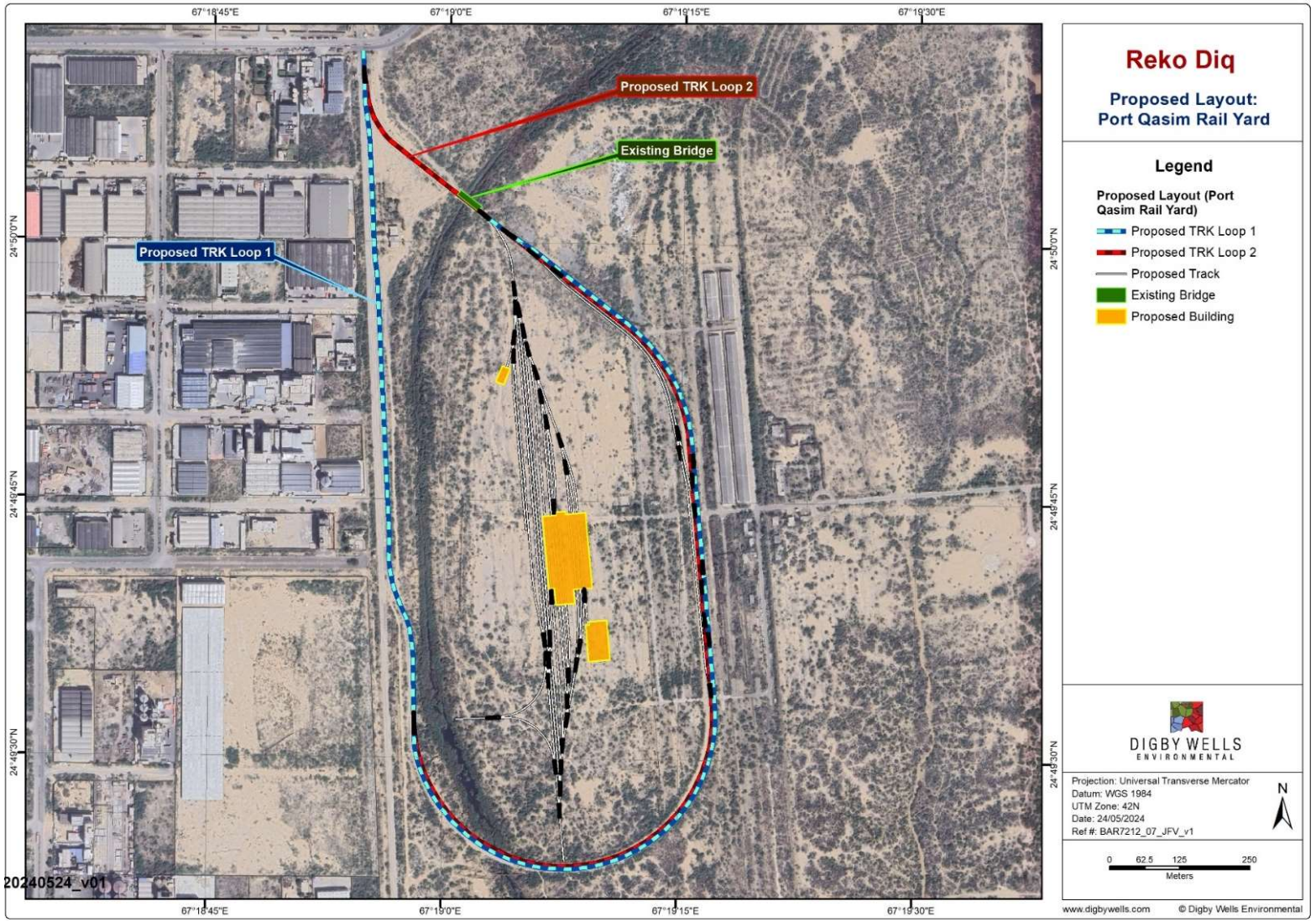
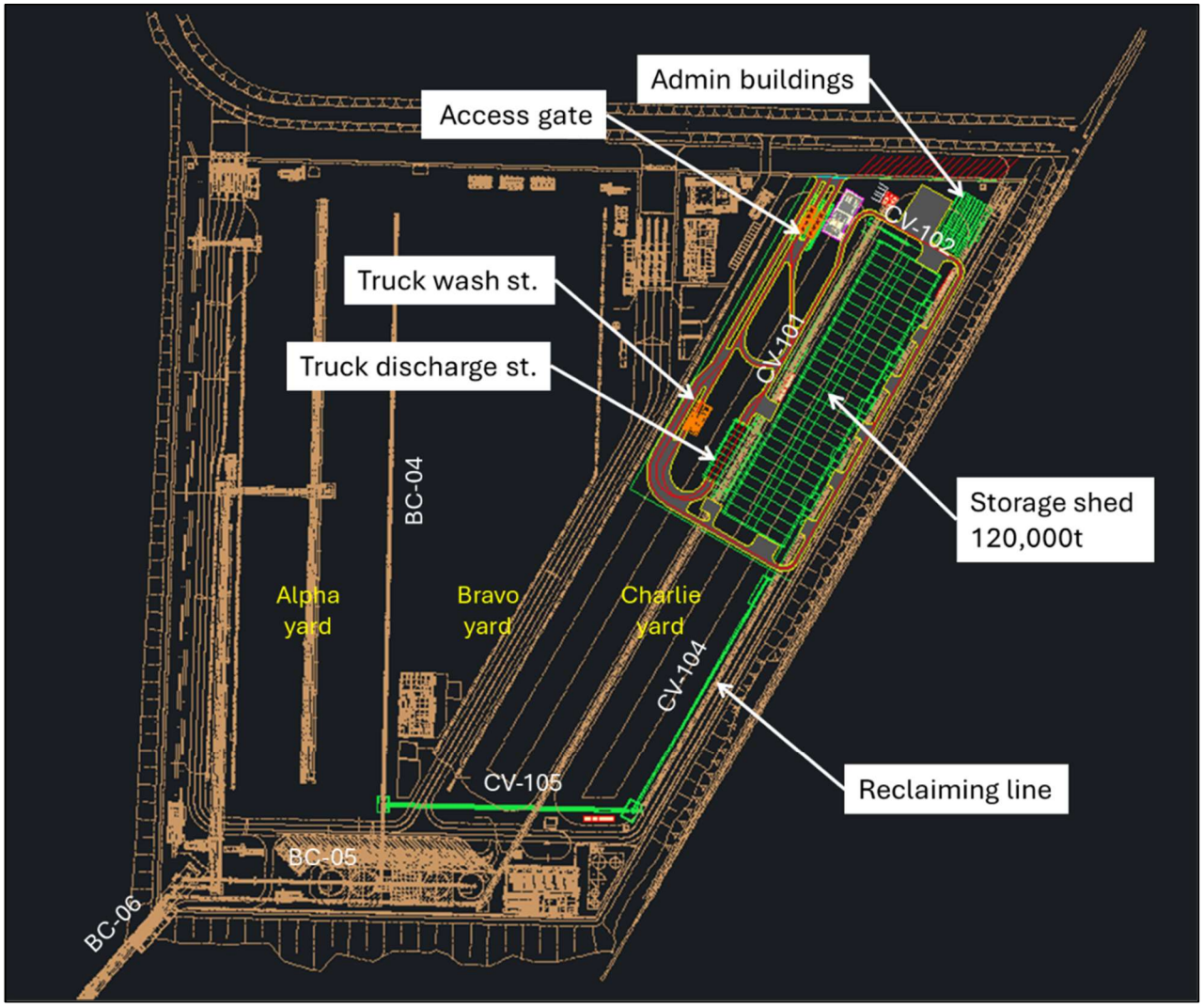


Exhibit 2.4: Layout of Concentrate Facilities at PIBT at Port Qasim



3. Legislative and Regulations Framework

Exhibit 3.1 provides the list of applicable legislations, guidelines and standards which have been taken as reference for assessment of the noise levels.

Exhibit 3.1: Applicable Legislations and International Guidelines

Legislation or Guidelines	*Applicability to Project Component*	*Description and Relevance*
Provincial and National Legislations		
National Environmental Quality Standards (NEQS), 2000*	♦ Reko Diq Mine Site ♦ Road Transport Route (Balochistan Section) ♦ Rail Transport Route (Balochistan Section)	The NEQS prescribe daytime and night-time noise limits for residential, commercial, industrial receptors, and silent zones. According to NEQS, the daytime period is 6 am to 10 pm while the night-time period is 10 pm to 6 am.
Sindh Environmental Quality Standards (SEQS), 2016	♦ Rail Transport Route (Sindh Section) ♦ Port Qasim	The SEQS prescribe daytime and night-time noise limits for residential, commercial, industrial receptors, and silent zones. The SEQS are applicable for all the receptors located within the provincial jurisdiction of Sindh province. According to SEQS, the daytime period is 6 am to 10 pm while the night-time period is 10 pm to 6 am.
International Guidelines and Standards		
IFC General EHS Guidelines, 2007	♦ Reko Diq Mine Site ♦ Road Transport Route ♦ Rail Transport Route ♦ Port Qasim	The IFC General EHS Guidelines prescribe noise limits for residential and industrial receptors.
United States Federal Railroad Administration (49 CFR 201.12 (b))	♦ Rail Transport Route	Used as a guideline for evaluation of noise from train pass-by as there were no relevant national legislations at the time of writing.

*At the time of this writing, the Balochistan Environmental Quality Standards, 2020 were in the draft phase and their formal notification was awaited. Therefore, according to Section 42 sub-section 5 of the Balochistan Environmental Protection Act, 2012, the NEQS will remain applicable until the BEQS are formally notified. When the implementation of BEQS will be notified, the NEQS will be repealed within the provincial jurisdiction of the Balochistan province.

4. Methodology

This section provides the methodology for the collection of ambient noise level data to establish a baseline and the assessment of impacts for all components of the Reko Diq Mine Project including the Road Transport Route and Rail Transport Route

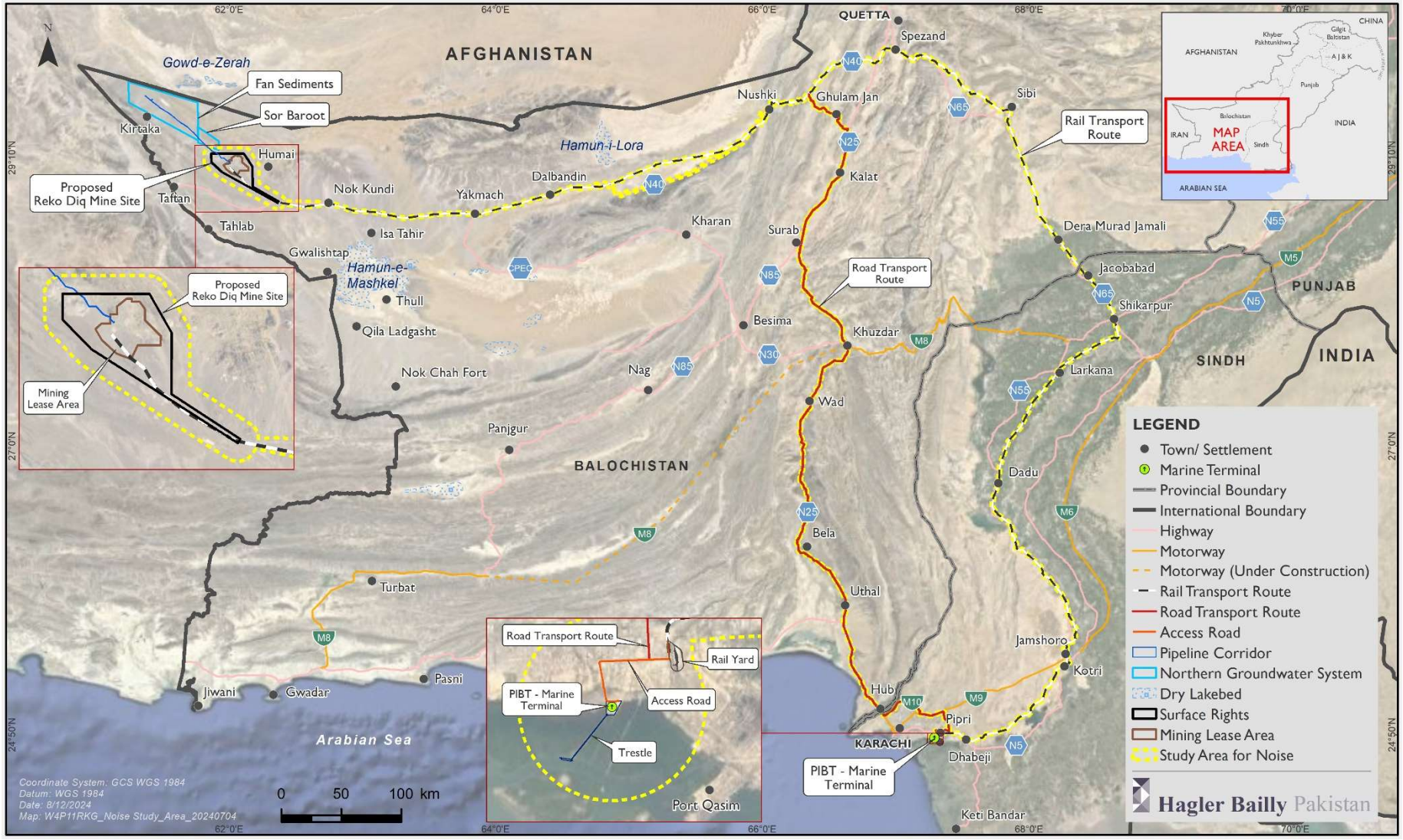
4.1 Overview of Study Area

A Study Area was delineated, taking into consideration receptors potentially affected by the Project related activities, to determine the scope for baseline data collection and the subsequent impact assessment. **Exhibit 4.1** delineates the Noise Study Area which included a buffer area of 5 kilometres (km) around the proposed Reko Diq Mine Site, a 1 km buffer along the Road Transport Route and Rail Transport Route, and a 4 km buffer around the Port Qasim.

An increase in the noise levels due to pipeline construction from the Northern Groundwater System to the Mine Site is not anticipated. This is due to the receptor located at relatively large distances (>15 km) from this pipeline. The impacts will also be minimal as they will be temporary and will last for during the construction phase. Due to this, noise levels were not monitored along the Northern Groundwater System which includes Sor Baroot and Fan Sediments.

The noise levels along the Road Transport Route were monitored at locations where the Project's contribution to traffic levels would be the highest. These locations include Nok Kundi and Dalbandin. Noise levels at some sections of the Road Transport Route were not monitored as these sections are extensively used by other industries and local communities. Thus, the Project's contribution to increased noise levels at these locations would be minimal.

Exhibit 4.1: Map of Noise Study Areas along Reko Diq Mine Site and Project Components



4.2 Scheduling

The baseline data was collected through field surveys to assess the baseline conditions within the Noise Study Area. The field surveys were carried out at the Project Components in the Balochistan and Sindh provinces. The primary data was collected using monitoring equipment and carried out over a series of field studies as follows:

- *Round 1:* The surveys completed under this round, referred to as the '2020 Surveys', were carried out between August 24, 2020, and August 27, 2020. The information collected in this round was reported in the 2020 Tanjeel ESIA (HBP, 2020), which includes data related to the noise levels at the proposed Reko Diq Mine Site and the access road to the Mine Site.
- *Round 2:* These surveys, referred to as '2022 Surveys', were completed as part of the Reko Diq Mining Project ESIA between September 12, 2022, and October 14, 2022. The information collected in this round included data related to the noise levels near the Road Transport Route from Nok Kundi and Dalbandin.
- *Round 3:* The surveys completed under this round, referred to as '2023 Surveys', were carried out between October 09, 2023, and November 15, 2023. The surveys included monitoring of noise along the Rail Transport Route from the Mine Site to Port Qasim.

4.3 Primary Data Collection

The section outlines the methodology for the preparation of the baseline, and the findings of the survey carried out in preparation of the ESIA for the Reko Diq Mining Project. The details include the noise monitoring locations, the methodology followed, and the equipment used for collections of baseline data at the proposed Reko Diq Mine Site and associated facilities.

4.3.1 Noise Monitoring Locations

Noise levels were monitored at 18 locations in 2020, 2022 and 2023 to assess the baseline noise levels at various Project Components in the Balochistan and Sindh provinces. **Exhibit 4.2**, presents a summary of the noise monitoring locations throughout the different surveys and their rationale for selection and **Exhibit 4.3** provides the map of noise monitoring locations. **Exhibit 4.4** through **Exhibit 4.7** provide the photograph of noise monitoring at Reko Diq Mine Site, Road Transport Route, Rail Transport Route, and Port Qasim.

Exhibit 4.2: Noise Monitoring Locations and Rationale for Selection

ID	*Location*	*Project Component*	*Time of Survey*	*Monitoring Round*	*Coordinates*	*Province*	*Rationale for Site Selection*
N1	Mine Area	Reko Diq Mine Site	August 24, 2020, to August 25, 2020, (24 hours)	Round 1	29°08'52.40"N 62°06'49.00"E	Balochistan	To assess the baseline noise conditions at the Mine Area.
N2	Access Road to Reko Diq Mine Site	Reko Diq Mine Site	August 25, 2020, to August 26, 2020, (24 hours)	Round 1	28°50'35.20"N 62°24'57.90"E	Balochistan	At the access road to Reko Diq from N-40..
N3	Nok Kundi	Road Transport Route	September 24, 2022, to September 25, 2022 (24 hours)	Round 2	28°49'06.32"N 62°46'21.54"E	Balochistan	At N-40 near Nok Kundi to assess the baseline noise levels from the traffic movement along the road that will be used for the Project–related transportation. The point was monitored simultaneously with a traffic count.
N4	Dalbandin	Road Transport Route	September 26, 2022, to September 27, 2022 (24 hours)	Round 2	28°53'59.89"N 64°26'14.43"E	Balochistan	At National Highway (N40) near Dalbandin to assess the baseline noise levels from the traffic movement along the road that will be used for the Project–related transportation. The point was monitored simultaneously with a traffic count.
N13	Nushki	Rail Transport Route	October 22, 2023 to October 23, 2023 (24 hours)	Round 3	29°31'55.28"N 66°2'57.506"E	Balochistan	To assess the baseline noise level at Nushki settlement before the Project.
N14	Spezand	Rail Transport Route	October 21, 2023 to October 21, 2023 (15 hours)	Round 3	29°58'35.83"N 67°1'07.360"E	Balochistan	To assess the baseline noise along the Rail Transport Route that passes through Spezand before the Project. The point was monitored simultaneously with a traffic count.
N15	Sibi	Rail Transport Route	October 19, 2023 to October 20, 2023 (24 hours)	Round 3	29°32'41.20"N 67°52'12.59"E	Balochistan	To monitor the baseline noise level at Sibi along Rail Transport Route before the Project.
N16	Dera Murad Jamali	Rail Transport Route	October 18, 2023 to October 19, 2023 (24 hours)	Round 3	28°33'08.90"N 68°13'03.29"E	Balochistan	At Dera Murad Jamali to assess the baseline noise levels from the traffic movement along the railway that will be used for the Project–related transportation.

ID	*Location*	*Project Component*	*Time of Survey*	*Monitoring Round*	*Coordinates*	*Province*	*Rationale for Site Selection*
N17	Jacobabad	Rail Transport Route	October 16, 2023 to October 17, 2023 (24 hours)	Round 3	28°14'23.58"N 68°28'14.81"E	Sindh	To monitor the baseline noise level at Jacobabad along Rail Transport Route before the Project. The point was monitored simultaneously with a traffic count.
N18	Shikarpur	Rail Transport Route	October 16, 2023 to October 17, 2023 (24 hours)	Round 3	27°56'20.60"N 68°38'51.60"E	Sindh	To monitor the baseline noise level at Shikarpur along Rail Transport Route before the Project.
N19	Larkana	Rail Transport Route	October 13, 2023 to October 14, 2023 (24 hours)	Round 3	27°34'36.27"N 68°13'23.86"E	Sindh	To monitor the baseline noise level at Larkana along Rail Transport Route before the Project.
N20	Dadu	Rail Transport Route	October 15, 2023 to October 16, 2023 (24 hours)	Round 3	26°44'41.36"N 67°46'34.40"E	Sindh	To monitor the baseline noise level at Dadu along Rail Transport Route before the Project.
N21	Jamshoro	Rail Transport Route	October 13, 2023 to October 14, 2023 (24 hours)	Round 3	25°26'31.10"N 68°16'58.19"E	Sindh	To assess the baseline noise from the railway tracks at Jamshoro that passes between Dadu and Kotri.
N22	Kotri	Rail Transport Route	October 12, 2023 to October 13, 2023 (24 hours)	Round 3	25°20'46.99"N 68°15'32.95"E	Sindh	To monitor the baseline noise level at Kotri along Rail Transport Route before the Project.
N23	Pipri	Rail Transport Route	October 09, 2023 to October 10, 2023 (24 hours)	Round 3	24°50'43.17"N 67°20'18.05"E	Sindh	At Port Qasim Railway track in Pipri settlement to assess the baseline noise levels before the Project.
N24	Dhabeji	Rail Transport Route	October 10, 2023 to October 11, 2023 (24 hours)	Round 3	24°47'35.69"N 67°31'24.50"E	Sindh	At Port Qasim Railway track in Dhabeji to assess the baseline noise levels before the Project. The point was monitored simultaneously with a traffic count.
N25	Marine Facility – Port Qasim	Port Qasim	October 11, 2023 to October 12, 2023 (24 hours)	Round 3	24°49'41.56"N 67°18'24.56"E	Sindh	At North-Western Industrial Zone of Port Qasim to assess the baseline noise levels before the Project. The point was monitored simultaneously with a traffic count.

Notes: Noise monitoring at Spezand was carried out for fifteen hours only due to security concerns.

Exhibit 4.3: Study Area with Noise Monitoring Locations

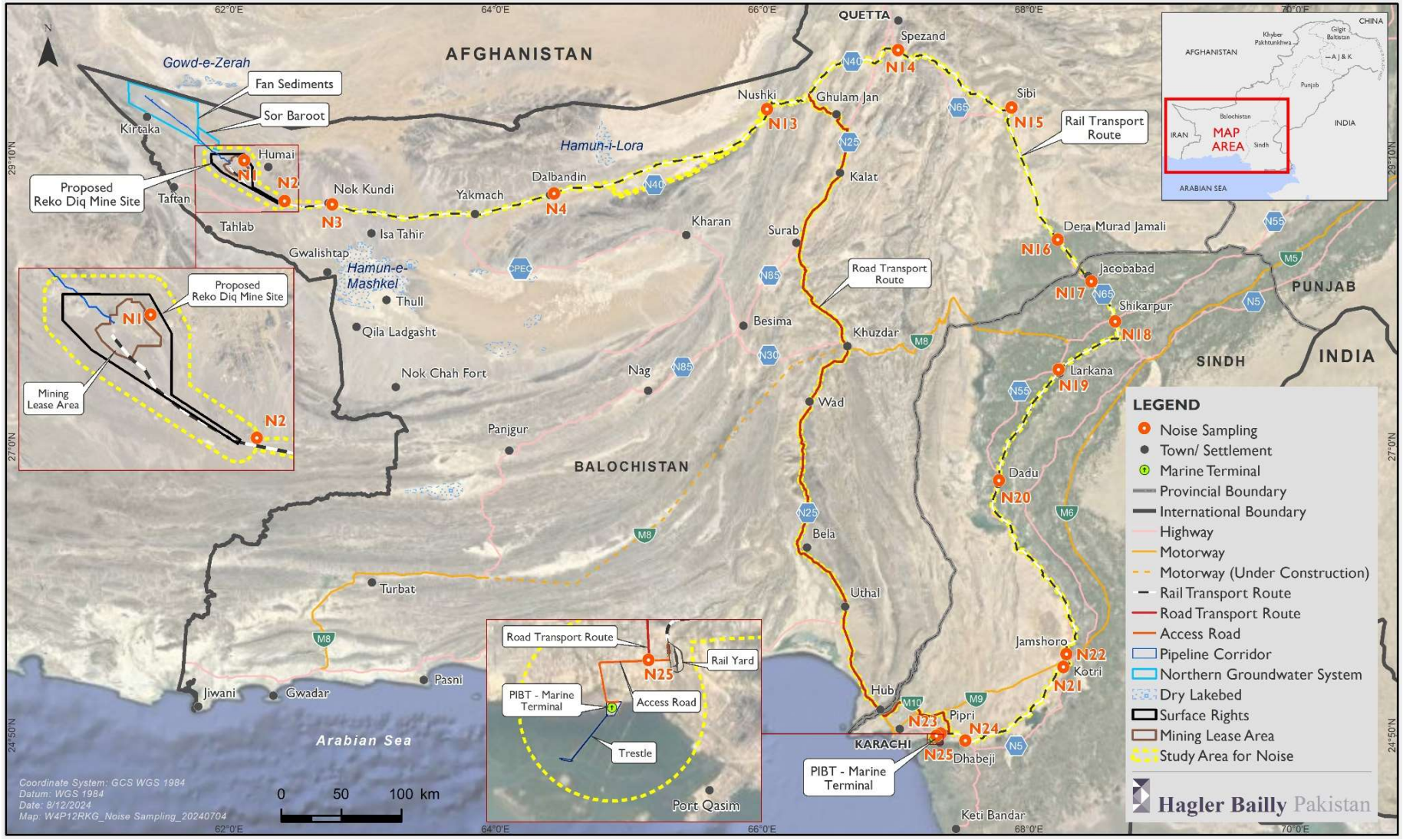


Exhibit 4.4: Photographs of Noise Monitoring at Reko Diq Mine Site

Noise meter installed at N1

Noise meter installed at N2

Exhibit 4.5: Photographs of Noise Monitoring along Road Transport Route

Noise meter installed at N3

Noise meter installed at N4

Exhibit 4.6: Photographs of Noise Monitoring along Rail Transport Route

Noise meter installed at N13

Noise meter installed at N14

Noise meter installed at N15

Noise meter installed at N16

Noise meter installed at N17

Noise meter installed at N18

Noise meter installed at N21

Noise meter installed at N22

Noise meter installed at N23

Noise meter installed at N24

Exhibit 4.7: Photographs of Noise Monitoring at Port Qasim

Noise meter installed at N25

4.3.2 Methodology of Noise Monitoring

A Cirrus Research® plc sound level meter (model: CR 1720) was used for the measurement of noise levels. The equipment has a time history data rate of 10 milliseconds (ms), 62.5 ms, 100 ms, 125 ms, 250 ms, ½ sec, 1 sec, and 2 secs respectively, with a resolution of 0.1 dB. The equipment complies with the international standards IEC 61672-1:2013, IEC 61672-1:2002, IEC 60651:2001, IEC 60804:2000, IEC 61252:1993, ANSI S1.4 -1983 (R2006), ANSI S1.43 - 1997 (R2007) and ANSI S1.25:1991.

The equipment was calibrated using the Cirrus Research plc acoustic calibrator (model: CR:514) at the beginning of each measurement. The equipment was mounted on a tripod at a height of ~ 1.5 m to avoid any surface reflecting fluxes in the surrounding and a

windshield was used in all the measurements. In order to avoid any reflections from the surrounding vertical surfaces, the equipment was installed at ~5 m distance from the nearby reflective surfaces. The monitoring activity at each location was carried out continuously over a 24-hour period for averaging noise levels based on day and night-time with a temporal resolution of 1 sec. Noise monitoring was carried out for a reduced period of 15 hours at Spezand due to security considerations.

National Environmental Quality Standards (NEQS) and Sindh Environmental Quality Standards (SEQS) for noise were used to compare the LAeq recorded over day and night-time periods. The day and night-time noise limits prescribed in the NEQS and SEQS are the same for the residential, commercial, and industrial areas. Daytime hours designated as between 6:00 am to 10:00 pm in NEQS and SEQS. Night-time hours are designated as between10:00 pm to 6:00 am in NEQS and SEQS.

IFC General EHS Guidelines were used to compare the hourly noise levels observed at each monitoring location. Daytime hours are designated as between7:00 am to 10:00 pm and night-time hours are designated as between10:00 pm to 7:00 am in the IFC General EHS Guidelines.

4.4 Impact Assessment

The impact assessment methodology used for the Project involves two phases, namely an impact identification and impact assessment. Impact identification was performed using an input-output model, whereby Project activities are superimposed onto the environmental and social baseline characteristics of the project area to generate assessment outputs in the form of instances of potential positive or negative biophysical and socio-economic changes in the environment. A numerical assessment of the significance of potential Project-induced impacts was done as follows:

$$Significance = Consequence \times Probability$$

Whereby

$$Consequence = Type\ of\ Impact \times (Intensity + Spatial\ Scale + Duration)$$

And

$$Probability = Likelihood\ of\ an\ Impact\ Occurring$$

In addition, the formula for calculating consequence:

$$\textbf{Type of Impact}\ (Nature) = +\mathbf{1}\ (Positive\ Impact)\ or\ -\mathbf{1}\ (Negative\ Impact)$$

The weight assigned to the various parameters for positive and negative environmental, social and cultural heritage impacts is provided for in the formula and is presented in **Exhibit 4.8** with the impact significance ratings described in **Exhibit 4.9**.

Exhibit 4.8: Impact Assessment Parameter Ratings

Rating	*Intensity*		*Spatial scale*	*Duration (duration of an impact without mitigation)*	*Probability (over the life of the project)*
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*			
5	Significant impact on the environment. Irreparable and irreplaceable damage to highly valued species, habitat or ecosystem. Persistent severe damage. Irreparable and irreplaceable damage to highly valued items of great cultural significance or complete breakdown of social order.	Significant improvement to livelihoods and living standards of a large percentage of population, as well as significant increase in the quality of the receiving environment.	Global Contribute to global impact	Inter -Generational >20 years	Certain / Definite There are sound evidence-based reasons to expect that the impact will definitely occur (90-100%)
4	Serious long-term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of significance.	On-going and widespread positive benefits to local communities which improves livelihoods, as well as a positive improvement to the receiving environment. Average to intense social benefits to some people. Average to intense environmental enhancements.	Regional Will affect the entire province or region. A broad geographical area distinguished by similar features.	Long term 5-20 years	Likely The impact may occur (50-90%)
3	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of significance.	Average, on-going positive benefits, not widespread but felt by some.	Sub-regional Will affect the sub-regional / commune area e.g. district level/ areas within the region with similar features	Medium term 2 to 5 years	Probable Has occurred here or elsewhere and could therefore occur (20-50%)

Rating	*Intensity*		*Spatial scale*	*Duration (duration of an impact without mitigation)*	*Probability (over the life of the project)*
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*			
2	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of significance.	Average, on-going positive benefits, not widespread but felt by some.	Local Extending across the site and to nearby settlements. Sub-division of a district.	Short term Up to 2 years	Unlikely Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur (5-20%)
1	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly repairable. Functions and processes not affected	Low positive impacts experience by very few of population.	Site Specific Limited to the site and its immediate surroundings.	Immediate Hours to weeks but less than 1 month	Rare / improbable Conceivable, but only in extreme circumstances and / or has not happened during lifetime of the Project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures (1-5%).

Exhibit 4.9: Probability Consequence Matrix

Probability	Significance																								
5	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75
4	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60
3	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45
2	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30
1	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15
	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15
	Consequence																								

Exhibit 4.10: Significance Threshold Limits

Score	*Description*	*Rating*
57 to 75	A very beneficial impact which may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change.	Major (positive)
39 to 56	A beneficial impact which may help to justify the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	Moderate (positive)
20 to 38	An important positive impact. The impact is insufficient by itself to justify the implementation of the Project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment.	Minor (positive)
3 to 19	A small positive impact. The impact will result in medium to short term effects on the social and/or natural environment.	Negligible (positive)
-3 to -19	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the social and/or natural environment. The impacts are reversible and will not result in the loss of irreplaceable aspects.	Negligible (negative)
-20 to -38	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the social and/or natural environment.	Minor (negative)
-39 to -56	A serious negative impact which may prevent the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects. The impacts may result in the irreversible damage to irreplaceable environmental or social aspects should mitigation measures not be implemented.	Moderate (negative)
-57 to -75	A very serious negative impact which may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts will be irreplaceable and irreversible should adequate mitigation and management measures not be successfully implemented.	Major (negative)

4.5 Assumptions, Exclusions, and Limitations

Key limitations associated with the data collection are listed below.

- Noise monitoring at N-14 (Spezand) was carried out for fifteen hours only due to security concerns.

5. Baseline Description

This section describes the noise levels monitored at the Reko Diq Mine Site and Project components along with an assessment with the applicable limits prescribed in provincial, national legislative framework and international guidelines and standards. Noise data collected in the 2020, 2022, and 2023 Surveys is presented in **Appendix A**.

5.1 Reko Diq Mine Site

Exhibit 5.1 presents the noise monitoring results and comparison with NEQS for day and night-time periods. **Exhibit 5.2** and **Exhibit 5.3** shows the hourly compliance with IFC General EHS Guidelines. The description of general trends in the noise levels and their comparison with NEQS is provided below.[1]

- *N1 – Mine area:* Noise levels at N1 exceeded the daytime and night-time noise limits prescribed in the NEQS for residential areas. The elevated noise levels at this location are primarily attributed to high-speed winds (called '*Gorek*' in the local language) that are in the range of 6-8 meters per second (m/s) blowing in the area.
- *N2 – Access Road:* Noise levels at the N2 remained within the daytime noise limits prescribed in the NEQS for commercial areas.[2] The night-time noise levels monitored at this location exceeded the noise limits prescribed in NEQS for commercial areas. The high noise levels recorded at night-time were associated with vehicular movement and high-speed winds.

The description of general trends in the hourly noise levels and their comparison with IFC General EHS Guidelines is provided below:

- *N1 – Mine Area:* Noise levels at N1 monitoring locations remained within the limits prescribed in IFC General EHS Guidelines from 2 pm till 12 am. The hourly noise levels exceeded the prescribed limits between 1 am and 1 am. Elevated noise levels during these hours were due to prevailing high-speed winds in the area.
- *N2 – Access Road:* The noise levels at N2 remained within the daytime and night-time limits prescribed in IFC General EHS Guidelines for commercial areas except at 8 am. High noise levels exceeding the prescribed limits at 8 am were due to increased movement of traffic and high-speed winds.

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1 At the time of noise monitoring, the Project facilities or human dwellings were not present at the noise monitoring locations along Reko Diq Mine Site. Therefore, the applicability of noise limits for commercial or residential limits for assessing exceedances was based on the future planned facilities. For example, the access road was not present at the time of noise monitoring, however, the location was selected based on Project layout to present the planned roads. For assessment of exceedance, noise levels at this location were compared with limits for commercial areas.

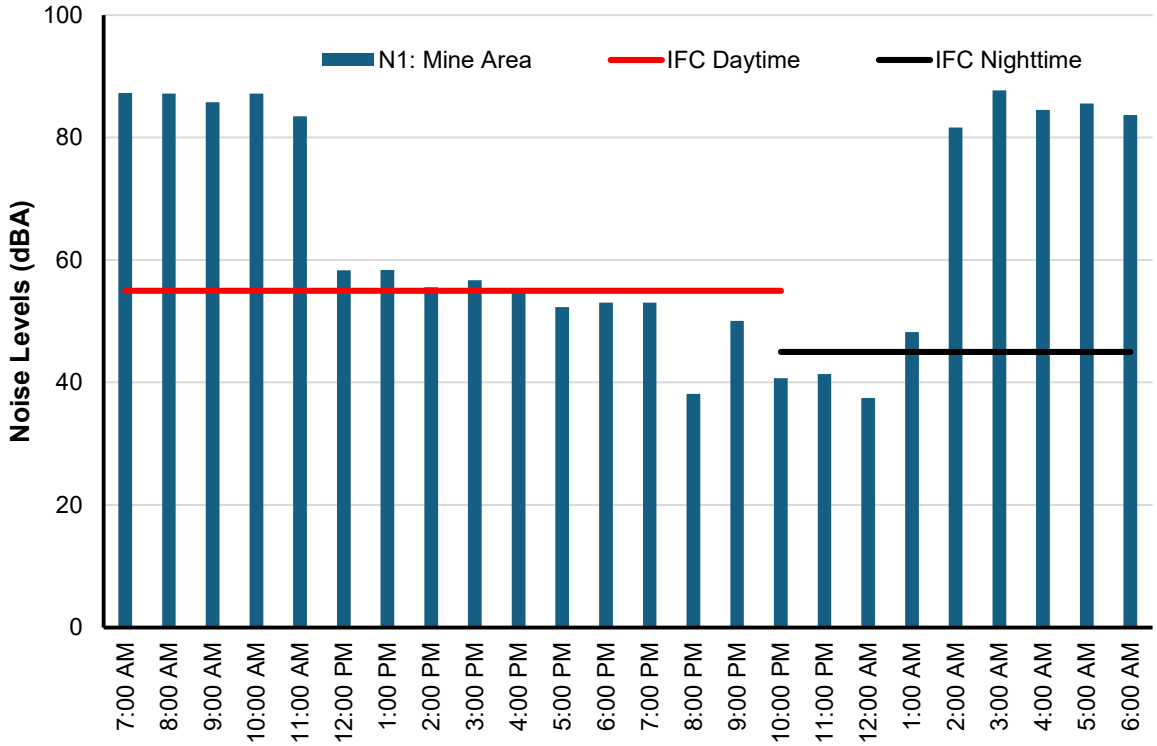
2 The noise levels at N2 were compared with the NEQS for commercial areas as this location was near the cross-border trade route. Residential limits were not used for comparison due to the absence of any human dwellings near this monitoring location.

Exhibit 5.1: Noise Monitoring Results (dBA) and Comparison with NEQS

Project Component	*ID*	*Location*	*LAeq (Day)*	*LAeq (Night)*
Noise Levels at Reko Diq Mine Site	N1	Mine Area	82.0	81.0
NEQS for Residential Areas			**55**	**45**
Noise Levels at access road to Mine Site	N2	Access road	64.0	58.0
NEQS for Commercial Areas			**65**	**55**

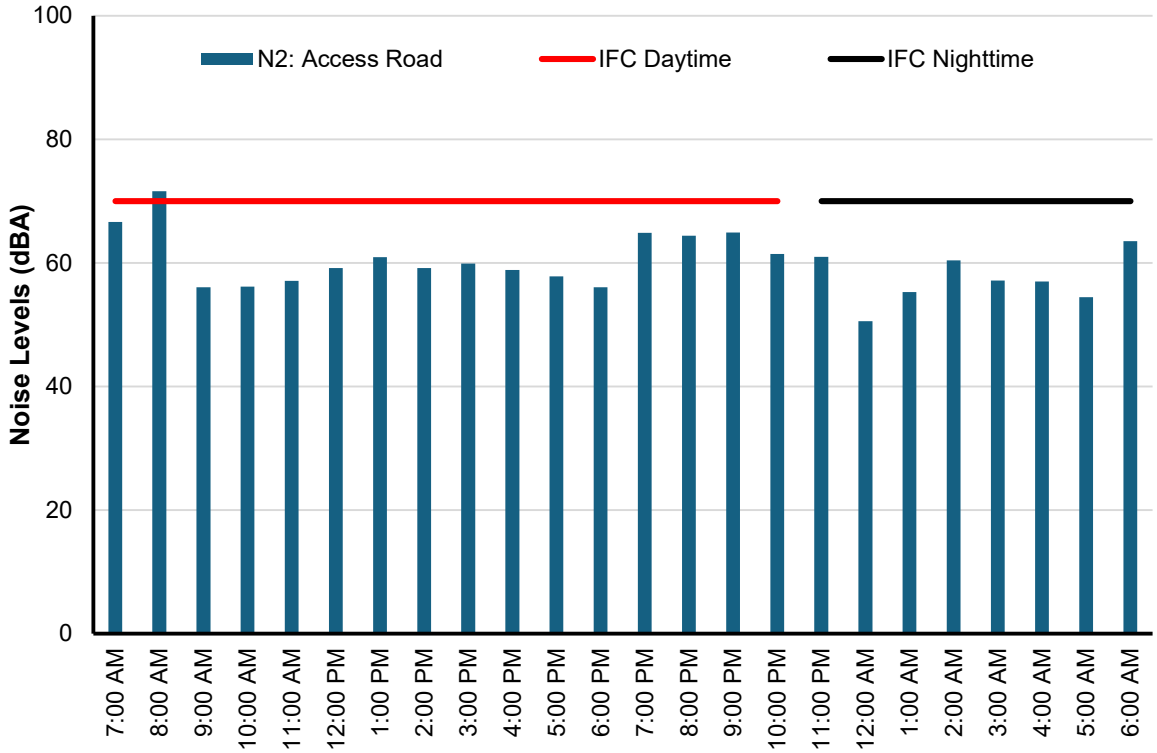
Note: Values exceeding the standards are shaded.
NEQS requires LAeq compliance over day and night-time periods.

Exhibit 5.2: Hourly Noise Levels at N1 and Comparison with IFC General EHS Guidelines for Residential Areas – Reko Diq Mine Site



IFC-EHS Guidelines require hourly compliance.

Exhibit 5.3: Hourly Noise Levels at N2 and Comparison with IFC General EHS Guidelines for Commercial Areas – Reko Diq Mine Site



5.2 Road Transport Route

Exhibit 5.4 presents the results of the noise monitoring undertaken and the comparison with NEQS for residential areas. **Exhibit 5.5** show the hourly compliance with IFC General EHS Guidelines.

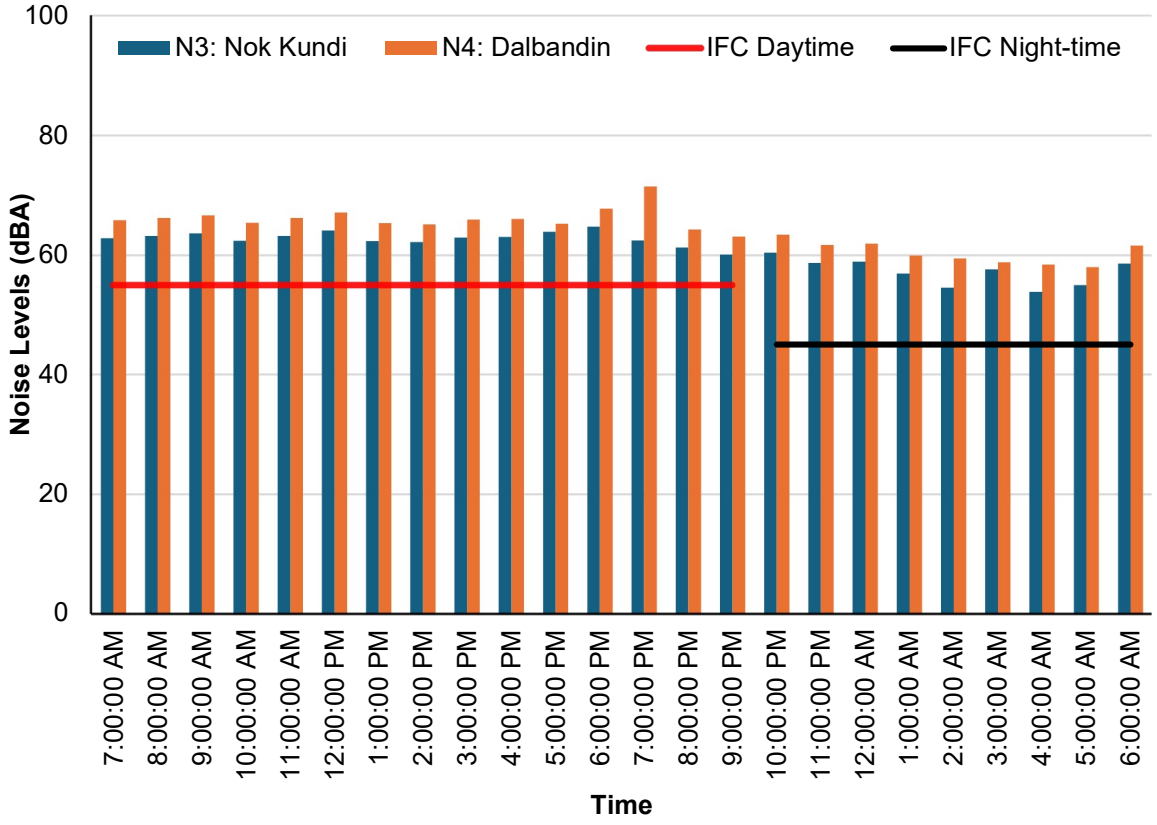
- *N3 – Nok Kundi:* The daytime and night-time noise levels observed at N3 exceeded the limits prescribed in the NEQS for residential areas. The noise values also exceeded the daytime and night-time noise limits prescribed in the IFC-EHS Guidelines at all times. High noise levels at this location are associated with the traffic movement along the National Highway N–40, high-speed winds, unplanned urban development including construction of pucca housing structures and small markets, and ongoing construction activities.
- *N4 – Dalbandin:* The noise levels recorded at the N4 exceeded the daytime and night-time noise limits prescribed in the NEQS for residential areas and IFC General EHS Guidelines. As this monitoring was conducted near the Quetta–Dalbandin bypass on the N–40 highway, the exceedance in noise levels at this location is predominantly attributed with HTV movement on this road.

Exhibit 5.4: Noise Monitoring Results (dBA) and Comparison with NEQS – Road Transport Route

Project Component	*ID*	*Location*	*LAeq (Day)*	*LAeq (Night)*
Noise Levels along Road Transport Route	N3	Nok Kundi	62.8	57.6
	N4	Dalbandin	66.4	60.6
NEQS for Residential Areas			**55**	**45**

Note:
Values exceeding the standards are shaded.
Daytime hours are from 6:00 am to 10:00 pm in NEQS.
Night-time hours are from 10:00 pm to 6:00 am in NEQS.
*Noise monitoring was carried out for two hours only during the daytime.
NEQS requires LAeq compliance over day and night-time periods.

Exhibit 5.5: Hourly Noise Levels and Comparison with IFC-EHS Guidelines for Commercial Areas – Road Transport Route (Nok Kundi and Dalbandin)



5.3 Rail Transport Route

Exhibit 5.6 presents noise monitoring results and comparison with NEQS and SEQS for day and night-time periods. **Exhibit 5.7** and **Exhibit 5.8** show the hourly compliance with IFC-EHS Guidelines for the railway section in Balochistan and Sindh, respectively.

- *Rail Transport Route – Balochistan Section:* The noise levels at all of the monitoring locations N14 (Spezand), N15 (Sibi), and N16 (Dera Murad Jamali) exceeded the noise limits prescribed in NEQS and IFC General EHS Guidelines for residential areas except at N13 (Nushki). The elevated noise levels can be attributed to the vehicular movement on the nearby roads, and movement along the railways. The noise levels at these locations also exceeded the hourly noise limits prescribed in IFC General EHS Guidelines for residential areas at all times. A brief description of the noise levels recorded at N13 and N14 is provided below:
  - *N13 – Nushki:* The daytime noise levels at N13 (Nushki) remained within the limits prescribed in NEQS and IFC General EHS Guidelines for residential areas. However, the noise levels at this location exceeded the night-time limits prescribed in NEQS and IFC General EHS Guidelines for residential areas and were reported to be 47.2 dBA. Elevated night-time noise levels at this location, compared with those recorded at daytime, are primarily attributed to the movement of freight trains on the nearby railway track during night-time which was not observed during the daytime.
  - *N14 – Spezand:* The noise levels at N14 (Spezand) were monitored for 15 hours during the daytime[3]. The noise levels at this location (65.2 dBA) exceeded the daytime noise limits of 55 dBA prescribed in the NEQS for residential areas. The hourly noise levels at this location also exceeded the daytime noise limits prescribed in the IFC General EHS Guidelines at all times.
- *Rail Transport Route – Sindh Section:* Noise levels at all locations within the Sindh province including N17 (Jacobabad), N18 (Shikarpur), N19 (Larkana), N20 (Dadu), N21 (Jamshoro), N22 (Kotri), N23 (Pipri), and N24 (Dhabeji) exceeded the daytime and night-time noise limits prescribed in the SEQS for residential areas. The elevated noise levels at these locations are primarily due to close proximity of the monitoring location to the nearby national highway and railway track. The hourly noise levels at all locations also exceeded the daytime and night-time noise limits prescribed in the IFC General EHS Guidelines for residential areas at all times.

Exhibit 5.6: Noise Monitoring Results (dBA) and Comparison with NEQS and SEQS – Rail Transport Route

Project Component	*ID*	*Location*	*LAeq (Day)*	*LAeq (Night)*
Noise Levels along Rail Transport Route – Balochistan section	N13	Nushki	44.1	47.2
	N14	Spezand	65.2*	-
	N15	Sibi	63.1	49.1
	N16	Dera Murad Jamali	62.9	51.6

[3] Noise monitoring was terminated during the night-time due to security and safety concerns.

Project Component	*ID*	*Location*	*LAeq (Day)*	*LAeq (Night)*
NEQS for Residential Area			**55**	**45**
Noise Levels along Rail Transport Route – Sindh section	N17	Jacobabad	74.2	67.0
	N18	Shikarpur	59.9	53.6
	N19	Larkana	59.9	53.2
	N20	Dadu	61.4	51.2
	N21	Jamshoro	59.6	54.3
	N22	Kotri	68.1	64.5
	N23	Pipri	63.0	52.0
	N24	Dhabeji	71.3	66.2
SEQS for Residential Area			**55**	**45**

Notes: Values exceeding the standards are shaded.

Daytime hours are from 6:00 am to 10:00 pm in NEQS and SEQS.

Night-time hours are from 10:00 pm to 6:00 am in NEQS and SEQS.

NEQS and SEQS require LAeq compliance over day and night-time periods.

*Noise monitoring was carried out for 15 hours only during the daytime.

Exhibit 5.7: Hourly Noise Levels and Comparison with IFC-EHS Guidelines for Commercial Areas – Rail Transport Route (Balochistan section)

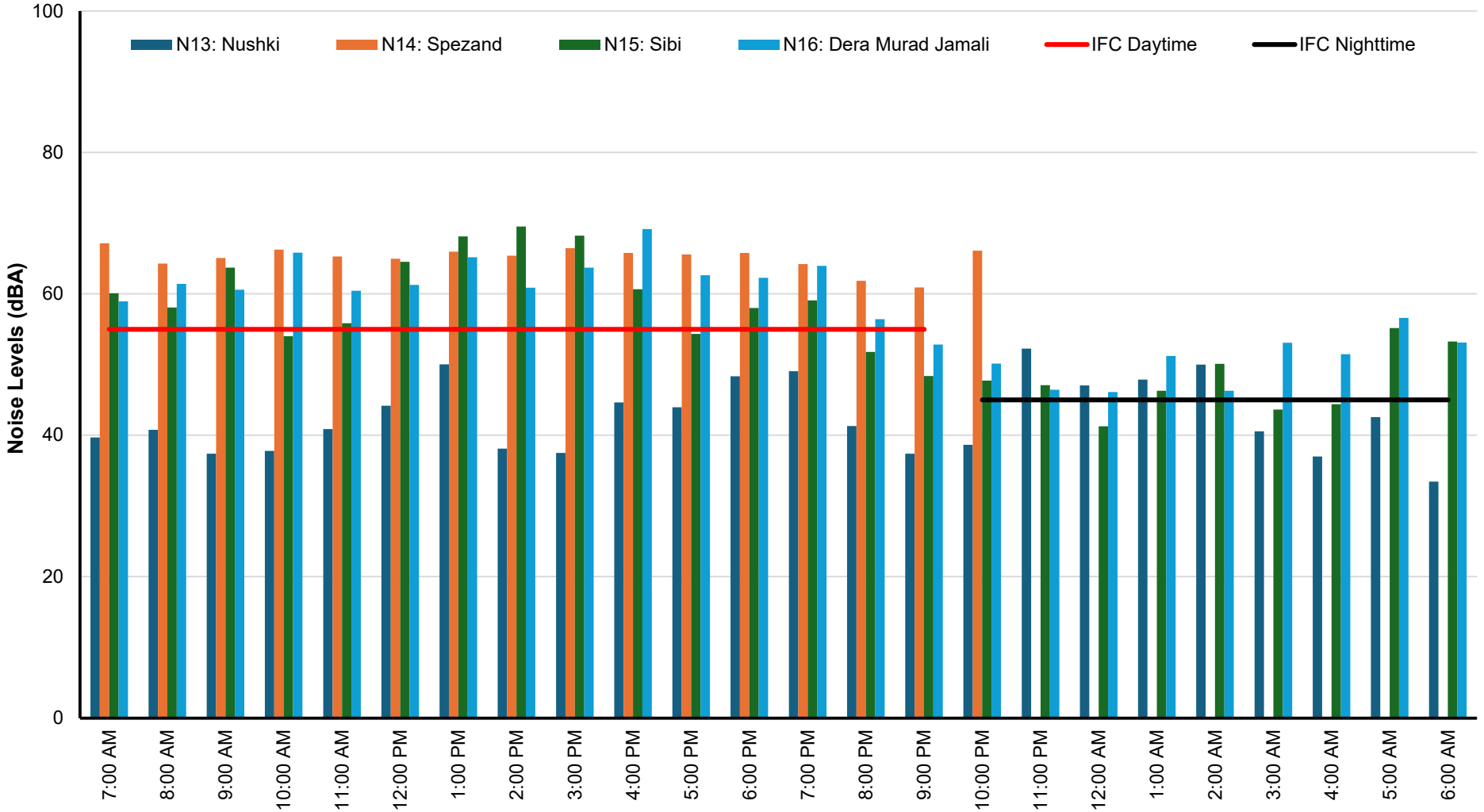
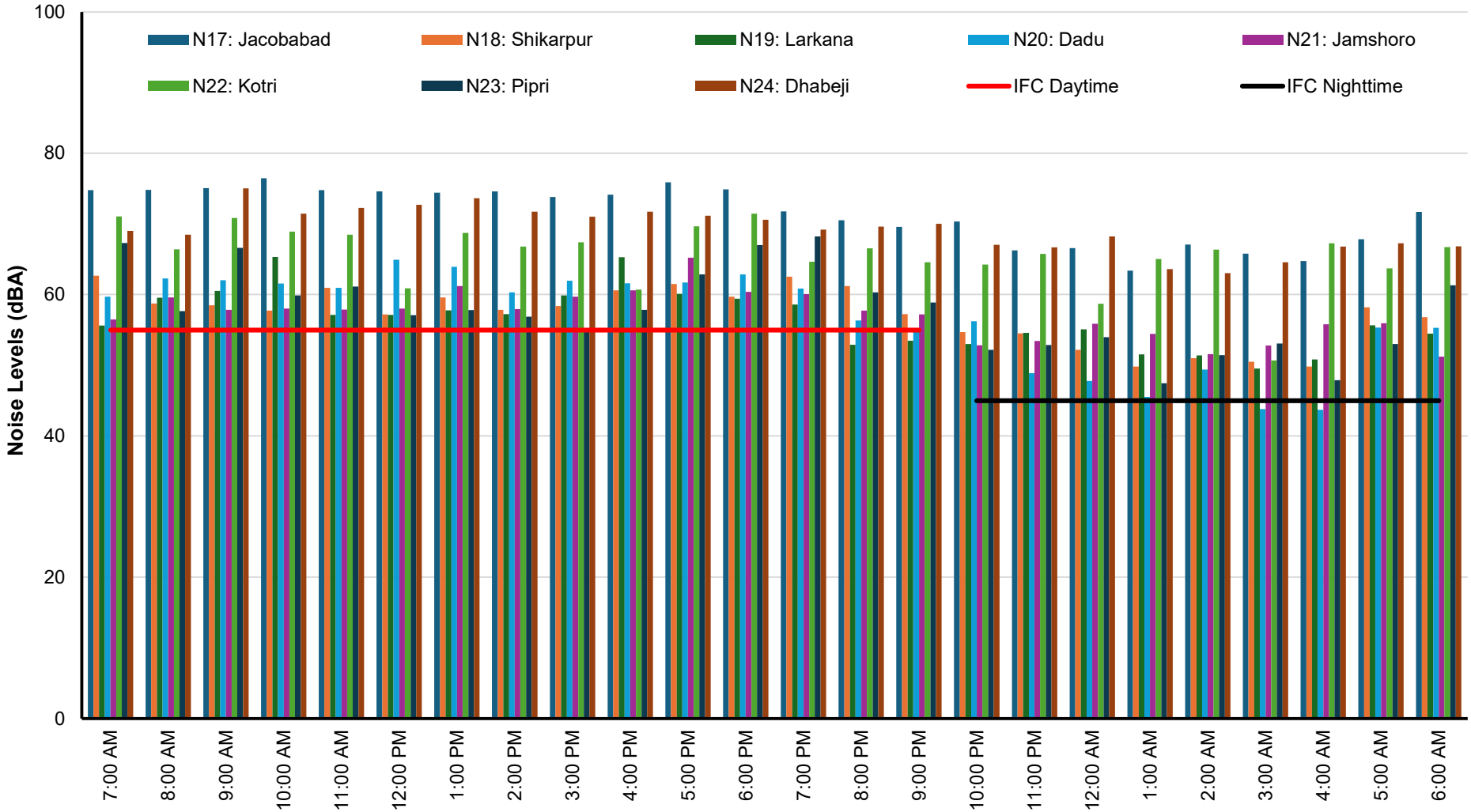


Exhibit 5.8: Hourly Noise Levels and Comparison with IFC-EHS Guidelines for Commercial Areas – Rail Transport Route (Sindh section)



IFC requires hourly compliance.

5.4 Port Qasim

Exhibit 5.9 presents the noise monitoring results and comparison with SEQS for day and night-time periods for industrial areas. **Exhibit 5.10** shows the hourly compliance with IFC General EHS Guidelines for industrial areas.

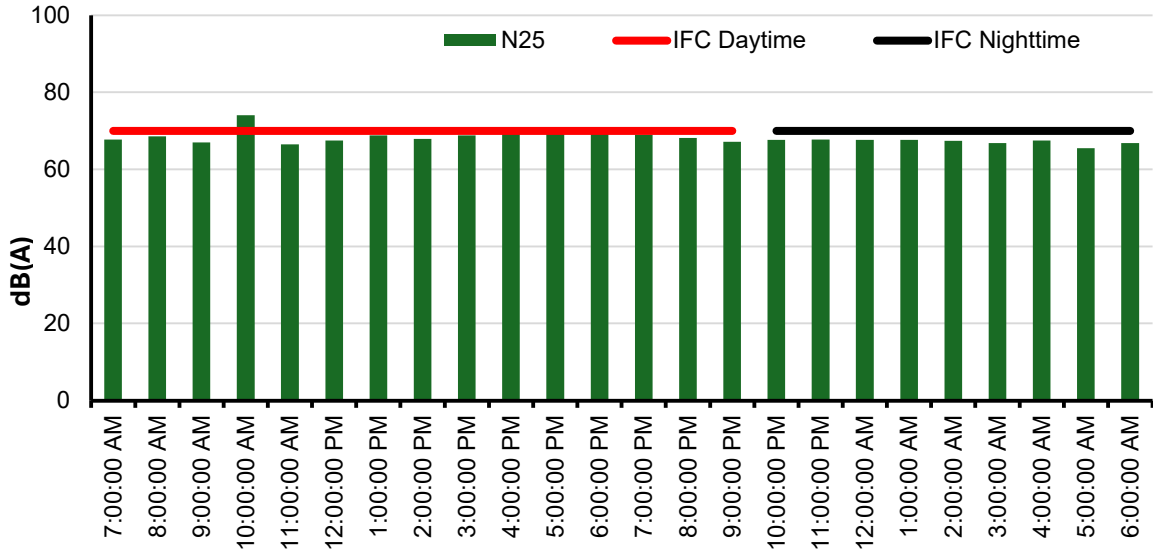
- Noise levels at N25 (Port Qasim) were monitored at the North-western Industrial Zone of the Port Qasim, a designated industrial area. Therefore, the noise levels have been compared with SEQS and IFC General EHS Guidelines for industrial areas. The daytime noise levels recorded at this location were within the noise limits prescribed in the SEQS for industrial areas. However, the night-time noise levels exceeded the night-time noise limits prescribed in SEQS by 2.3 dBA. The exceedances in night-time noise levels at this location was due to ongoing industrial operations and vehicular movement in Port Qasim.
- The hourly noise levels recorded at N25 remained within the daytime and night-time noise limits prescribed in the IFC General EHS Guidelines for industrial areas, except at 10 am and 4 pm. Exceedances in baseline noise levels at these hours were primarily due to traffic noise.

Exhibit 5.9: Noise Monitoring Results (dBA) and Comparison with SEQS – Port Qasim

Project Component	*ID*	*Location*	*LAeq (Day)*	*LAeq (Night)*
Noise Levels at Port Qasim	N25	Port Qasim	69.1	67.3
SEQS for Industrial Area			**75**	**65**

Note: Values exceeding the standards are shaded.
Daytime hours are from 6:00 am to 10:00 pm and Night-time hours are from 10:00 pm to 6:00 am.
SEQS requires LAeq compliance over day and night-time periods.

Exhibit 5.10: Hourly Noise Levels and Comparison with IFC General EHS Guidelines for Industrial Areas – Port Qasim



IFC requires hourly compliance.

6. Impacts Screening

This section provides the proposed Project activities during construction, operations, and decommissioning phases along with estimation of noise generated from each activity or equipment.

6.1 Construction Phase

6.1.1 Noise Generated from Construction of Reko Diq Mine Site

The Project construction phase will involve the operation of construction equipment and vehicles. These equipment and vehicles will cause an overall incremental increase in the ambient noise levels. Although these noise levels can attenuate over distances, the resultant noise levels can cause nuisance to receptors if the overall increment in the ambient noise levels is significantly higher.

A comprehensive inventory of construction equipment developed by the United States' Federal Highway Authority (FHWA)[4] was used as a reference for equipment noise levels. **Exhibit 6.1** provides the selected list of equipment and associated noise specifications.

Exhibit 6.1: Equipment List and Reference Noise Levels

Equipment	*Model*	*Acoustic Usage Factor (%)*[5]	*Sound Pressure Level (dBA) Specified by Manufacturers, Lmax at 50 ft (15m)*	*Quantities*
Batch Plant	-	15%	83	1
Concrete Mixers	-	40%	85	1
Water Bowser	789D SC	40%	80	3
Loader	CAT 980	40%	84	1
Trailer	-	16%	80	2
Crane	North-western 8	16%	85	2
Excavator	-	40%	85	2
Tractor/Trolley	-	40%	80	2
Bulldozers	-	40%	85	1
Paver	-	50%	85	1
Compactor	-	20%	80	2
Pumps	-	50%	77	1

[4] Federal Highway Authority, Construction Noise Handbook, August 2006, https://www.fhwa.dot.gov/ENVIRONMENT/noise/construction_noise/handbook/handbook09.cfm.

[5] Acoustic usage factor presents the time for which an equipment remains operational within 24-hours. 50% acoustic usage factor indicates that the equipment will remain operational for 12-hours in one day.

Equipment	*Model*	*Acoustic Usage Factor (%)*[5]	*Sound Pressure Level (dBA) Specified by Manufacturers, Lmax at 50 ft (15m)*	*Quantities*
Generators	-	50%	82	2
Vibrator	-	20%	101	1
Drilling Machines	-	10%	55	1
Compressors	-	40%	80	1
Dump Truck	-	40%	84	5
Roller	-	20%	85	1
Welding Machines	-	40%	73	2
Fork Lifter	-	40%	85	1
Face Shovel	PC7000	40%	116	1
Large Front-End Loader	WE2350-2	40%	79	1
Haul Truck	980E-5	75%	88	5
Track Dozer	D11T	40%	87	4
Wheeled Dozer	854K	40%	83	2
Grader	24M	40%	111	4
Small Excavator	390DL	40%	81	2
Water Truck	789D SC	40%	80	3
Service Truck	789D WC	40%	121	3
Production Drill	EPIROC PV271XC LP	20%	91	4
Presplit Drill	EPIROC SmartROC D65LF	20%	96	2
Grade Control Drill	-	20%	85	2

Source: HEP (2006)
'-' indicates that model information was not available at the source.

The construction noise was estimated following empirical approach using the sound levels at the source, acoustic usage factor and quantities of the construction phase equipment. Based on the equipment noise, their quantities, and acoustic usage factor, the incremental increased in noise levels due to the Project construction is estimated to be 122.7 dBA at 15 m.

6.2 Operations Phase

6.2.1 Impulse Noise from Blasting

The Project will use a blend of Ammonium Nitrate Fuel Oil (ANFO) and a water-based emulsion to carry out blasting for the excavation of ore from the mining pit during the

operational phase. The composition of this blend will be 49% ANFO and 51% waster-based emulsifier. At present there are no legal limits for impulse noise in Pakistan, however, the noise generated can be a significant source of nuisance for local communities, particularly if occurring at night-time or without warning.

For a single blast, ~190 tonnes of ANFO will be used during the operations phase. The blasting will be an intermittent activity which will be carried out depending on the requirement.[6] Therefore, the noise generated from the blasting activity will be impulse in nature and its impact on the overall daytime or night-time weighted averages will be low. The lower contribution is due to very small acoustic usage factor (0.069%) of impulse noise. The impulse noise generated from blasting is therefore compared with instantaneous peak noise limit of 140 dB(C) prescribed in IFC General EHS Guidelines.

For estimation of impulse noise from blasting, trinitrotoluene (TNT) equivalent factor is used for ANFO and water-based emulsified (cumulative 0.48 TNT factor consisting of 0.25 for ANFO and 0.7 for emulsifier). Thus, 1,000 kg of ANFO has a similar explosive energy yield as ~250 kg of TNT (Specialty, 2020). Similarly, 1,000 kg of emulsifier has a similar explosive yield energy of 700 kg of TNT (Simoens, Lefebvre, & Minami, 2011). Assuming 10 events of blasting activity in one day, and that it does not occur in successive smaller detonations which will be the likely case, would result in detonation of ~19 tonnes of explosives in a single session.

Using the formula provided by the International Ammunition Technical Guidelines (IATG), the distance at which 140 dB(C) of impulse noise would be generated if the mass of the explosives can be calculated via:

$$Distance\ (m) = 215\ x\ [Mass\ of\ Explosives\ (kg)]^{1/3}$$

A distance of ~4,490 m is derived at which an impulse sound of 140 dB(C) can occur which would damage hearing.

6.2.2 Noise Generated from Mining Operations at Reko Diq Mine Site

The Project operations phase will involve the vehicular movement, and operations of crushing, grinding, screening tailings equipment (pumps, promotors, frothers etc.), and HFO power plant. As these equipment and vehicles are expected to remain operational continuously, this can cause an overall incremental increase in the ambient noise levels. Although these noise levels can attenuate over distances, the resultant noise levels can cause nuisance to receptors if the overall increment in the ambient noise levels is significantly higher.

In order to assess the overall noise levels of operations phase, the noise levels of the equipment and vehicles is taken as in conjunction with the acoustic usage factor[7]. As the noise levels are not expected to remain available during the design phase, equipment specific noise levels have been used based on the manufacturer specifications as well as

[6] Usually, blasting is carried out at an interval of 3-days, however, this frequency can be further reduced if the mineral processing plant reaches to its maximum capacity. Based on the mining plan, the Project will start its operations in 2027 and will reach its maximum capacity in 2029. In the initial two years, there will be one blast per week (estimated).

[7] The acoustic usage factor represents the percentage of time that a particular equipment is assumed to be running at full power.

via publicly published literature. **Exhibit 6.2** provides the list of operations phase equipment and their associated noise levels.

Based on this analysis, the noise generated from the Project due to operations of the mining equipment and vehicles is 136 dBA. This estimation is exclusive of the impulse noise generated from blasting. The impulse noise is of shorter durations, not lasting for more than 1-2 minutes. Due to very low acoustic usage factor (0.069%), the contribution of blasting in the daytime or night-time noise levels will be negligible.

The noise levels from Project operations estimated through **Exhibit 6.2** consider that all of the equipment will be placed in open environment without implementation of mitigation measures. These noise levels can be considered as representatives of the worst-case scenario. The actual noise levels will be relatively lower as most of the equipment will be placed in closed premises except mobile sources.

Exhibit 6.2: Operations Phase Equipment List and Reference Noise Levels

Source	*Model*	*Max Quantity*	*Acoustic Usage Factor (%)*	*Sound Pressure Level (dBA) Specified by Manufacturers, Lmax at 50 ft (15m)*	*Source*
Mobile Sources					
Rope Shovel	4100 XPC	8	20%	93	Transportation (2017)
Face Shovel	PC7000	4	40%	116	Transportation (2017)
Large Front-End Loader	WE2350-2	3	40%	80	Transportation (2017)
Haul Truck	980E_5	127	75%	88	Transportation (2017)
Track Dozer	D11T	22	40%	87	Transportation (2017)
Wheeled Dozer	854K	3	40%	83	Transportation (2017)
Grader	24M	16	40%	111	Transportation (2017)
Small Excavator	390DL	5	40%	81	Transportation (2017)
Water Truck	789D SC	12	40%	80	Transportation (2017)
Service Truck	789D WC	12	40%	121	Transportation (2017)
Production Drill	EPIROC PV271XC LP	14	20%	91	Transportation (2017)
Presplit Drill	EPIROC SmartROC D65LF	4	20%	96	Transportation (2017)
Grade Control Drill	-	6	20%	85	Transportation (2017)
Primary Crushing					
Conveyors	-	15	50%	105	Brown (2004)
Gyratory Primary Crusher	Metso 60 x 89 Mk III Eq.	4	75%	110	Metso (2022)
Secondary Crushing					
Conveyors	-	15	50%	105	Brown (2004)

Source	*Model*	*Max Quantity*	*Acoustic Usage Factor (%)*	*Sound Pressure Level (dBA) Specified by Manufacturers, Lmax at 50 ft (15m)*	*Source*
Screen Feeder	Vibrating Feeder	7	50%	95	Viilo (2011)
Coarse Ore Screen	Vibrating Multi-slope, Double Deck	7	50%	95	Viilo (2011)
Secondary Crusher	Metso MP1250 or Eq.	8	75%	110	Metso (2022)
High-Pressure Grinding Roll (HPGR)					
Conveyors	-	15	50%	105	Brown (2004)
HPGR	Polycom 26/18 or Eq.	7	75%	89	K. Leśniak (2019)
Fine Ore Screen	Wet Vibrating Multi-slope, Double Check	13	50%	95	Commission (2012)
Milling					
Ball Mill	Reverse Close Circuit Ball Mill	2	75%	85	Joergensen (2020)
Regrinding					
Regrind Mill Stage 1	HIG700 or Eq.	7	75%	125	Welding (2023)
Regrind Mill Stage 2	HIG15000	7	75%	125	Welding (2023)
Cleaner Floatation					
1st Cleaner Flotation	e70 or Eq.	7	75%	100	T. Thai (2021)
1st Cleaner Scavenger Flotation	e70 or Eq.	7	75%	100	T. Thai (2021)
2nd Cleaner Flotation	e20 or Eq.	7	75%	100	T. Thai (2021)
3rd Cleaner Flotation	OK8 or Eq.	7	75%	100	T. Thai (2021)

Source	*Model*	*Max Quantity*	*Acoustic Usage Factor (%)*	*Sound Pressure Level (dBA) Specified by Manufacturers, Lmax at 50 ft (15m)*	*Source*
Concentrate Dewatering					
Concentrate Trash Screen	Single Deck Vibrating Screen	1	75%	110	Environmental (2023)
Tails Dewatering and Transfer					
Promotor 1	Aero 3894	1	60%	95	Syensqo (2024)
Promotor 2	Aero MAXGOLD 900	1	60%	95	Syensqo (2024)
Promotor 3	Aero 7249	1	60%	95	Syensqo (2024)
Frother 1	MIBC	1	60%	95	Africa (2024)
Frother 2	Kemtec F160-05	1	60%	95	Africa (2024)
Power Generation					
HFO Power Plant	Wärtsilä W 18V50DF D	2	75%	91	Shelledy (2013)

'-' indicates that model information was not available at the source.

6.2.3 Noise Generated from Additional Rail Traffic

The Project will use freight trains for transportation of copper concentrate from Reko Diq Mine Site to Port Qasim. The Project's contribution to the railway traffic will consist of 14 freight trains (7 loaded and 7 empty) during the daytime and 6 freight trains (3 loaded and 3 empty) during the night-time with each train comprising of one locomotive and twenty wagons. Between the railway section of Nushki and Kishinghi, and Abigum and Kolpur, an additional locomotive will be added to account for the steep gradient. The trains will also include a rest van between Spezand and Reko Diq Mine Site.

As there are a number of residential receptors along the railway tracks, the movement of trains will result in an incremental change in the noise levels as they pass by. The train movement will also cause an increment in the daytime and night-time noise levels as train movements associated with Project will remain active over a 24-hour period. In order to assess the increase, empirical estimations and deterministic modelling has been carried out at three different segments of the Rail Transport Route to predict incremental noise level increases from the railway movement. The detailed methodology of railway noise estimations is provided in **R4NM8RKG – Noise Modelling of Rail Transport Route** provided as **Appendix B** of this Specialist Report. The following definitions, along with their descriptions, are frequently used terminologies:

- *Baseline Noise Levels (dBA):* The measured noise levels before the Project development are referred to as '*Baseline Noise Levels*'.
- *Predicted Incremental Noise Levels:* The modelled noise levels are the predicted incremental increase in noise levels due to increased movement along the railway, therefore, these predicted noise levels are referred to as 'Predicted Incremental Noise Levels.' These Predicted Incremental Noise Levels are the model outputs and exclude any contribution from Baseline Noise Levels.
- *Predicted Ambient Noise Levels:* Upon addition of Predicted Incremental Noise Levels to the Baseline Noise Levels, these are referred to as '*Predicted Ambient Noise Levels*'. The Predicted Ambient Noise Levels have been used for comparison with the daytime and night-time noise limits prescribed in the applicable standards and guidelines.

The Predicted Ambient Noise Levels are compared with the daytime and night-time noise limits prescribed in NEQS and IFC General EHS Guidelines for residential areas. At the time of this writing, the noise limits were not prescribed in the local or national legislations for train pass-by events. Therefore, the noise levels were compared with the limits prescribed by Federal Railroad Administration (49 CFR 201.12 (b)). **Exhibit 6.3** provides the noise levels during a train pass-by event and their comparison with 49 CFR 201.12 (b).

Exhibit 6.3: Noise Levels (dBA) During Train Pass-by Event

Segment	*Railway Speed (km/h)*	*Noise Levels (dBA) at 1 m*	*Noise Levels (dBA) at 30 m*	*49 CFR 201.12 (b) Limit (dBA) at 30 m*
Segment 1 - Nok Kundi	40	101.0	71.5	88
Segment 2 - Nushki	40	101.8	72.3	88
Segment 3 – Sibi	65	104.9	75.4	88
Maximum Speed	80	106.6	77.1	93
Maximum Speed with Horn	80	116.0	86.5	93

Note: Noise levels at 1 m in Segment 2 are higher than those at Segment 1 despite similar train speed. The increase in noise levels in Segment 2 is due to use of two locomotives due to high elevation gradient of ~23.5˚.

Therefore, the noise levels during a pass-by event are expected to remain within the FRA noise limits prescribed in 49 CFR 201.12 (b) in all segments. **Exhibit 6.4** provides the levels of perception of Predicted Ambient Noise Levels based on increment from the Baseline Noise Levels.

Exhibit 6.4: Perception of Increment in Noise Levels to Humans

Segment	*Baseline Noise Levels (dBA)*		*Predicted Ambient Noise Levels (dBA)*		*Increment Over Baseline Noise Levels (dBA)*		*Interpretation to Human Receptors*[8]
	Day	*Night*	*Day*	*Night*	*Day*	*Night*	
Segment 1 – Nok Kundi	62.8	57.6	63.02	58.20	0.22	0.60	Not perceptible
Segment 2 – Nushki	44.1	47.2	60.01	59.56	15.91	12.36	Doubling in loudness
Segment 3 – Sibi	63.1	49.1	66.31	62.98	3.21	13.88	Doubling in loudness

6.3 Screening of Impacts

Based on the analysis of noise generated from Project activities, noise-related impacts are identified in **Exhibit 6.5**. These impacts are further assessed as part of the impact assessment in **Section 1**.

[8] Ibid.

Exhibit 6.5: Screening of Noise-Related Impacts

No.	*Activity*	*Sensitivity/Impact*	*Project Phase*	*Further Assessment as Part of this Study*	*Impact Assessment Section*
1.	Construction of Reko Diq Mine	The Project is expected to generate noise levels up to 122.7 dBA at 15 m from source. As the baseline noise levels at the receptors are relatively lower at the receptors, these noise levels can elevate these baseline levels, with a potential exceedance from applicable limits for residential areas.	C	Yes	**Section 7.2.1**
2.	Impulse noise from blasting	Impulse noise from blasting can cause instantaneous increase in noise levels resulting in unrest among the site staff and nearby receptors.	O	Yes	**Section 7.3.1**
3.	Mining operations	Mining operations at Reko Diq Mine Site is expected to generated noise levels of 136 dBA which can cause OHS risks due to long exposure periods. The noise levels can also elevate baseline noise levels at receptors, if located close to mining facilities.	O	Yes	**Section 7.3.2** **Section 7.3.3**
4.	Additional railway movement	Movement of additional railway on the Rail Transport Route can result in unrest among the nearby residents.	O	Yes	**Section 7.3.4**
5.	Road transportation	Additional vehicular traffic along the Road Transport Route can potentially elevate noise levels at the receptors.	C, O	Yes	**Section 7.5**

C: Construction

O: Operations

D: Decommissioning

7. Impact Assessment

This section discusses the potential impacts that may result from the Project, along with associated mitigation measures. The assessment has been undertaken in accordance with the methodology provided in **Section 4.4**.

The following impacts have been detailed below:

- Impact N01: Noise generated from construction of Reko Diq Mine Site
- Impact N02: Elevated noise levels during construction phase transportation
- Impact N03: Nuisance to receptors due to impulse noise generated from blasting
- Impact N04: Nuisance to receptors due to impulse noise generated from operations phase activities
- Impact N05: Adverse impacts on the workers' health due to continuous exposure to loud noise.
- Impact N06: Elevated noise levels due to movement along railways, and
- Impact N07: Noise generated during decommissioning phase.

7.1 Design Phase

The baseline noise levels at the Mine area were significantly above the limits prescribed in NEQS and IFC General EHS Guidelines for residential areas. The baseline noise levels were reported to be 82 dBA for day-time and 81 dBA for night-time. Although the noise levels from the Project operations may not be perceptible by the staff living in the onsite accommodation camp due to large distance from operational areas, prolonged exposure to the elevated baseline noise levels can cause various health impacts depending on the levels of exposure. The Project will ensure incorporation of effective noise abatement measures in the design of onsite accommodation camp to limit the exposure of staff to elevated baselines.

7.2 Construction Phase

7.2.1 Noise Generated from Construction of Reko Diq Mine Site

Depending on the construction equipment used and its distance from receptors, the receptors may be exposed to intermittent and variable noise levels. A change in sound level of 3 dB is a just noticeable difference, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

the incremental increased in noise levels due to the Project construction is estimated to be 122.7 dBA at 15 m (see **Section 6.1.1**). The noise levels at the nearby receptors have been estimated using the empirical approach by following equation. This equation

estimates noise levels using the inverse square law for noise attenuation at distances.[9] **Exhibit 7.1** provides the resultant noise levels at the nearest human receptor during daytime and night-time.

$$LP2 = LP1 - 20xlog\frac{R2}{R1}$$

Where;

LP1 (dBA) = sound pressure level at the reference distance from the noise source

LP2 (dBA) = sound pressure level at the receptor

R1 = reference distance of where the sound pressure level of the noise producing unit measured/referenced

R2 = distance between the source and receptor

Exhibit 7.1: Resultant Daytime and Noise Levels (dBA) at Nearest Receptor Without Mitigation

Location	*Baseline Noise (dBA)*	*Resultant Ambient Noise (dBA)*	*NEQS*	*Increase (dBA)*	*Interpretation*
Onsite Accommodation Camp – Day	82	82.14	55	0.14	Not perceptible
Onsite Accommodation Camp – Night	81	81.18	45	0.18	Not perceptible
Humai – Day	82	82.02	55	0.02	Not perceptible
Humai – Night	81	81.02	45	0.02	Not perceptible
Nok Kundi – Day	62.8	62.96	55	0.16	Not perceptible
Nok Kundi – Night	57.6	58.10	45	0.50	Not perceptible

Note**:** Noise levels were not monitored at Humai. Therefore, the noise levels monitored at N1 (Mine Area) have been used to assess increment in baseline noise levels due to construction activities.

Based on the analysis made in **Exhibit 7.1**, the construction activities of the Project will not result in a perceptible increase over the ambient noise levels at the receptor during daytime or night-time.

Impact N01: Noise generated from construction activities
Phase: Construction
Impact Description: Elevated noise levels due to construction activities which may cause a nuisance among the human receptors.

[9] This equation assumes that the noise levels will attenuate only through increase in distance. This increase in distance estimates the linear reduction in noise pressure levels. It should be noted that noise levels calculated through this equation overestimate the actual onsite conditions as it does not account for any noise barriers within the areas. Therefore, this equation provides worst case noise levels in the absence of noise barriers.

Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	3	Medium term 2 to 5 years	Negligible (negative) - 15
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on physical environment. Minor medium-term social impacts on local population.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		
Mitigation/Management Actions			
Good Practice Measures: • Monitor and periodically maintain noise producing units to reduce noise levels to the possible extent. • Consider installation of visual alarms instead of audible alarms to the extent possible. • Installation of noise abatement devices such as mufflers and silencers to be considered to reduce noise at the source, wherever feasible. • Prioritise use of new equipment and vehicles over older equipment to ensure that the noise levels do not exceed the prescribed limits at reference distances. • Periodically monitor instantaneous and 24-hours continuous noise levels at the Mine Site boundary and at receptors to ensure compliance with applicable standards.			
Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	3	Medium term 2 to 5 years	Negligible (negative) - 15
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on physical environment. Environmental damage can be rehabilitated. Minor medium-term social impacts on local population.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		

7.3 Operations Phase

7.3.1 Impulse Noise Generated from Blasting

The impulse noise is estimated to be 140 dBA at a distance of ~4,490 m from the blasting site (see **Section 6.2.1**). The noise levels can be determined at the nearest receptor, the Humai settlement, using the following equation:

$$LP2 = LP1 - 20xlog\frac{R2}{R1}$$

An impulse noise of 125 dB(C) is estimated at the receptor of Humai settlement, assuming no ground barriers and energy losses. While this value is within the Occupational Safety and Health Administration (OSHA) threshold of 140 dB(C) which can cause loss of hearing, this noise value may still cause a significant nuisance for local community residents asleep at night or if it occurs without warning. This impulse noise is expected to substantially reduced with increasing depth of the open-pit. The Project will implement mitigation measures centred around scheduling and prior notice to local communities.

It is important to note that the equation above does not account for barrier effects and ground absorption of the impulse. Additionally, blasting will likely be carried out as a series of smaller detonations. Thus, the magnitude of impact on receptors may be lower than predicted via these calculations.

Impact N03: Nuisance to local communities due to Impulse noise generated from blasting			
Phase: Operations			
Impact Description: Nuisance to local communities due to impulse noise generated from blasting activities			
Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter-Generational - >20 years	Minor (negative) -21
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on the biological or physical environment.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		
Mitigation/Management Actions			
• Local communities will be informed prior to blasting activities. • Blasting will not be carried out during night-time hours (10:00 PM to 06:00 AM). • Workers at the Project site will be provided with noise PPE during blasting sessions if they are within 3,000 m of blasting activities.			

Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter-Generational - >20 years	Negligible (negative) -7
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on the biological or physical environment.	
Probability	1	Rare / improbable Conceivable, but only in extreme circumstances and / or has not happened during the lifetime of the Project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate mitigation measures (1-5%).	
Nature	Negative		

7.3.2 Elevated Noise levels due to Operations of Mining Equipment

According to the assessments carried out in **Section 6.2.2**, the noise generated from the Project due to operations of the mining equipment and vehicles is 136 dBA. **Exhibit 7.2** provides the resultant noise levels at the receptors during Project operations.

The onsite accommodation camp is ~8.9 km from the proposed location of mineral processing plant, and is susceptible to relatively high noise from Project operations as compared to Humai settlement which is located at ~25 km in the east of mineral processing plant. Based on analysis carried out in **Exhibit 7.2**, the elevated noise levels due to Project operations will be barely perceptible at the onsite accommodation camp and will not be perceptible at the Humai settlement. Furthermore, as the increment in noise levels at both of the receptors is within 3 dBA from the baseline, it can be considered within the acceptable limits based on the requirements specified in IFC General EHS Guidelines.[10] The noise levels estimated in **Section 6.2.2** do not consider implementation of control measures. Therefore, the overall increment in baseline noise levels due to operations of the Reko Diq Mine Site is expected to be further lower at the nearby sensitive receptors.

[10] According to IFC General EHS Guidelines, an exceedance of 3 dBA from the baseline is permissible if the baseline noise levels are exceeding the applicable limits.

Exhibit 7.2: Resultant Daytime and Noise Levels (dBA) at Nearest Receptor Without Mitigation

Receptor	*Baseline Noise Levels (dBA)*		*Incremental Noise Levels (dBA) at Receptors from Project Operations*	*Ambient Noise Levels (dBA) with Project Contribution*		*Increment Over Baseline Noise Levels (dBA)*		*Interpretation at Human Receptors*
	Day	*Night*		*Day*	*Night*	*Day*	*Night*	
Onsite Accommodation Camp	82	81	81	84	84	2	3	Barely perceptible
Humai Settlement	82	81	72	82	81	0	0	Not perceptible

Note: Noise levels were not monitored at Humai settlement. Therefore, the noise levels monitored at N1 (Mine Area) have been used to assess increment in baseline noise levels due to Project operations.

Impact N04: Nuisance to receptors due to impulse noise generated from operations phase activities			
Phase: Operations			
Impact Description: Nuisance to receptors due to impulse noise generated from operations phase activities including mobile sources, operations of the mineral processing plant, and HFO power plant			
Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter-Generational - >20 years	Minor (negative) - 36
Extent	2	Local Extending across the site and to nearby settlements.	
Intensity	2	Moderate, short-term effects. On-going social issues.	
Probability	4	Likely The impact may occur (50-90%)	
Nature	Negative		
Mitigation/Management Actions			
Good Practices: • Visual alarms will be used in preference to audible alarms where appropriate. • Acoustical enclosures will be provided around noise producing equipment where appropriate. • Periodic noise monitoring will be carried out at the receptors to ensure compliance with applicable standards.			
Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter-Generational - >20 years	Minor (negative) - 27
Extent	2	Local Extending across the site and to nearby settlements.	
Intensity	2	Moderate, short-term effects. On-going social issues.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		

7.3.3 Occupational Health and Safety

Potential occupational health and safety impacts on the onsite personnel can be caused due to long exposures to high noise equipment. Repeated overexposure to loud noise can cause permanent hearing loss, tinnitus, and difficulty understanding speech in noise among the workers (Themann & Masterson, 2019).

According to the list of mining equipment (see **Exhibit 6.2**), the noise levels from the operations phase equipment can reach up to 125 dBA. Continuous exposure to such equipment is expected especially for the staff working in the mineral processing plant especially those working near crushing and grinding equipment.

Elevated noise levels due to operations of the mining equipment can cause exceedance from the noise limit of 85 dBA prescribed in IFC General EHS Guidelines for a period of 8-hours. Furthermore, the noise levels from the blasting are also expected to reach up to 158 dB, thus, exceeding the impulse noise limit of 140 dBA prescribed in IFC General EHS Guidelines. Although the blasting noise will be instantaneous in nature, frequent exposure to this noise can cause hearing loss.

The Project will ensure implementation of adequate mitigation measures and issuance of PPEs to ensure that the impulse noise from blasting and noise levels from mining equipment remain within the applicable limits. Shift durations will also be reduced for working near high noise equipment to limits exposure to high noise.

Impact N05: Adverse impacts on the workers' health due to continuous exposure to loud noise			
Phase: Operations			
Impact Description: Impacts on workers' health due to continuous exposure to loud noise from mining equipment, vehicular movement, operations of the power plant, and blasting.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter-Generational - >20 years	Moderate (negative) -50
Extent	1	Site Specific	
Intensity	4	Serious long-term health effects. On-going serious issues among workers.	
Probability	5	Certain / Definite There are sound evidence-based reasons to expect that the impact will definitely occur (90-100%)	
Nature	Negative		
Mitigation/Management Actions			
Control Measures: • Investigate options of equipment enclosures to reduce noise levels. • Mufflers will be installed to reduce noise from power plants and back-up generators. **Mitigation Measures:** • Prefer use of relatively quieter equipment and new vehicles. • Frequent inspection and period maintenance of the mining equipment and vehicles will be carried out as per manufacturer specifications. • Use of PPEs will be ensured for staff working close to high noise equipment. • Blasting will not be carried out during night-time hours (10:00 PM to 06:00 AM). • Workers at the Mine Area will be provided with noise PPE during blasting sessions if they are within 3,000 m of blasting activities.			

• Noise levels within the operational areas will be periodically monitored to ensure that the noise levels remain within the applicable limits throughout the duration of shift. • Safety signages will be installed in areas where use of hearing PPEs is mandatory. • Warning sirens will be sounded prior to blasting activities to inform the staff to hearing PPEs. • Shift timings will be reduced for workers in operational areas with high noise levels to limit their exposure durations. • Medical check-ups of the mining staff and those working in the mineral processing plant will be frequently conducted to assess any impacts due to high noise levels. • .			
Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter-Generational - >20 years	Minor (negative) -24
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	2	Moderate, short-term effects. On-going social issues.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		

7.3.4 Elevated Noise Levels due to Additional Rail Traffic

The comparison of Baseline Noise Levels and Predicted Ambient Noise Levels in **Exhibit 6.4** depicts that the Predicted Ambient Noise Level in Segment 1 will not be perceptible to human receptors due to a lower level of increment over the Baselines Noise Levels. However, the increment over Baseline Noise Levels in Segment 2 and 3 is significantly higher, ranging between 12.36 dBA and 15.91 dBA. Due to this, the Predicted Ambient Noise Levels in these segments will be perceived as doubling in loudness due to railway movement.

The railway movement will be intermittent throughout the day, with the addition of 20 trains to the baseline train traffic. As a result, daytime and night-time noise levels may not accurately reflect the conditions experienced by receptors. These averaging periods are appropriate for assessing compliance when noise levels are continuous or when receptors are exposed to noise for extended durations. Continuous exposure with traffic related to the Project is unlikely, as receptors will be exposed to elevated noise levels only during brief pass-by events, which typically last less than a minute depending on the train's speed and length. Therefore, impacts on receptors have been assessed based on these pass-by events alone.

Although **Exhibit 6.3** indicates that noise levels during Project train pass-by events will remain within applicable limits, the Project will conduct continuous noise monitoring for a weekday and weekend, to assess on-ground noise levels and their impact on receptors. This will be monitored via frequent engagement with the receptors located close to the railway track as well as through noise monitoring conducted in areas where an increment

of more than 3 dBA is estimated over the baselines such as Nushki, and Sibi. Additional noise monitoring will be conducted in case of grievances from the receptors.

As monitoring of noise levels during a pass-by event is more appropriate in assessing impacts on the receptors, this noise monitoring will be focused on capturing noise levels during pass-by events as well as changes in day-time and night-time noise levels. The noise levels of a pass-by event will be compared with the limit of 88 dBA prescribed in 49 CFR 201.12 (b), or as notified by regulatory authorities at the time of monitoring.

Since changes to infrastructure within the railway track's right of way are beyond the Project's scope and jurisdiction, the Project will collaborate with Pakistan Railways to implement adequate mitigation or control measures, as deemed appropriate, in areas where the impacts on receptors due to increase in noise levels is attributed to the Project's railway traffic.

The Project, in consultation with Pakistan Railways, will investigate options for implementation of the following mitigation or control measures to ensure that the noise levels remain within the limits and do not impact the receptors.

A detailed investigation of mitigation and control measures for each modelled segment of Rail Transport Route is provided in **Appendix B** (**D4NM9RKI** – Noise Modelling of Rail Transport Route). Overall, the impact of noise from the Project's railway traffic on receptors is predicted to be relatively low, as the railway track is already in use for freight trains operated by Pakistan Railways. Additionally, the acoustic usage factor of the train movement is 2%, resulting in a minimal contribution to the overall noise levels.

Impact N06: Elevated noise levels due to movement of additional railway traffic			
Phase: Operations			
Impact Description: Nuisance to local communities due to elevated noise levels from railway movement			
Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter -Generational >20 years	Minor (negative) -36
Extent	2	Local Extending across the site and to nearby settlements.	
Intensity	2	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation can be done in less than a month. On-going social issues.	
Probability	4	Likely The impact may occur (50-90%).	
Nature	Negative		

Mitigation/Management Actions			
• Conduct continuous 24-hours noise monitoring for over a weekday and weekend at nearest receptors where the Predicted Ambient Noise levels with Project railway shows an increase of more than 3 dBA over the baselines. This will assist the Project to assess incremental noise levels as well as their perception by the receptors. • In case of any impacts due to increase in noise levels from Project's railway traffic, collaborate with Pakistan Railway for implementation of mitigation and control measures.			
Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	5	Inter -Generational >20 years	Minor (negative) -36
Extent	2	Local Extending across the site and to nearby settlements.	
Intensity	2	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation can be done in less than a month. On-going social issues.	
Probability	4	Likely The impact may occur (50-90%).	
Nature	Negative		

7.4 Decommissioning Phase

7.4.1 Noise Generated during Decommissioning Phase

The sources of elevated noise levels during the decommissioning phase will include operation of equipment and vehicles for backfilling of foundations, demolition of structures, closure of the open-pit and tailings storage facility, disposal of the debris.

Noise generated from the demolition activity will be among the major noise sources during the decommissioning phase, but these noise levels will last for a short duration. The noise levels estimated for the construction phase are used for assessing noise levels impacts during the decommissioning phase in absence of a decommissioning plan at the time of writing this report. The noise levels during the decommissioning phase are expected to be much lower as compared with the construction phase. This is due to several equipment and vehicles such as batch mixers, and drills etc., not being used for decommissioning.

Based on the analysis made in **Exhibit 7.1**, the decommissioning activities of the Project will not result in a perceptible increase over the ambient noise levels at the receptor during daytime or night-time. This is primarily due to a lower increment in daytime and night-time noise levels, in the range of 0.02 dBA to 0.5 dBA at the location of receptors. The lower contribution of decommissioning phase noise levels is primarily attributed to the larger distance of the receptors from the Mine Site. As the increase in noise levels during the construction phase for receptors are considered minimal, the intensity of this impact is expected to be minor.

Impact N07: Noise generated during decommissioning phase			
Phase: Decommissioning			
Impact Description: Elevated noise levels during the decommissioning phase can cause nuisance among the human receptors.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	2	Short term Up to 2 years	Negligible (negative) -12
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on physical environment. Environmental damage can be rehabilitated. Minor medium-term social impacts on local population. Mostly repairable.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%).	
Nature	Negative		
Mitigation/Management Actions			
Good Industrial Practice: • Monitor and periodically maintain noise producing units to reduce noise levels to the possible extent. • Consider installation of visual alarms instead of audible alarms to the extent possible. • Installation of noise abatement devices such as mufflers and silencers will be considered to reduce noise at the source, wherever feasible. • Prioritise use of new equipment and vehicles over older equipment to ensure that the noise levels do not exceed the prescribed limits at reference distances. • Periodically monitor instantaneous and 24-hours continuous noise levels at the Mine Site boundary and where receptors are located.			
Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	2	Short term Up to 2 years	Negligible (negative) -12
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on physical environment. Environmental damage can be rehabilitated. Minor medium-term social impacts on local population. Mostly repairable.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		

7.5 Elevated Noise Levels from Road Transportation

Increased vehicular movement on roads can cause elevated noise levels due to noise from engines and use of horns. These elevated noise levels can cause nuisance at receptors if exposed for longer durations.

The primary transport route for the project during construction and operations will be via road from Karachi to Reko Diq Mine Site. At several sections, the Road Transport Route transits past habituated areas located at distance of <500 km from the road. An increase in baseline traffic levels due to Project induced traffic can cause elevated noise levels, especially within the silent zones where baseline noise levels are already low.

Based on the analysis of traffic conducted in **R4TS8RKG – Traffic Study**, the Project's contribution to the existing traffic levels will be less than 1%. Therefore, the Project's contribution to elevated noise levels due to vehicular movement will be very low. The exposure period will be relatively longer as this noise will last during both construction and operations phase of the Project.

The Project will ensure that the instantaneous noise levels from the transportation vehicles will remain within the limits prescribed in NEQS for motor vehicles and IFC General EHS Guidelines. Although the significance of Project's impacts on the sensitive receptors due to road transportation is low, implementation of the following good practices can be investigated for further reduction in noise levels. This will enable the Project to ensure that the vehicular movement during construction or operational phase does not impact the nearby sensitive receptors.

- Regularly maintenance of vehicles according to the manufacturer specifications.
- Implement policies to prohibit use of horn (except in emergency situations) in areas where human dwellings or receptors are close to the Road Transport Route.
- Minimize vehicular movement during peak congestion hours to reduce contribution in elevated noise levels.
- Comply with regional speed limits at all times.

Impact N02: Elevated noise levels from road transportation			
Phase: Construction and Operations			
Impact Description: Increase in vehicular movement on local roads can cause elevated noise levels.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	3	Medium term 2 to 5 years	Negligible (negative) - 15
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local	

		population. Mostly repairable. Functions and processes not affected.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		
Mitigation/Management Actions			
Good Practices: • Regularly maintenance of vehicles according to the manufacturer specifications. • Implement policies to prohibit use of horn (except in emergency situations) in areas where human dwellings or receptors are close to the Road Transport Route. • Minimize vehicular movement during peak congestion hours to reduce contribution in elevated noise levels. • Comply with regional speed limits at all times.			
Post-Mitigation			
Dimension	**Rating**	**Interpretation of Rating**	**Significance**
Duration	3	Medium term 2 to 5 years	Negligible (negative) - 15
Extent	1	Site Specific Limited to the site and its immediate surroundings.	
Intensity	1	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly repairable. Functions and processes not affected.	
Probability	3	Probable Has occurred here or elsewhere and could therefore occur (20-50%)	
Nature	Negative		

7.6 Impact on Noise Levels due to Changing Climate

The climate change assessment indicates an increasing trend in temperature under both optimistic and worst-case scenario. This can also lead to changes in relative humidity for the future time horizon. Although the increasing temperature can affect the propagation of pressure waves, the projected change for the Reko Diq Mine Site, Road Transport Route, Rail Transport Route, and Port Qasim is relatively low with a maximum increase of 2.86ºC under the worst-case scenario for mid-term time horizon. Hence, the resultant impact of changing temperature on the propagation of sound pressure waves is expected to remain negligible.

Other parameters such as changes in mean seasonal or annual precipitation do not impact noise levels. Therefore, the impacts of noise levels assessed in **Section 7.2** through **Section 7.4** will remain unchanged under changing climate.

8. Environmental / Social Management Plan

Exhibit 8.1 provides the Environmental and Social Management Plan with respect to management of all noise related impacts.

Exhibit 8.1: Environmental Management Plan – Noise

Impact	*Activity*	*Mitigation Measures*	*Recommended Action Plans*	*Time period for implementation*
Construction Phase				
Noise generated from construction activities	Excavation of open-pit, installation and commissioning of the Project equipment.	♦ Monitor and periodically maintain noise producing units to reduce noise levels to the possible extent. ♦ Install visual alarms instead of audible alarms to the extent possible. ♦ Installation of noise abatement devices such as mufflers and silencers will considered to reduce noise at the source wherever feasible. ♦ Prioritise use of new equipment and vehicles over older equipment to ensure that the noise levels do not exceed the prescribed limits at reference distances. ♦ Periodically monitor instantaneous and 24-hours continuous noise levels at the Mine Site boundary and at location of receptors to ensure compliance with applicable standards.	-	Continually during construction phase
Elevated noise levels from road transportation	Transportation on Road Transport Route	**Good Practices:** ♦ Regularly maintenance of vehicles according to the manufacturer specifications. ♦ Implement policies to prohibit use of horn (except in emergency situations) in areas where human dwellings or receptors are close to the Road Transport Route. ♦ Minimize vehicular movement during peak congestion hours to reduce contribution in elevated noise levels. ♦ Comply with regional speed limits at all times.	-	Continually during construction and operations phase
Operations Phase				
Nuisance to receptors due to impulse noise generated from blasting	Open-pit operations for rock loosening	♦ Local communities will be informed prior to blasting activities.	Air Quality, Noise and Vibration	Continually during operations phase

Impact	*Activity*	*Mitigation Measures*	*Recommended Action Plans*	*Time period for implementation*
		• Blasting will not be carried out during night-time hours (10:00 PM to 06:00 AM). • Workers at the Project site will be provided with noise protection equipment during blasting sessions if they are within 3000 m of blasting activities.	Management Plan.	
Nuisance to receptors due to impulse noise generated from operations phase activities	Vehicular movement, operations of mineral processing plant, mining equipment, and HFO power plant	**Good Practices:** • Visual alarms will be used in preference to audible alarms where appropriate. • Acoustical enclosures will be provided around noise producing equipment where appropriate. • Periodic noise monitoring will be carried out at the receptors to ensure compliance with applicable standards.	Air Quality, Noise and Vibration Management Plan.	Continually during operations phase
Adverse impacts on the workers' health due to continuous exposure to loud noise	Vehicular movement, operations of mineral processing plant, mining equipment, and HFO power plant	**Control Measures:** • Investigate options of equipment enclosures to reduce noise levels • Mufflers will be installed to reduce noise from power plants and back-up generators. **Mitigation Measures:** • Prefer use of relatively quieter equipment and new vehicles. • Frequent inspection and period maintenance of the mining equipment and vehicles will be carried out as per manufacturer specifications. • Use of PPEs will be ensured for staff working close to high noise equipment. • Blasting will not be carried out during night-time hours (10:00 PM to 06:00 AM).	Air Quality, Noise and Vibration Management Plan.	Continually during operations phase

Impact	*Activity*	*Mitigation Measures*	*Recommended Action Plans*	*Time period for implementation*
		♦ Workers at the Mine Area will be provided with noise PPE during blasting sessions if they are within 3,000 m of blasting activities. ♦ Noise levels within the operational areas will be periodically monitored to ensure that the noise levels remain within the applicable limits throughout the duration of shift. ♦ Safety signages will be installed in areas where use of hearing PPEs is mandatory. ♦ Warning sirens will be sounded prior to blasting activities to inform the staff to hearing PPEs. ♦ Shift timings will be reduced for workers in operational areas with high noise levels to limit their exposure durations. Medical check-ups of the mining staff and those working in the mineral processing plant will be frequently conducted to assess any impacts due to high noise levels.		
Elevated daytime and night-time noise levels due to movement of railways	Project transport	♦ Conduct continuous 24-hours noise monitoring for over a weekday and weekend at nearest receptors where the Predicted Ambient Noise levels with Project railway shows an increase of more than 3 dBA over the baselines. This will assist the Project to assess incremental noise levels as well as their perception by the receptors. ♦ In case of any impacts due to increase in noise levels from Project's railway traffic, collaborate with Pakistan Railway for implementation of mitigation and control measures.	-	Continually during operations phase
Decommissioning Phase				

Impact	*Activity*	*Mitigation Measures*	*Recommended Action Plans*	*Time period for implementation*
Noise generated during decommissioning phase		♦ Monitor and periodically maintain noise producing units to reduce noise levels to the possible extent. ♦ Install visual alarms instead of audible alarms to the extent possible. ♦ Installation of noise abatement devices such as mufflers and silencers will be considered to reduce noise at the source, wherever feasible. ♦ Prioritize use of new equipment and vehicles over older equipment to ensure that the noise levels do not exceed the prescribed limits at reference distances. ♦ Periodically monitor instantaneous and 24-hours continuous noise levels at the Mine Site boundary and at location of receptors to ensure compliance with applicable standards.	-	Continually during decommissioning phase

9. Monitoring Plan

Exhibit 9.1 provides the Environmental Monitoring Plan for monitoring and reporting of the noise-related aspects throughout the Project lifecycle.

Exhibit 9.1: Environmental Monitoring Plan – Noise

Aspect	*Type of Monitoring*	*Monitoring Frequency*
Construction		
Elevated daytime and night-time noise levels	Continuous 24-hours monitoring at the onsite accommodation camp and Humai settlement.	Monthly. Additional monitoring in case of any grievance.
Vehicular noise	Instantaneous noise monitoring of construction phase vehicles	Quarterly Additional monitoring in case of any grievances.
Operations		
Noise levels during blasting	Short-term noise monitoring to capture impulse noise during blasting.	During blasting events.
Elevated daytime and night-time noise levels	Continuous 24-hours monitoring at the onsite accommodation camp and Humai settlement.	Monthly. Additional monitoring in case of any grievance.
Elevated noise levels in operational areas	Continuous 8-hour monitoring in operational areas including mineral processing plant, open-pit, and HFO power plant.	Monthly.
Noise levels during train pass-by	Noise monitoring during train pass-by at 30 m distance from the centre of the railway track. This monitoring will be conducted in sections where sensitive receptors are located close to the railway track along the Rail Transport Route.	Quarterly, at receptors situated within 100 m of the Rail Transport Route during pass-by events.
Elevated daytime and night-time noise levels	Continuous 24-hours monitoring at the nearest receptor from the railway track along the Rail Transport Route.	Quarterly, can only be done on days where train pass-by occurs. Additional monitoring in case of any grievance.
Decommissioning		
Elevated daytime and night-time noise levels	Continuous 24-hours monitoring at the onsite accommodation camp and Humai settlement.	Quarterly. Additional monitoring in case of any grievance.

10. Conclusions and Recommendations

10.1 Specialist Impact Statement

The Project's impact due to blasting in the open pit is not significant considering that human receptors and dwellings are located at significant distances from the Mine Site. These impacts are expected to be further minimised after implementation of the mitigation measures and timing the blasting activities during daytime. Additionally, the impulse noise from blasting is also expected to lessen with increase in the depth of the open pit. Therefore, the implementations of mitigation should be investigated in consideration of the mine depth.

During operations phase, high noise levels are anticipated in the operational areas. Due to use of large quantities of ANFO for ore loosening, impulse noise from the blasting is also expected to be high. The Project will ensure that all of the onsite personnel are issued with appropriate hearing PPEs.

In terms of noise levels during operational phase along the Rail Transport Route, the noise-related impacts on the receptors are considered significant considering that several receptors are located in close proximity of the railway track. However, these noise levels will elevate for relatively short durations not lasting more than the duration of the pass-by event.

10.2 Key Findings and Recommendations

The key findings and recommendations of this Specialist Report are summarised below:

- There are no receptors near the open-pit or the processing plant.
- The baseline noise levels indicate exceedance from the limits prescribed in NEQS, SEQS, and IFC General EHS Guidelines for residential receptors. At the Reko Diq Mine Site, these exceedances are due to high-speed natural wind conditions. At the other Project components, the exceedances are due to existing levels of high road and rail traffic.
- Noise protection PPEs will be provided to the onsite personnel for working near the equipment having high noise levels (>85 dBA). The exposure periods of the staff will also be reduced while working near high noise equipment to reduce the potential of noise-induced illness.
- Workers will be provided with noise protection if their occupational areas are within 3,000 m distance from the location of explosives detonation.
- Along the Rail Transport Route, continuous noise monitoring will be conducted at sensitive receptors to ensure that noise levels remain within the applicable limits. In case of any exceedances, Pakistan Railways will be consulted to assess noise control/mitigation options for reduction of noise levels.

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