

PAPUA LNG PROJECT - DOWNSTREAM

Noise Impact Assessment

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In this document a reference to "ExxonMobil" may be to ExxonMobil PNG Antelope Limited, or Niugini LNG Operating Company Limited, as the case requires. Nothing in this material is intended to override the corporate separateness of any entities.

DOCUMENT CONTROL

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CONTENTS

1	INTRODUCTION	7
1.1	Assessment Objectives	8
2	PROJECT DESCRIPTION	10
2.1	Project Area	10
2.2	Project Overview.....	10
2.3	Onshore Production Facilities.....	15
2.3.1	Supporting Utilities and Offsites.....	15
2.3.2	Temporary Facilities	18
2.3.3	Marine Facilities	18
2.3.4	Offshore Pipelines	18
2.3.5	Workforce and Accommodation	18
2.3.6	Logistics Route.....	19
2.3.7	Commissioning and Operation	19
2.4	Project Schedule	19
2.5	Noise Sensitive Receptors.....	19
3	PROJECT SITE EXISTING NOISE ENVIRONMENT	22
3.1	Noise Environment at External Noise Sensitive Receptors	22
3.2	Noise Environment at LNG Plant	27
4	PROJECT SITE METEOROLOGICAL ENVIRONMENT	30
4.1	Prevailing Wind	30
4.2	Atmospheric Stability.....	33
4.3	Selected Representative Meteorology	35
5	NOISE ASSESSMENT CRITERIA	36
5.1	PNG LNG Project Environment Permit	36
5.2	PNG Environment Act No. 64 of 2000	36
5.3	WHO Guidelines for Community Noise	37
5.4	IFC / World Bank Noise Management Guidelines	38
5.5	Construction Noise	38
5.6	Recommended Environmental Noise Criteria	38
6	NOISE MODELLING METHODOLOGY.....	40
6.1	Noise Model Details.....	40

CONTENTS

6.2	Noise Emission of Existing Operation (Normal Operation)	41
6.2.1	Existing Plant Noise Model Verification.....	41
6.3	Project Construction Noise Sources	42
6.4	Noise Emission During Project Operation.....	44
6.4.1	Normal Operation	44
6.4.2	Upset Operation	45
7	NOISE PREDICTION RESULTS	46
7.1	Construction Noise Predictions	46
7.2	Operational Noise Predictions	50
8	DISCUSSION	53
8.1	Existing Plant Under (Normal) Operation	53
8.2	Construction Noise	54
8.3	Operational Noise	55
8.4	Noise Assessment Summary.....	57
8.5	Recommendations.....	58
9	CONCLUSION.....	61

DOCUMENT REFERENCES

TABLES

Table 1	Project Components at the LNG Plant	11
Table 2	Project Timeframe.....	19
Table 3	Closest NSR Locations used in the LNG Plant Noise Modelling	20
Table 4	Baseline Noise Monitoring Locations and Equipment Details	22
Table 5	Summary of Ambient Noise Level Results, LA90 noise descriptor.....	25
Table 6	Summary of Ambient Noise Level Results, LAeq noise descriptor.....	25
Table 7	Attended Ambient Noise Measurement Results	26
Table 8	NSR adopted Background Levels.....	27
Table 9	LNG Plant Unattended Reference Noise Monitoring Location	28
Table 10	Summary of Unattended Noise Monitoring Results at the Reference Location	28
Table 11	Description of Atmospheric Stability Classes	34
Table 12	Prevailing Weather and Worst Case Noise Propagation Meteorological Parameters	35
Table 13	PNG LNG Project Environment Permit, Noise Limit Guidelines	36
Table 14	Recommended Project Noise Criteria	38
Table 15	NSR adopted Noise Limits	39
Table 16	Comparison of Predicted and Measured Noise Levels at the Plant Boundary	42

CONTENTS

Table 17	Summary of Construction Noise Scenarios	43
Table 18	Summary of Operational Noise Scenarios.....	45
Table 19	Predicted LAeq Construction Noise Levels Under Prevailing weather Noise Propagation Conditions, dBA	47
Table 20	Predicted LAeq Construction Noise Levels Under Adverse Noise Propagation Conditions, dBA.....	48
Table 21	Predicted LAeq Cumulative Construction Noise Levels Under Prevailing Weather Noise Propagation Conditions, dBA	49
Table 22	Predicted LAeq Cumulative Construction Noise Levels Under Adverse Noise Propagation Conditions.....	50
Table 23	Predicted Operational LAeq Noise Levels Under Prevailing Weather Noise Propagation Conditions, dBA	51
Table 24	Predicted Operational Noise Levels Under Adverse Noise Propagation Conditions, dBA.....	52
Table 25	Attended noise measurement results.....	68
Table 26	Existing LNG Plant Modelled (Normal) Noise Emission	75
Table 27	NiuPower 58 MW Power Plant Modelled Noise Emission	81
Table 28	Construction Noise Source Emission Database.....	82
Table 29	Plant Noise Emission Data for Normal Operation (Source: Reproduced from PGLP-CC-SRVIB-903001).....	86
Table 30	New Trains Diesel Generation Noise Emission (Upset Operation Only)	93

FIGURES

Figure 1	Papua LNG Project - Downstream Project location	9
Figure 2	Proposed Onshore Facilities for the Project	13
Figure 3	Proposed Marine Facilities for the Project.....	14
Figure 4	Overview of Proposed LNG Processing Systems	17
Figure 5	Closest Noise Sensitive Receptors and Baseline Long-Term Noise Monitoring Locations	21
Figure 6	Noise monitoring at Metago Bible College	23
Figure 7	Noise monitoring at Papa Village	23
Figure 8	Noise monitoring at Boera Village.....	24
Figure 9	Noise monitoring at Lea Lea Village	24
Figure 10	Attended Noise Measurement at Edai Village	24
Figure 11	Noise Monitoring at LNG Plant Reference Location	28
Figure 12	Noise monitoring location at LNG plant.....	29
Figure 13	Wind Roses for the LNG Plant Site – CALMET Prediction (2015)	31
Figure 14	Wind Roses for the Papua LNG Site – Model Prediction and Observations	32
Figure 15	Wind Speed Frequency Plot for the Papua LNG Plant Site – Measured versus Modelled	33
Figure 16	Stability Class Distribution for the Papua LNG Plant Site (WRF/CALMET Predictions, 2015)	34

CONTENTS

Figure 17	Focused Area of Mobile Equipment for Construction Activities (yellow shaded areas) (source: PGLP-CC-SRVIB-903001)	85
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APPENDICES

Appendix A	Background Noise Monitoring Time traces
Appendix B	LNG Plant Attended Noise Measurement Results
Appendix C	LNG Plant Reference Noise Measurement Time Traces
Appendix D	Noise Source Emissions Applied in Noise Modelling
Appendix E	Construction Noise Contour Maps
Appendix F	Operational Noise Contour Maps

1 Introduction

ExxonMobil PNG Limited (EMPNG) is the operator of the PNG LNG Project, an integrated development that is commercialising the gas resources of Papua New Guinea. The Papua LNG Project is a gas development project for the Papua LNG Project Joint Venture participants, which are: 1) TotalEnergies EP PNG Limited (TotalEnergies, an affiliate of TotalEnergies SA), 2) ExxonMobil PNG Antelope Limited (EMPNGA) and ExxonMobil PNG Elk Limited, 3) Pac LNG Assets Limited, Pac LNG International Limited, Pac LNG Investments Limited, Pac LNG Overseas Limited and Pac LNG Holdings Limited (affiliates of Santos Limited) and 4) JX Nippon Oil and Gas Exploration Pty Ltd.

ExxonMobil PNG Antelope Limited (EMPNGA) is the ExxonMobil affiliate responsible for the construction of the Project. Once the Project has been constructed and commissioned, the ExxonMobil affiliate Niugini LNG Operating Company Limited (NLOC), will be responsible for operation of the expanded LNG Plant (both new and existing facilities).

The Papua LNG Project involves two components:

- The Papua LNG Project – Upstream (referred to as the Upstream component)
- The Papua LNG Project – Downstream (the Project and the component addressed in this document).

The Papua LNG Project will involve producing and processing the gas and condensate from the Elk and Antelope gas reserves in Petroleum Retention License 15 (PRL-15), located in Gulf Province, Papua New Guinea and piping them overland, then offshore in the Gulf of Papua, to the existing Papua New Guinea Liquefied Natural Gas Project (PNG LNG Project) producing and exporting facility (LNG Plant) located in Caution Bay (Central Province) approximately 20 km north-west of Port Moresby (see Figure 1).

The existing PNG LNG Project commercialises gas reserves in the Hela, Western and Southern Highlands provinces of Papua New Guinea. The gas is extracted and conditioned, then transported to the LNG Plant via pipeline, where it is liquefied and exported by ship to international gas and domestic electricity markets.

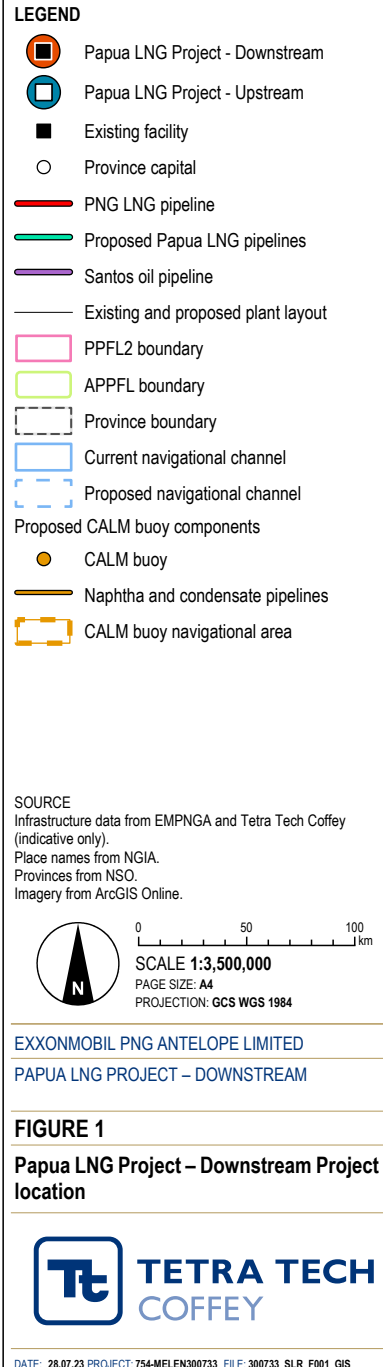
Execution of the Upstream component and the Project is delimited in Caution Bay, with the approximate boundary (i.e., the scope break) between the components located near the fence of the LNG Plant, south of the existing jetty.

SLR Consulting Australia Pty Ltd (SLR) was commissioned by Tetra Tech Coffey PNG Ltd (Tetra Tech Coffey), on behalf of EMPNGA to prepare a noise impact assessment for the Project. The findings of this assessment will inform the Environmental Impact Statement (EIS) for the Project.

1.1 Assessment Objectives

The objectives of the noise impact assessment were to:

- Evaluate the LNG Plant's performance against relevant criteria in Environment Permit EP-L3(210) (CEPA, 2015) and, where guidelines are not provided for in the Environment Permit, relevant international standards.
- Characterise the ambient noise environment.
- Compile an inventory of noise emissions from the existing LNG plant, proposed new expansion and ancillary infrastructure, and construction equipment noise sources.
- Assess the impacts of the LNG Plant's noise emissions on Noise Sensitive Receptors (NSR), from construction and operation of the new facilities.
- Assess the impacts of cumulative noise emissions on NSR, from construction and the operation of the new facilities, in conjunction with existing noise emission sources operating at the LNG Plant.
- Propose measures to manage noise exceedances of relevant criteria in Environment Permit EP-L3(210) and where not applicable, relevant international standards.



2 Project Description

2.1 Project Area

The LNG Plant is located in the Central Province, approximately 20 km north-west of Port Moresby, between the coastal settlements of Boera and Papa. The LNG Plant occupies three separate lease areas: Portion 2456, Portion 2457 (coastal strip) and Portion 2458 (offshore).

2.2 Project Overview

The Project incorporates the expansion of the LNG Plant's existing onshore and marine facilities in Caution Bay, including the installation of new LNG processing trains (SMR technology).

A new Combined Cycle Power Plant (CCPP) will be utilised to provide electric power for the LNG plant. The CCPP will consist of four gas turbine generators (GTGs), four Heat Recovery Steam Generators (HRSGs) and two steam turbine generators. The CCPP will provide sufficient power to the integrated LNG Plant, therefore three of the seven PNG LNG STGs will be repurposed as cold standby for the integrated LNG Plant.

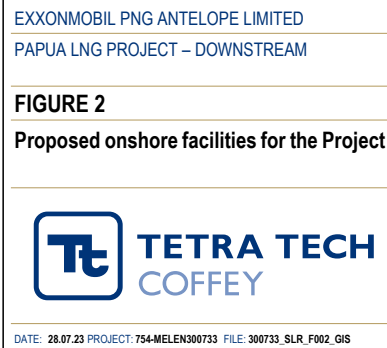
Figure 2 shows the proposed areas within the existing LNG Plant lease area where the new onshore facilities will be developed. The proposed marine facilities associated with the Project are shown in **Figure 3**.

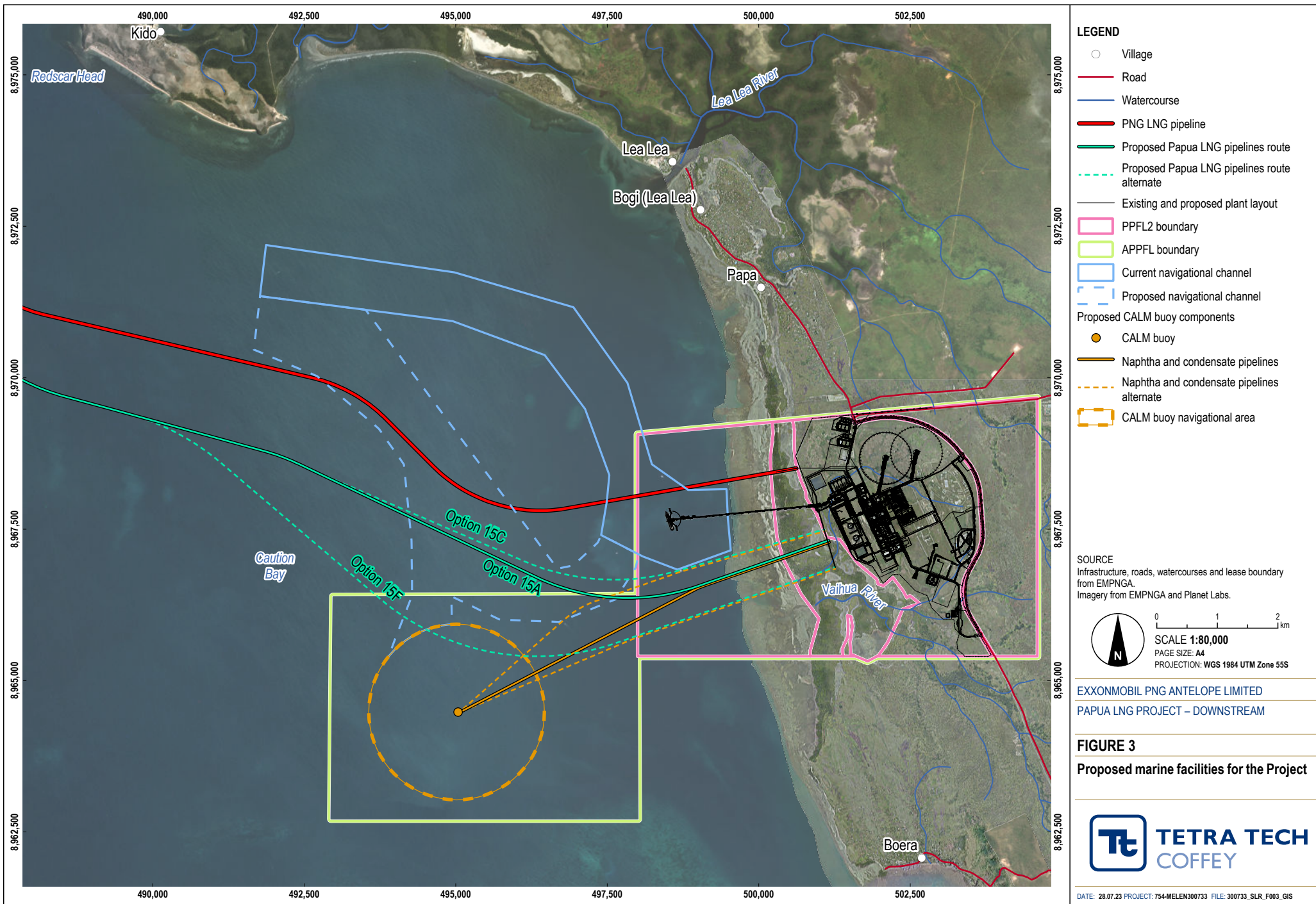
A summary of the components of the Project is provided in **Table 1**.

Table 1 Project Components at the LNG Plant

Component	Description
Additional LNG trains	New LNG processing trains and supporting systems including: • Inlet gas receiving and treatment. • Dehydration/mercaptan removal. • Mercury removal. • Heavy-hydrocarbon separation (which contains benzene, toluene, ethylbenzene, and xylenes (BTX)). • Liquefaction. • Stabilisation. • Refrigeration system. • Fractionation system (naphtha).
Expansion of existing utilities	Existing PNG LNG shared utilities to be expanded include: • Hot oil system. • Service and instrument air system. • Nitrogen system. • Freshwater system. • Desalinated water system. • Potable water system. • Diesel oil storage and distribution system. • Open and closed drain systems. • Sanitary wastewater treatment systems.
New utilities	Options for new separate utilities may include: • Integrated fuel gas system and power generation system. • Tempered water system. • Highly demineralised water system for the Heat Recovery Steam generators. • Flare system (wet and dry gas). • Thermal oxidizer.
Product storage	Product storage will include: • New condensate storage tanks with a total storage capacity of up to 110,000 m³.
New marine facilities	Marine facilities will include: • Catenary Anchor Leg Mooring (CALM) buoy and associated exclusion zones. • Pipeline end manifold (Upstream construction component, Project operations component) • Naphtha and condensate export pipelines (Upstream construction component, Project operations component). • New feed pipelines including a gas pipeline and a condensate pipeline (Offshore: Upstream construction and operations; Nearshore Project construction component and Upstream operations component), with landfall and tie-in to the pipelines at the LNG Plant. The pipelines will be located south of the existing LNG Plant jetty. • Alternate shipping channel. • Navigation and monitoring system.

Component	Description
Temporary facilities	Temporary construction facilities will be located within the PNG LNG Project's lease boundaries and will include laydown areas, offices, workshops and concrete batching plants.
Waste	Options being reviewed for waste facilities and management being assessed may include: • Temporary onsite storage and segregation of waste, with transport to and disposal at third party waste management facility • New engineered solid waste landfill within existing LNG Plant fence for disposal of non-restricted waste, with limited disposal of restricted waste by specialised service.
Logistics route	Most construction materials will be transported by truck from Motukea Port in Port Moresby to the LNG Plant via Lea Lea road. Repairs or upgrades to the road, or relocation of overhead cables may be required to allow transport of large, heavy loads.
Workforce	Construction: Approximately 5,000 to 7,000 personnel at peak. Operation: Increase of approximately 50 operations and maintenance technicians with support staff anticipated to increase.
Accommodation	Construction: Up to 6,000 bed construction camps. Operation: Up to 500 beds at the existing operations camp.





2.3 Onshore Production Facilities

New liquefaction trains will be located adjacent to the existing trains 1 and 2, as shown in **Figure 2**. As with the existing trains 1 and 2, processing of the gas into LNG requires removal of impurities and hydrocarbons that are heavier than methane, followed by super cooling to form a liquid. The new trains will utilise Single Mixed Refrigerant (SMR) technology to process the gas.

The main steps in LNG processing are shown in **Figure 4** and include the following systems:

- **Inlet receiving and treatment:** These systems receive gas from the pipelines, heat it to prevent hydrate (water) formation, and separate out liquids from the gas.
- **Dehydration and mercury removal:** Gas from the inlet and treatment systems is processed to remove moisture and mercury.
- **Heavy hydrocarbon removal:** The sweet, dry gas stream is fed to the Heavy Hydrocarbon Removal system, which includes the heavy hydrocarbon removal cold box, scrub column feed separator and scrub column. Heavier hydrocarbons (such as ethane, propane and butane) are separated off at this stage to avoid freezing in the liquification step.
- **Liquefaction:** The gas is cooled to below the methane boiling point of around -161°C. At this temperature, it liquefies to 1/600th of its original volume.
- **Refrigeration:** These systems cool and pressurise the refrigerants used in the liquefaction systems.
- **Fractionation:** The heavier hydrocarbons removed prior to cooling the gas are processed to produce naphtha.

The main products produced by the existing LNG Plant include LNG and naphtha. The LNG Plant also supplies gas to the Port Moresby Power Station for the domestic electricity market.

Sour naphtha recovered from the fractionation system will be blended with the Papua LNG field condensate and stored in new storage tanks with a total capacity of 110,000 m³. The blended product is then pumped from the new condensate storage tanks to the CALM buoy, to be loaded onto tankers for shipping.

2.3.1 Supporting Utilities and Offsites

Facilities and infrastructure required to support the operation of the new LNG trains are distinguished by those that are shared facilities and those that are new facilities. The shared facilities will be common to existing and new trains and will utilise the available capacity of the existing LNG Plant systems with some modifications and upgrades to provide expanded capacity where required. New facilities will be for the operation of the new LNG trains.

The existing LNG Plant shared facilities and infrastructure that the Project will tie into, modify, or expand include:

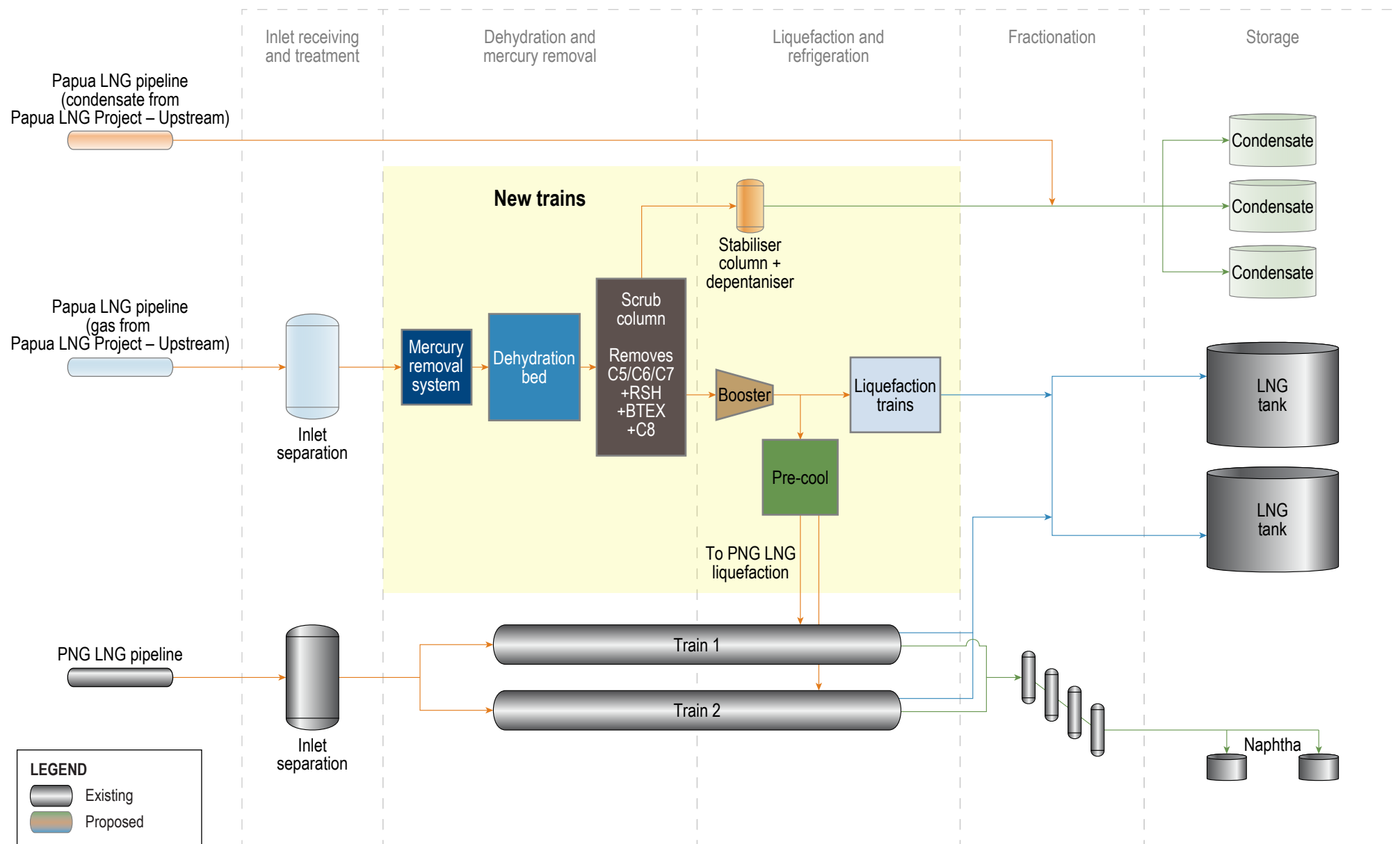
- Hot oil system.
- Power generation system.
- Service and instrument air system.
- Nitrogen system.

-
- Fresh water system.
 - Desalinated water system.
 - Firewater supply system.
 - Potable water system.
 - Diesel oil storage and distribution system.
 - Open and closed drain systems.
 - Sanitary wastewater treatment systems.

New facilities and infrastructure to be constructed include:

- Integrated fuel gas system.
- Tempered water system.
- Highly demineralized water system for the Heat Recovery Steam Generators (HRSGs).
- Wet and dry flare systems.
- Thermal oxidizer.

As the Project progresses through FEED, final design may also include removing certain articles of proposed infrastructure completely, using existing infrastructure, or adjusting locations within the LNG Plant boundary.



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PAPUA LNG PROJECT – DOWNSTREAM

FIGURE 4

Overview of proposed LNG processing systems

SOURCE
EMPNGA

2.3.2 Temporary Facilities

Temporary facilities will be required during construction and include laydown areas, offices, workshops, a temporary desalination facility and concrete batching plants. These facilities will be located within the existing LNG Plant lease boundaries.

2.3.3 Marine Facilities

A Catenary Anchor Leg Mooring (CALM) buoy will be installed to expand the existing marine offloading facilities to accommodate the increased LNG and non-LNG liquids production rates and subsequent increase in the number of vessels. The CALM buoy will delink the non-LNG liquids (naphtha and condensate) from LNG offloading at the existing berth. The concept includes a second shipping channel, additional navigational and monitoring systems, and approximately 7 km of subsea pipelines for the naphtha and condensate. Additional upgrades to the existing berth are being considered to improve maintainability such as the installation of a maintenance crane and replacement of the existing condensate loading arm with an LNG loading arm.

2.3.4 Offshore Pipelines

Two new pipelines, one for feed gas (40-inch diameter pipe) and one for field condensate (10-inch diameter pipe), and including a fibre optic cable line, will be constructed, and operated as part of the Upstream component to deliver product to the LNG Plant. Combined, this pipeline infrastructure is referred to as the 'Papua LNG pipelines'. The Papua LNG pipelines are to be located on the southern side of the existing LNG Plant jetty and traverse the existing LNG Plant PPFL2 boundaries (see **Figure 3**).

The Papua LNG pipelines will be laid on the sea floor by a pipelaying vessel and pulled ashore by equipment located on land. Depending on seabed conditions, the pipe will be placed in an excavated trench, or laid by ploughing or jetting. The Papua LNG pipelines will be concrete-coated to weigh them down and for protection from external influences.

The offshore pipelines will connect to a short section of onshore pipeline that will then 'tie-in' to the LNG Plant.

2.3.5 Workforce and Accommodation

A construction workforce of between 5,000 and 7,000 people will be needed to construct the Project over the planned four-year period. The permanent operations and maintenance workforce is expected to increase by approximately 50 technician personnel to support the integrated LNG Plant. Support staff is anticipated to increase and will be evaluated throughout FEED.

The existing operations camp is sufficient to meet increased capacity from the Project and will not be expanded. Camp A is anticipated to meet the capacity of the integrated LNG Plant. The existing Camp A has approximately operational 500 beds, of which approximately 300 personnel represent the steady state requirement on site. This provides approximately 200 beds for overflow capacity for events such as major maintenance programs and unplanned events.

2.3.6 Logistics Route

Most construction material will be imported by ship via Motukea Port and trucked to site along the Lea Lea Road. If materials are shipped to Motukea Port then the Road may require repairs or upgrade, including relocation of overhead cables, to accommodate heavy and/or overweight vehicles and transport of large modules. Transport of construction and operations personnel from Port Moresby will also occur along this road.

Smaller sensitive equipment and time constrained shipments may be transported by air to Jacksons International Airport in Port Moresby and trucked to the LNG Plant.

2.3.7 Commissioning and Operation

Commissioning activities will be required to test the modified shared facilities and new facilities at the LNG Plant. These activities are expected to include testing the operation of individual components and systems, including flaring during start-up.

The operational and maintenance procedures are expected to be similar to those in place at the existing LNG Plant.

2.4 Project Schedule

Timeframes for key project development milestones are shown in **Table 2** below:

Table 2 Project Timeframe

Key Milestone	Timeframe
Environment surveys and approval process	2022 to 2023
Front-end engineering design	2023
Detailed engineering design	2024 to 2026
Construction	2023 to 2027
Commissioning and start-up	2027 to 2028

2.5 Noise Sensitive Receptors

The four villages closest to the LNG Plant are Lea Lea, Papa, Boera and Porebada. These villages are located within the Hiri Rural Local Level Government (LLG) area, which forms part of Hiri District in Central Province. In the 2011 National Population and Housing Census, the Hiri Rural LLG was reported to have a total population of approximately 47,000 people, with the population in the closest villages to the LNG Plant being (Coffey, 2020):

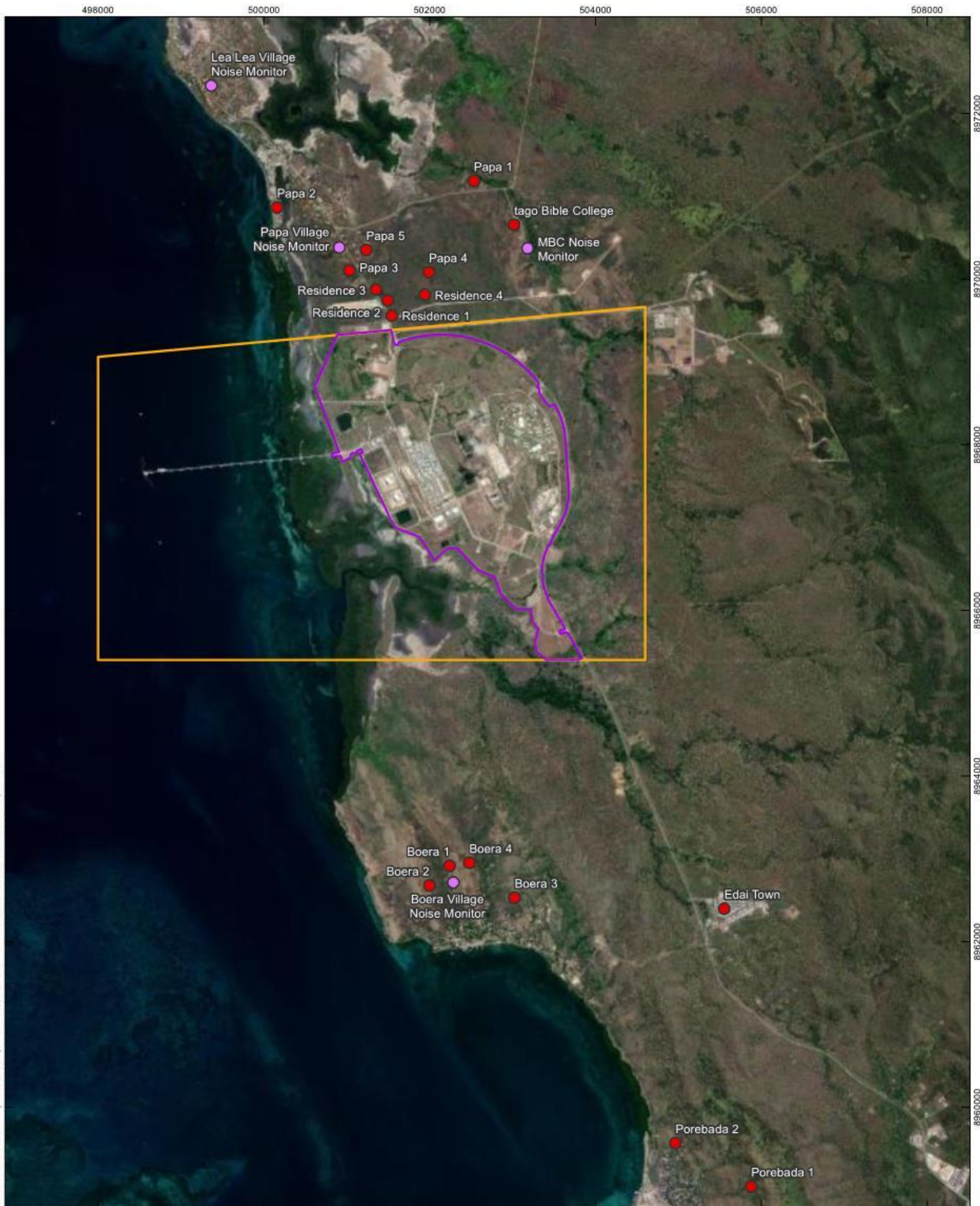
- Papa - 2,415 people.
- Boera - 3,178 people.
- Porebada - 7,193 people.
- Lea Lea - 4,577 people.

In addition to these villages, four residences are identified within 500 m from the northern perimeter fence of the of the project site. These residences along with thirteen representative receptor locations for the villages were selected to use in the noise modelling study performed as part of this assessment to represent the residential areas closest to the LNG Plant site.

The Noise Sensitive Receptor (NSR) receptor locations whereby noise predictions have been conducted are shown in **Figure 5** and their coordinates are listed in **Table 3**. These represent the closest NSR to the Project.

Table 3 Closest NSR Locations used in the LNG Plant Noise Modelling

Receptor	Receptor Name	Location (MGA 94 Zone 55)	Approximate distance from perimeter fence, Km
NSR1	Boera 1	502,240 mE, 8,962,912 mN	3.8, south
NSR2	Boera 2	501,992 mE, 8,962,677 mN	4.0, south
NSR3	Boera 3	503,026 mE, 8,962,530 mN	3.9, south
NSR4	Boera 4	502,474 mE, 8,962,950 mN	3.6, south
NSR5	Edai Town	505,553 mE, 8,962,397 mN	3.5, south-southeast
NSR6	Papa 1	502,534 mE, 8,971,184 mN	1.9, north
NSR7	Papa 2	500,154 mE, 8,970,865 mN	1.7, north-northwest
NSR8	Papa 3	501,030 mE, 8,970,105 mN	0.8, north
NSR9	Papa 4	501,991 mE, 8,970,083 mN	0.8, north
NSR10	Papa 5	501,231 mE, 8,970,351 mN	1.0, north
NSR11	Porebada 2	504,964 mE, 8,959,564 mN	5.9, south-southeast
NSR12	Residence 1	501,540 mE, 8,969,563 mN	0.2 north
NSR13	Residence 2	501,491 mE, 8,969,745 mN	0.4 north
NSR14	Residence 3	501,348 mE, 8,969,874 mN	0.5 north
NSR15	Residence 4	501,940 mE, 8,969,813 mN	0.5 north
NSR16	Metago Bible College	503,017 mE, 8,970,657 mN	1.6, north
NSR17	Porebada 1	505,878 mE, 8,959,040 mN	6.7, south-southeast



 0 1 2 km
 Coordinate System: WGS 1984 UTM Zone 55S
 Scale: 1:60,000 at A4
 Project Number: 620.31072
 Date: 27-Feb-2023
 Drawn by: NT

- Receptor
- Long-Term Baseline Noise Monitoring Location
- Perimeter Fence
- Lease Boundary

CLOSEST NOISE SENSITIVE RECEPTORS TO LNG PLANT SITE

3 Project Site Existing Noise Environment

3.1 Noise Environment at External Noise Sensitive Receptors

Noise monitoring was conducted in four villages close to the LNG plant during May 2019 to characterise existing ambient noise levels.

The selected monitoring sites were:

- Metago Bible College - approximately 2.4 km north-northeast of the LNG plant
- Papa Village, approximately 2.6 km north-northwest of the LNG plant
- Boera Village, approximately 4.5 km south of the LNG plant
- Lea Lea Village, approximately 4.5 km northwest of the LNG plant
- In addition, a daytime attended noise measurement was conducted at Edai Village, located approximately 5.5 km southeast of the LNG plant.

These baseline noise monitoring locations are also show **Figure 5** above.

These locations give a good representation of the village areas nearest the LNG plant. Photographs taken at each of the monitoring sites are presented in **Figure 6** to **Figure 10**.

All measurements were conducted with Acoustic Research Laboratories ARL Type 316 noise loggers which were set to capture hourly data, including the L_{Amax}, L_{A10}, L_{A90}, L_{Aeq} and L_{Amin} noise level descriptors. Details of the monitoring equipment are provided in **Table 4**.

All acoustic instrumentation employed throughout the monitoring programme complied with the requirements of Australian Standard 1259.2:1990 – *Sound Level Meters* and carried current NATA¹ or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

Table 4 Baseline Noise Monitoring Locations and Equipment Details

Location	Description of location and geographic coordinates	Measurement Period	Equipment Details
Metago Bible College	10 m north of chapel building, next to water storage tank mE 503181, mN 8970374	1530 h 13 May 2019 to 0900 h 16 May 2019.	S/N 16-203-526
Papa Village	Base of pole house on southeast corner mE 500907, mN 8970383	1430 h 13 May 2019 to 1000 h 16 May 2019.	S/N 16-207-043
Boera Village	Base of pole house on southeast corner mE 502284, mN 8962709	0930 h 14 May 2019 to 1030 h 16 May 2019.	S/N 16-306-043
Lea Lea Village	Bogi Station- northern corner of fence mE 499365, mN 8972340	1630 h 13 May 2019 to 0900 h 16 May 2019.	S/N 16-207-046

¹ National Association of Testing Authorities of Australia.

Figure 6 Noise monitoring at Metago Bible College



Figure 7 Noise monitoring at Papa Village



Figure 8 Noise monitoring at Boera Village



Figure 9 Noise monitoring at Lea Lea Village



Figure 10 Attended Noise Measurement at Edai Village



Table 5 and **Table 6** presents a general summary of the ambient noise levels for day, evening and night periods in terms of the LA90 and LAeq noise levels (time trace plots are provided in **Appendix A**).

Table 5 Summary of Ambient Noise Level Results, LA90 noise descriptor

Location	Ambient Noise Level, dBA											
	LA90,1hr				LA90,1hr				LA90,1hr			
	(07:00 to 18:00)				(18:00 to 22:00)				(22:00 to 07:00)			
	Max	Ave	Min	RBL	Max	Ave	Min	RBL	Max	Ave	Min	RBL
Metago	36	32	28	29	50	42	35	38	43	40	37	38
Papa	43	36	30	32	48	43	38	40	51	46	43	43
Boera	40	33	28	30	47	42	35	39	51	46	43	45
Lea Lea	41	37	33	34	47	42	38	40	46	41	38	39

Table 6 Summary of Ambient Noise Level Results, LAeq noise descriptor

Location	Ambient Noise Level, dBA								
	LAeq,1hr			LAeq,1hr			LAeq,1hr		
	(07:00 to 18:00)			(18:00 to 22:00)			(22:00 to 07:00)		
	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min
Metago	68	47	40	64	54	44	54	44	40
Papa	69	50	42	80	53	48	79	52	47
Boera	64	50	42	62	52	48	54	49	46
Lea Lea	57	50	43	57	50	46	52	44	40

In order to supplement the unattended logger measurements and to assist in identifying the source and character of ambient noise sources, attended daytime surveys were also conducted at all background noise monitoring sites (results are summarised in **Table 7**).

Based on the observations made on site, the measured results and the noise level time traces, noise emitted by the existing normal operation of the plant is not identified at these receptors during the monitoring period and the cause of ambient noise levels above the noise limit is believed to be due to local noise sources.

The noise environment at all monitoring locations was generally similar in character, with the main noise sources being natural sources such as wind noise in foliage, insects, birds and domesticated animals, together with typical village activities. Infrequent aircraft flyovers were also observed.

The monitoring results show that at all sites the evening and night-time background noise levels are higher than during the day time. Elevated insect noise was identified to be the cause of the higher noise levels during the evening and night periods. This is prevalent throughout much of PNG where high insect noise levels are a common feature of the ambient environment all year round as the tropical nature of the climate results in little variation in temperature (and insect activity) from season to season.

It is noted that, based on the ambient noise levels, noise limits established following the relevant assessment Guidelines discussed in **Section 5** were exceeded at various times of the 24hr day during the monitoring period at Metago, Papa, Boera and Lea Lea without the influence of the LNG plant as noted above.

Table 7 Attended Ambient Noise Measurement Results

Location	Date, Start Time, Weather	Measured noise level, dBA				Description of ambient noise sources
		L _{Amax}	L _{A10}	L _{A90}	L _{Aeq}	
Metago	14/05/2019 1350 h Partly cloudy W= 2m/s NE Temp=29°C	64	43	38	42	Trees rustling in wind: 38-40 dBA Villager conversations: 20 metres away, 37-42 dBA Chainsaw / line trimmer: distant engine noise, approx. 37 dBA Bees / insects: intermittent, low level
Papa	14/05/2019 1430 h Partly cloudy W= 2m/s NE Temp=29°C	56	45	35	41	Insect noise, birdsong Grass / trees rustling in wind: 34-37 dBA Villager conversations: 30 metres away, up to 47 dBA Vehicles: one car on main road, approx. 38 dBA Rooster: distant crowing, up to 38 dBA Plane: one flyover, up to 54 dBA
Boera	14/05/2019 0920 h Partly cloudy W= calm Temp=25°C	56	38	29	37	Insects: continuous, approx. 33 dBA at 5 kHz Construction: distant hammering of stakes, 45-55 dBA Dogs barking: intermittent, approx. 35 dBA Chickens clucking: intermittent, approx. 38 dBA Rooster crowing in distance, intermittent birdsong
Lea Lea	14/05/2019 1320 h Partly cloudy W= 3m/s SW Temp=29°C	63	50	41	47	Villager conversations: intermittent, 20 metres away, typically 41-54 dBA, up to 63 dBA Birdsong: low level Plane: one flyover, 45-53 dB A Children's voices and baby crying Construction: Intermittent, 40 metres away Vehicles: cars on main road, approx. 48 dBA
Edai	15/05/2019 0840 h Partly cloudy W= calm Temp=27°C	75	50	34	49	Vehicles: cars on main road 46-54 dBA Voices / construction: intermittent, 40 metres away Birdsong: 34-42 dBA Truck: entering compound approx. 52 dBA, airbrake approx. 52 dBA, opening tray approx. 74 dBA Insects / birds: approx. 34 dBA Plane: one flyover, approx. 56 dBA

Following the results presented in **Table 5**, background noise levels adopted for the NSR are presented in **Table 8**. The Rating Background Level (RBL) measured at the closest monitoring location to each receptor as defined in Australian State and local Council Guidelines², has been presented to provide a measure of the background noise levels in the absence of a procedure to define this in the PNG and other Guidelines referred in **Section 5** of this report.

² RBL is defined in various Australian State Policies, for example the NSW Noise Policy for Industry ([Link](#)) and Brisbane City Council Noise Impact Assessment Planning Scheme Policy ([Link](#)).

Table 8 NSR adopted Background Levels

Receptor	Receptor Name	Background Level, RBL dBA		
		Day (07:00 to 18:00)	Evening (18:00 to 22:00)	Night (22:00 to 07:00)
NSR1	Boera 1	30	39	45
NSR2	Boera 2	30	39	45
NSR3	Boera 3	30	39	45
NSR4	Boera 4	30	39	45
NSR5	Edai Town	29	38	38
NSR6	Papa 1	29	38	38
NSR7	Papa 2	32	40	43
NSR8	Papa 3	32	40	43
NSR9	Papa 4	32	40	43
NSR10	Papa 5	32	40	43
NSR11	Porebada 2	29	38	38
NSR12	Residence 1	32	40	43
NSR13	Residence 2	32	40	43
NSR14	Residence 3	32	40	43
NSR15	Residence 4	32	40	43
NSR16	Metago Bible College	29	38	38
NSR17	Porebada 1	29	38	38

3.2 Noise Environment at LNG Plant

In order to verify the acoustic model, attended noise measurements were conducted at a number of reference locations around the existing LNG Plant boundary. All measurements were conducted with a NGARA NA28 sound level meter used to capture samples between 4 to 10 minute duration. The measurement locations and a summary of results are presented in **Figure 12**. Detailed monitoring details are presented in **APPENDIX B**.

Furthermore, unattended (reference) noise monitoring was conducted at a fixed internal reference location within the LNG plant boundary, to provide an account for possible variations in the noise levels from the LNG Plant during the noise surveys. This reference location was situated approximately 120 metres east of the compressor stacks. Photographs taken at the fixed internal reference location are shown in **Figure 11**. The monitoring location and results are also shown in **Figure 12**.

An Acoustic Research Laboratories ARL Type 316 noise logger (serial 16-306-044) was setup to capture hourly data, including the LAmax, LA10, LA90, LAeq and LAmin noise level descriptors. Details of the location are provided in **Table 9**.

Table 9 LNG Plant Unattended Reference Noise Monitoring Location

Location	Description of Location and GPS Coordinates	Measurement Period	Logger Details
LNG reference location	On dirt access road approx. 120 m east of compressor stacks, midway between the stacks GPS 0502184, 8967824	1100 h 14 May 2019 to 1130 h 16 May 2019.	S/N 16-306-044

Figure 11 Noise Monitoring at LNG Plant Reference Location



The results of the attended noise reference locations around the existing LNG Plant boundary are shown in **Figure 12**.

The results of the unattended noise monitoring conducted at the Reference Location are summarised in **Table 10**, which presents a general summary of the average LA90 background noise levels for day, evening and night periods together with the associated average LA10 and LAeq noise levels. Time trace plots of noise levels captured at the Reference Location are shown in **Appendix C**.

Table 10 Summary of Unattended Noise Monitoring Results at the Reference Location

Location	Day (07:00h to 18:00h)			Evening (18:00h to 22:00h)			Night (22:00h to 07:00h)		
	LA90 ¹	LA10 ¹	LAeq ²	LA90 ¹	LA10 ¹	LAeq ²	LA90 ¹	LA10 ¹	LAeq ²
LNG Reference	66	68	67	66	67	67	64	66	64

1. LA10 & LA90 levels are the arithmetic average of the hourly data for each day / evening / night.
2. LAeq levels are the logarithmic average of the hourly data for each day / evening / night.



4 Project Site Meteorological Environment

Relevant aspects of the meteorological modelling conducted within the separate air quality study applicable to the noise study are reproduced in the sections below. For further details on meteorology, refer to the SLR air quality report 620.31072.00000-R01-v1.0.

4.1 Prevailing Wind

Wind that is light, stable and blowing towards the receiver from the source of noise has the potential to increase noise levels. For this reason, the effect of wind should be considered when it features in the project region.

As the strength of the wind increases, noise produced by wind will mask noise from most industrial and transport sources. Winds are therefore generally only considered to be noise-enhancing up to 3 m/s.

A summary of the annual wind behaviour predicted by CALMET for the LNG Plant is presented in **Figure 13**. **Figure 13** indicates that over the 1-year period used in the modelling (2015 calendar year), the site experienced light to moderate winds (between 1.5 m/s and 8 m/s), predominantly from the southeastern quadrant. Calm wind conditions (wind speeds less than 0.5 m/s) were predicted to occur approximately 3% of the time. The seasonal wind roses indicate that winds are lighter during the wet season compared to the dry season. Winds from the western and northern quadrant occur very infrequently during both the dry and wet seasons.

Wind speed and wind direction measurements are available from the onsite weather station for 2013, 2015, 2019 and 2020 calendar years. A comparison of wind data predicted by WRF/CALMET and available wind data recorded at the onsite meteorological station is presented in **Figure 14**. A comparison of the wind roses presented in **Figure 14** shows that the WRF/CALMET wind data for 2015 captures the predominant south easterly winds characteristic of the site and compares well with the monitoring data recorded by the onsite meteorological station in 2013 and 2015 calendar years. There are some differences between the two sets of wind roses however, which may be due to interannual variations as they are for different years. Monitoring data recorded in 2019 and 2020 shows relatively high frequency of light winds and low frequency of high winds compared to that recorded in 2013 and 2015 calendar years.

A wind speed frequency chart is presented in **Figure 15** comparing the available measured (2013, 2019 and 2020 calendar years) and modelled (2015 calendar year³) datasets. This plot shows that the frequency of wind speed categories predicted by WRF/CALMET compares well with the available on-site data. The modelling dataset has a noticeably lower frequency of winds in the 0 to 1 m/s range, which is likely to be due to these winds being close to the stall speed of the wind sensor (0.4 m/s). The comparison also showed that frequencies of higher wind speed (>4 m/s) recorded in 2019 and 2020 are significantly lower than that recorded in 2013 calendar year and predicted by WRF/CALMET model for 2015 calendar year.

Enhancement due to wind has been included as a part of this assessment as 'prevailing weather' which assumes a steady 3 m/s wind blows in the direction of the receiver from each source. This simulates downwind propagation to all receivers (this is conservative) and is also relevant to the noise propagation towards the closest residences from the Project.

³ The 2015 calendar year was selected for use in the modelling as it was the most recent year with a complete dataset from Port Moresby Airport, which was used in the air quality study.

Figure 13 Wind Roses for the LNG Plant Site – CALMET Prediction (2015)

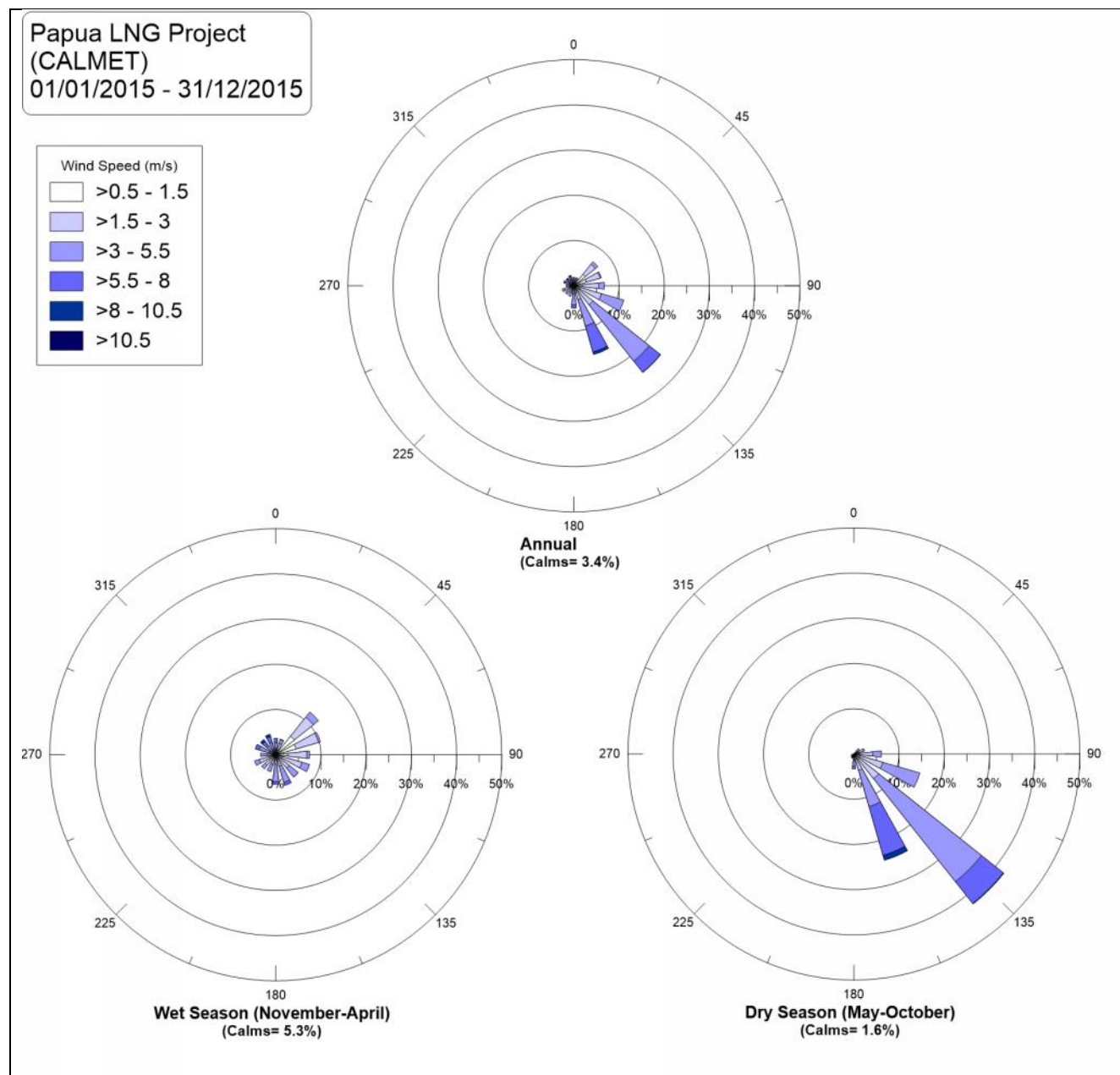


Figure 14 Wind Roses for the Papua LNG Site – Model Prediction and Observations

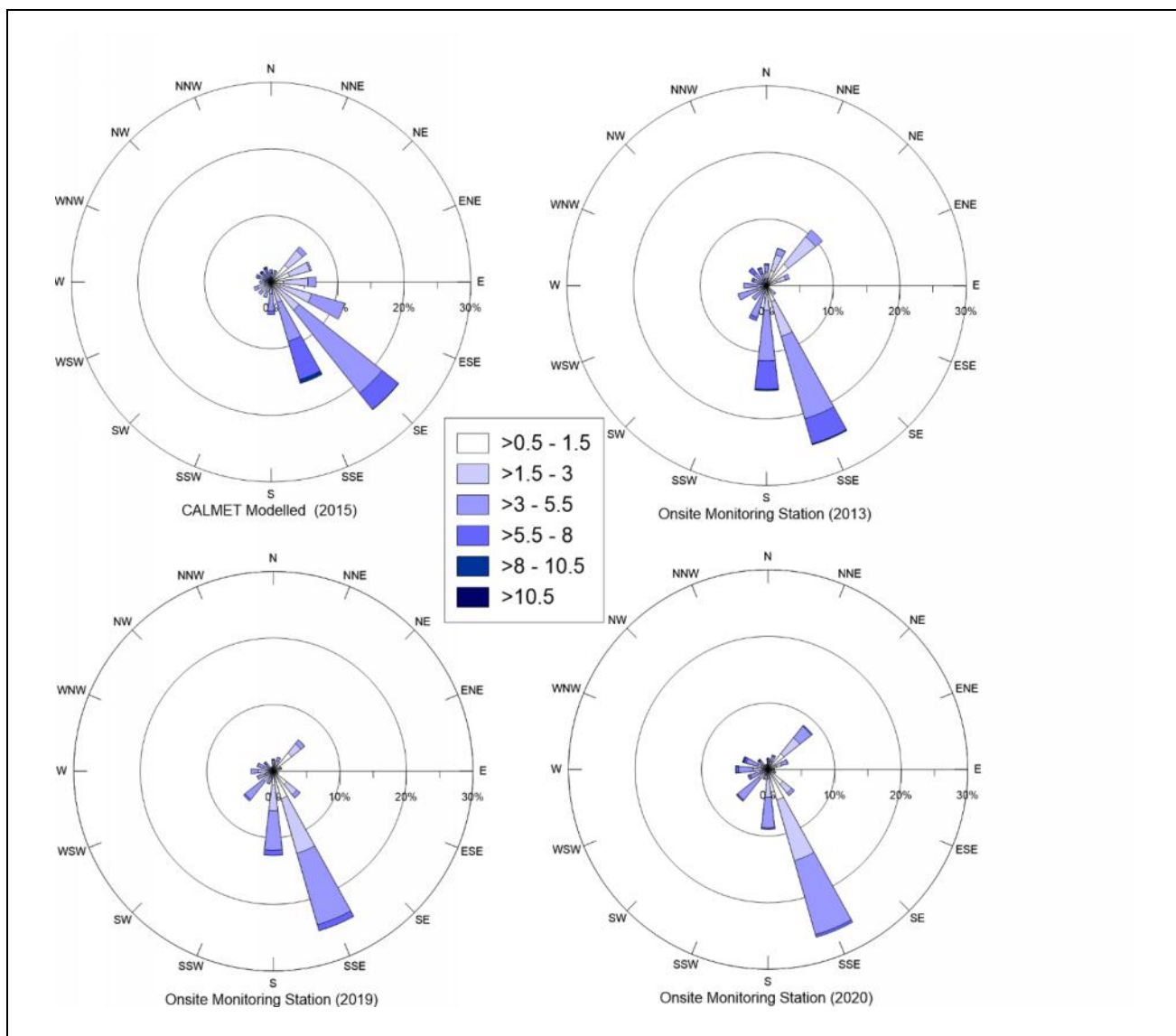
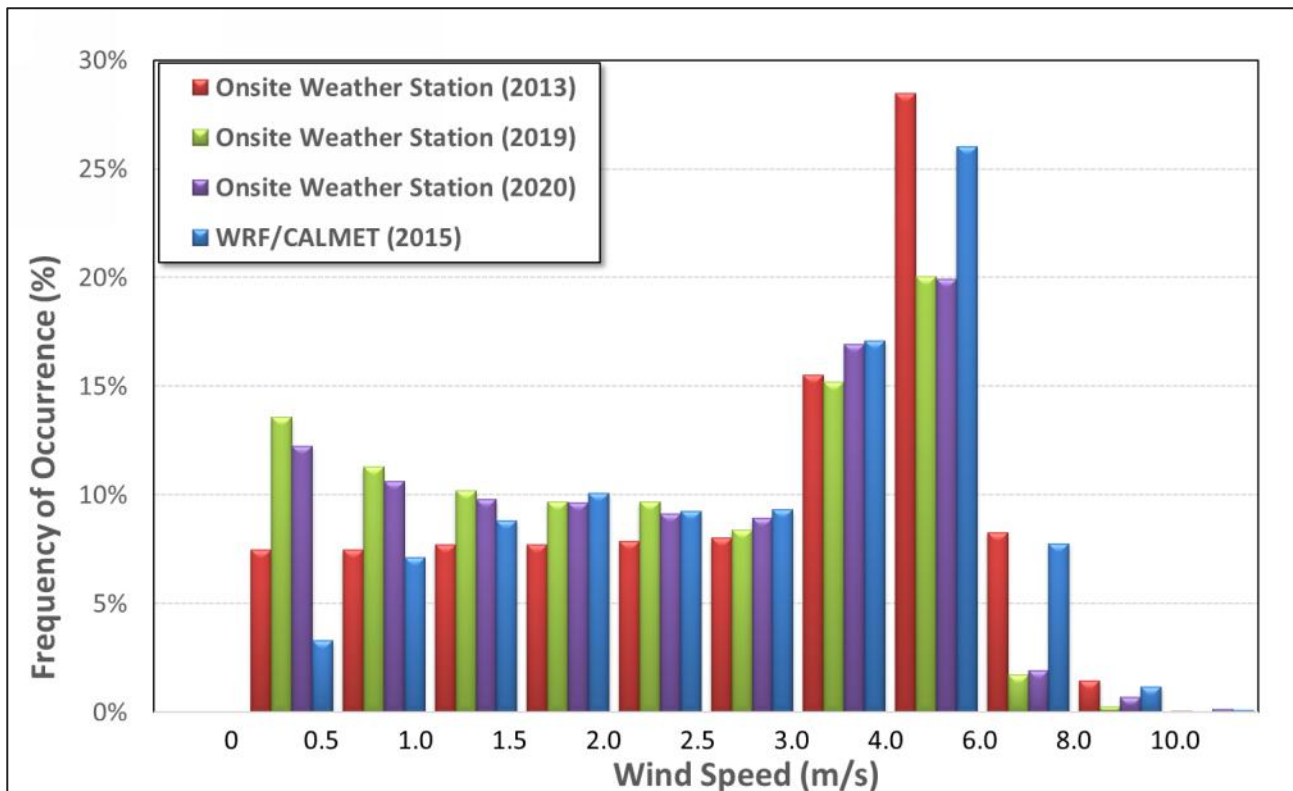


Figure 15 Wind Speed Frequency Plot for the Papua LNG Plant Site – Measured versus Modelled



4.2 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill assignment scheme identifies six Stability Classes, A to F, to categorize the degree of atmospheric stability as follows (Pasquill, 1961):

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

Under stable atmospheric conditions (i.e., when there is minimal atmospheric turbulence or mixing) a temperature inversion can occur whereby a layer of cool air at the earth's surface is overlain by a layer of warmer air at higher altitude. When they occur, temperature inversions have the ability to increase noise levels by bending upward travelling sound waves back towards the ground.

The meteorological conditions defining each Pasquill stability class are shown in **Table 11**.

Table 11 Description of Atmospheric Stability Classes

Surface wind speed (m/s)	Daytime Insolation			Night-time Conditions	
	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	≤ 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

(Source: Pasquill, 1961)

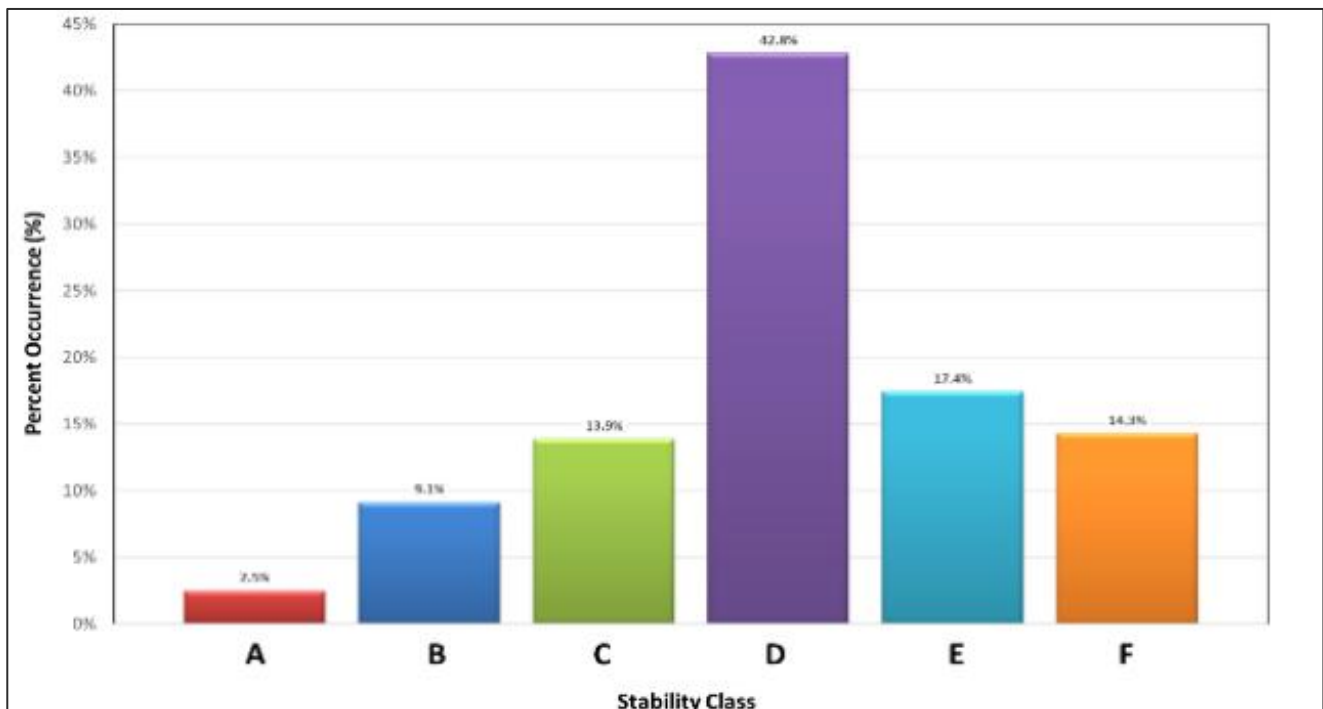
Notes:

1. Strong insolation corresponds to midday on a sunny midsummer day; slight insolation corresponds to similar conditions in midwinter
2. Night refers to the period from 1 hour before sunset to 1 hour after sunrise
3. The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above

Figure 16 shows the frequency distribution of the atmospheric stability classes predicted for the LNG Plant site. This plot shows that neutral conditions (Stability Class D) are predicted to occur most frequently at the LNG Plant site. The high frequency of Stability Class D is due to the coastal location of the site and frequent high wind speed (wind speed > 3 m/s) conditions.

Similarly, the results for the evening and night periods indicate reasonable occurrence of stability class F conditions which support temperature inversions which in turns increases noise at the time people are more sensitive.

Figure 16 Stability Class Distribution for the Papua LNG Plant Site (WRF/CALMET Predictions, 2015)



4.3 Selected Representative Meteorology

The meteorological parameters that were used in the computational noise modelling detailed in **Section 6** are shown in **Table 12**. The parameters were selected to represent noise propagation resulting in the normal and worst-case noise levels.

Table 12 Prevailing Weather and Worst Case Noise Propagation Meteorological Parameters

Season	Period	Air Temp.	Relative Humidity	Barometric Pressure	Wind Velocity	Atmospheric Stability Class
"Prevailing weather" noise propagation	Day	27°C	95%	1015 mBar	3 m/s	D
"Adverse" worst-case noise propagation	Evening and night	27°C	95%	1015 mBar	3 m/s (in the direction source to receptor)	F

5 Noise Assessment Criteria

5.1 PNG LNG Project Environment Permit

The existing PNG LNG Project operates under *Environmental Permit EP-L3(210) dated 9 September 2009 (amended 20 August 2010, 22 October 2012, 05 October 2015, and 12 September 2022)* which specifies noise limit guidelines shown in **Table 13**.

Construction of the Project will be over a four-year period. On this basis, construction activities may be considered a long-term “operational” noise emission; therefore, the Environmental Permit is also considered to be applicable for assessment of the Project construction activities.

Table 13 PNG LNG Project Environment Permit, Noise Limit Guidelines

Receptor	External one hour LAeq (dBA)	
	Day (0700 - 2200)	Night (2200 - 0700)
Perimeter Fence Line ¹	55	45

1. Excludes background noise levels

The above night time limit appears to have been derived from the World Health Organisation (WHO) *Guidelines for Community Noise* (**Section 5.3**) or and the IFC/World Bank *Noise Management Guidelines* (**Section 5.4**). Both Guidelines apply the limit at the location of the receptor. Considering this and the fact that the criteria appear to be exceeded at the NSR already, the above permit limits, which are to be applied at the site perimeter fence according to the Permit are considered overly conservative.

The LNG Plant is currently zoned as an industrial facility with the Department of Lands. ExxonMobil will recommend to CEPA that the limit at the fence line is amended to meet industrial limits and residential limits to be met at the NSR.

5.2 PNG Environment Act No. 64 of 2000

In February 2014, the Papua New Guinea (PNG) Parliament passed an Act to set up a new Conservation and Environment Protection Authority (CEPA). CEPA replaced the Department of Environment and Conservation (DEC) as the government agency responsible for administering the *Environment Act 2000*.

The *Environment Act 2000* (Environment Act) is the primary legislation in PNG that regulates the environmental impact of development activities and how adverse effects of such activities should be avoided, remedied or mitigated. The Environment Act caters for the sustainable management of the biological and physical components of the land, air and water resources of the country.

The emission of unreasonable noise is deemed an enforceable offence in accordance with the Act; however, it is noted that the Act does not include or nominate any specific criteria or method outlining how environmental noise should be assessed.

5.3 WHO Guidelines for Community Noise

The World Health Organisation (WHO) *Guidelines for Community Noise* 1999 have been prepared as a practical response to the need for action on community noise at the local level, as well as the need for improved legislation, management and guidance at the national and regional levels. Recommendations from the WHO Guidelines relevant to the PNG LNG Project and the Project are provided below.

WHO Day Period Noise Level Recommendation

WHO recommends day period noise levels outside dwellings as follows:

- 55 dBA LAeq to 'protect the majority of people from being seriously annoyed';
- 50 dBA LAeq to 'protect the majority of people from being moderately annoyed'.

In addition, the Guidelines nominate an internal noise level inside dwellings of 35 dBA LAeq for the purpose of allowing the understanding of complicated messages.

WHO Night Period Noise Level Recommendation to Protect Against Sleep Disturbance

The WHO Guidelines generally prescribe two noise levels at indoor residential locations to ensure that sleep is not adversely affected, with these being:

- Up to 30 dBA LAeq for continuous noise.
- Up to 45 dBA L_{Amax} for single events.

According to WHO, at night-time, outside sound levels about 1 metre from facades of living spaces should not exceed 45 dBA LAeq, so that people may sleep with bedroom windows open. This value assumes that the noise reduction from outside to inside with the window open is 15 dBA, which may not be applicable to the type of building construction at the identified NSR.

The Guidelines also note that special attention should be given to the following considerations when investigating sleep disturbance:

- a. Noise sources in an environment with a low background noise level. For example, night traffic in suburban residential areas.
- b. Environments where a combination of noise and vibrations are produced. For example, railway noise or heavy duty road vehicles.
- c. Sources with low-frequency components. Disturbances may occur even though the sound pressure level during exposure is below 30 dBA.

5.4 IFC / World Bank Noise Management Guidelines

These Guidelines prescribe noise levels for the day and night periods. The following is an extract:

Noise impacts should not exceed the levels presented in Table 1.7.1 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 1.7.1 Noise Level Guidelines

Receptor	One Hour LAeq (dBA)	
	Day (0700-2200)	Night (2200-0700)
Residential / Institutional / educational	55	45
Industrial / Commercial	70	70

Highly intrusive noises, such as noise from aircraft flyovers and passing trains, should not be included when establishing background noise level.

5.5 Construction Noise

Construction of the Project will be over a four-year period. On this basis, construction activities may be considered a long-term “operational” noise emission; therefore, criteria selected for the operation of the Project is also considered to be applicable for assessment of the Project construction activities.

Since the construction of the project will occur during the normal operation of the existing plant, the construction noise emission has been assessed to consider cumulative noise impact (ie. construction and operational noise sources occurring concurrently).

5.6 Recommended Environmental Noise Criteria

Based on the considerations presented in **Sections 5.1 to 5.5**, the recommended assessment noise criteria for various activities are presented in **Table 14**.

The assessment periods have been selected to reflect the assessment periods in the Environmental Permit.

Table 14 Recommended Project Noise Criteria

Activity / Operation	Recommended Noise Criteria (external, at receptor)		Comment
	Day / Evening (7.00 a.m. to 10.00 p.m.)	Night (10.00 p.m to 7.00 a.m.)	
General operational noise and construction noise	55 dBA LAeq,1hr, or a maximum increase in background levels of 3 dBA at the closest NSR off-site if the RBL + 3dBA exceeds 55 dBA.	45 dBA LAeq,1hr, or a maximum increase in background levels of 3 dBA at the closest NSR off-site if the RBL + 3dBA exceeds 45 dBA.	Noise limit applied externally at the NSR location following WHO guideline, not at the LNG plant perimeter fence as per Environmental Permit EP-L3(210).

Notwithstanding the proposed criteria, an assessment of the noise emissions at the property fence line in accordance with Environmental Permit EP-L3(210) is also presented in the following sections for information.

Following the NSR adopted background levels in **Table 8**, the applicable noise limits at each receptor is presented in **Table 15**.

Table 15 NSR adopted Noise Limits

Receptor	Receptor Name	Day (07:00 to 18:00)			Evening (18:00 to 22:00)			Night (22:00 to 07:00)		
		RBL	RBL + 3dB	Noise limit	RBL	RBL + 3dB	Noise limit	RBL	RBL + 3dB	Noise limit
NSR1	Boera 1	30	33	55	39	42	45	45	48	48
NSR2	Boera 2	30	33	55	39	42	45	45	48	48
NSR3	Boera 3	30	33	55	39	42	45	45	48	48
NSR4	Boera 4	30	33	55	39	42	45	45	48	48
NSR5	Edai Town	29	32	55	38	41	45	38	41	45
NSR6	Papa 1	29	32	55	38	41	45	38	41	45
NSR7	Papa 2	32	35	55	40	43	45	43	46	46
NSR8	Papa 3	32	35	55	40	43	45	43	46	46
NSR9	Papa 4	32	35	55	40	43	45	43	46	46
NSR10	Papa 5	32	35	55	40	43	45	43	46	46
NSR11	Porebada 2	29	32	55	38	41	45	38	41	45
NSR12	Residence 1	32	35	55	40	43	45	43	46	45 ¹
NSR13	Residence 2	32	35	55	40	43	45	43	46	45 ¹
NSR14	Residence 3	32	35	55	40	43	45	43	46	45 ¹
NSR15	Residence 4	32	35	55	40	43	45	43	46	45 ¹
NSR16	Metago Bible College	29	32	55	38	41	45	38	41	45 ¹
NSR17	Porebada 1	29	32	55	38	41	45	38	41	45

Note 1: NSR12 to NSR15 were identified as residential receptors after the 2019 noise survey. In the absence of long-term noise monitoring data within this area, the RBL from Papa Village has been used as an estimate of the background noise level at these receptors. The background noise levels are to be confirmed with further monitoring. Thus, a 45 dBA noise limit has been adopted conservatively.

6 Noise Modelling Methodology

The following sections present the noise prediction method, the investigated modelling scenarios and the modelling results.

6.1 Noise Model Details

A SoundPLAN (Version 8.1) computer noise model was developed to predict noise levels at the identified NSR. SoundPLAN is a software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site, and the location of NSR for assessment purposes.

The software was used to predict the noise levels resulting from the Project noise emission alone, i.e. the results exclude the noise levels currently experienced at the receptors which due to its variability are impractical to quantify. Furthermore, the noise criteria in **Table 14** has been applied at the Project cumulative noise alone.

The model calculates noise levels considering factors such as the sound power levels and locations of noise sources, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The *Conservation of Clean Air and Water Europe* (CONCAWE 1981) prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specifically designed for large industrial facilities and incorporates the influence of wind effects and the stability of the atmosphere and was selected due to the ability to model meteorological effects on noise propagation over large distances.

The CONCAWE method is a research paper especially designed and originally developed for the requirements of large facilities, specifically petrochemical complexes, in Europe. It was published in 1981 under the title, *'The propagation of noise from petroleum and petrochemical complexes to neighbouring communities'*.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to ± 2 dBA in any one octave band between 63 hertz (Hz) and 4 kHz and ± 1 dBA overall.

Noise levels for the Project have been calculated using CONCAWE for both prevailing weather and adverse weather (i.e., enhanced propagation) conditions where appropriate. The parameters used to assess the effect of adverse meteorological conditions such as temperature inversions and slight winds (from the source to receptor) are discussed in **Section 4.3**.

A 3D model was built from a digital survey of existing terrain contours covering the closest NSR locations at 2m intervals and a civil works model of the Project. Ground absorption coefficients⁴ for different ground surfaces utilised within the noise model are defined below:

- For all the Plant trafficable areas, and for pad mounted equipment or compacted earth, a 'hard surface' sound absorption coefficient of 0 dB has been used.

⁴ Value ranging from 0.0 to 1.0 that describes the average sound absorption performance of the material. A value of 0.0 indicates the object does not attenuate sounds, but rather reflects sound energy. A value of 1.0 indicates the object absorbs all the sound impacting it.

- For all other receptor areas, the model has assumed a ground absorption coefficient of 1 since the remaining areas are predominately 'soft ground'.

Large building structures were included in the model for completeness, such as tanks and power plant and compressor buildings. The radiation of noise emitting structures was incorporated in the model. Where previous noise surveys identified a large accumulation of plant within a given area, the noise emission was modelled as a single area source representing the accumulated noise emission from the plant.

Sound source directivities⁵ were not applied to the modelled noise sources, which were assumed to be omnidirectional, ie. emitting sound equally in all directions. This is expected to have a minor effect when the emission of directional sources is combined with the noise emission of others, particularly over large distances where the directivity effects diminish due to the accumulated noise from the various sources.

NSR were modelled as point receptors at 1.8m above the ground.

Noise contour maps were interpolated by the acoustic software from a noise grid calculated at 10m intervals, at 1.8m above the ground.

6.2 Noise Emission of Existing Operation (Normal Operation)

The noise emission of the existing plant under normal operation has been derived from extensive monitoring conducted in previous site noise survey campaigns. A total 159 noise sources were digitized in the computer model.

In addition, the noise emission of the 58 MW power plant operated by NiuPower has been included in the assessment to better represent the total environmental noise emission.

The derived noise emission of the existing plant and power station are presented in **Appendix D**.

6.2.1 Existing Plant Noise Model Verification

In order to quantify the accuracy of the computer model, a comparison was made between the predicted and measured noise levels at the closest plant boundary locations where the noise emission from the plant was audible at the time of the May 2019 site visit.

The results from this comparison are presented in **Table 16**. Refer to **Section 3.2** for the measurement locations at the perimeter fence line. The following is noted:

- The results presented in the table are for neutral noise propagation conditions considered to be representative of the specific meteorological conditions existing on site at the time of the noise measurements. A 0 m/s wind speed has been assumed in this case based on the calm to light breeze at the measurement locations observed during monitoring. For all other noise predictions, the meteorological parameters presented in **Table 12** have been adopted.

⁵ Directivity is a measure of the directional characteristic of a sound source relative to a sound source that emits energy equally in all directions.

- The exception to the above is an overprediction observed at Boundary 4 and 5 by approximately 10-14 dBA. The reason of the overprediction is unknown and may be due to a noise source identified during the previous noise survey and not captured during the latest noise survey. Nevertheless, the overprediction at Boundary 4 and 5 is considered to be acceptable because the predicted noise levels at Boundary 4 and 5 are compliant with the Environmental Permit noise criteria and predicted construction and operational noise levels at NSR further South (Boera) are below background levels; therefore, there is no noise impact expected.

On average, the computer model overpredicts the noise levels by 0.7 dBA with a maximum error of 2.5 dBA at all the other prediction locations. This is considered adequate for a computer model including a very large number of noise sources (159 noise sources for the existing plant alone) with a wide variation in noise emission. For example, in various Australian states it is commonly accepted that a noise model is considered verified when the average difference between predicted and measured values is ± 2.0 dBA. Consideration of the above, the model is considered adequate for the prediction of noise emissions from the existing LNG plant, and conservative overall (in particular at those locations to the south of the site).

Table 16 Comparison of Predicted and Measured Noise Levels at the Plant Boundary

Location	Predicted LAeq, dBA	Estimated LA90 from measurement, dBA	Noise level difference, dBA
Boundary 4	40.4	30	10.4
Boundary 5	45.1	31.5	13.6
Boundary 6	42.2	40.3	1.9
Boundary 7	40	38.3	1.7
Boundary 8	38.1	39.1	-1
Boundary 9	38.6	40	-1.4
Boundary 10	41.4	40.6	0.8
Boundary 11	38.9	36.4	2.5
Reference location	66.8	66.6	0.2
A comparison is not presented for Boundary 1-3 due to the noise levels captured by the instruments being influenced by external noise sources, including road traffic.			

6.3 Project Construction Noise Sources

The construction of the new trains will involve site preparation and bulk earthworks to get the existing landform to the required grade. These works will involve various noise generating activities such as:

- Top soil removal using bulldozers and scrapers.
- Bulk earthworks and platform construction using front end loaders, excavators, backhoes, graders, rollers, dump trucks and water trucks.

The trains are envisaged to be constructed using a modular and prefabricated execution strategy with some items remaining as stick built. The main civil works are envisaged to involve:

- Installation and operation of concrete and asphalt batching plants.
- Installation of structures on the LNG Plant allotment using heavy rollers, dump trucks, concrete trucks, generators, cranes, and steel reinforcement fabrication hand tools such as grinders, welders.

During the course of construction, many of these activities would occur simultaneously and at varying levels of intensity; therefore, it is difficult to accurately predict construction noise emissions throughout the entire construction period. In order to facilitate the noise assessment a number of key 'worst case' scenarios are developed based on the construction schedule.

To facilitate noise modelling, the construction noise emissions inventory contained in the reference document PGLP-CC-SRVIB-903001 - Noise Emissions Inventory Summary SMR+, Rev 0 of 30-09-2022 was supplied to SLR. The inventory specifies five construction source groups, the location of the sources, the noise emission (understood to have been reproduced from AS 2436-2010⁶) per noise source and quantity of noise sources. A reference noise spectrum for a similar noise source obtained from a past SLR project and or from DEFRA⁷ was selected and adjusted to match the specified overall sound power level in the noise emission inventory. The cumulative noise level per construction source group was digitised in the computer model as an area source at 3.5m above the ground.

The construction noise scenarios which have been assessed are shown in Table 17 . Results for construction scenarios C1-C4 are presented in the following sections to inform the contribution from these activities whilst the impact is assessed from the cumulative noise levels from Scenarios C5-C7.

Table 17 Summary of Construction Noise Scenarios

Scenario	Existing LNG Train 1-2 (normal operation plant noise)	58 MW Power Plant	Mobile Equipment (incl. Liquefaction New Trains)	Mobile Equipment CCP	Mobile Equipment Utility and offsite	Static equipment
C1			X			
C2				X		
C3					X	
C4						X
C5	X	X	X			X
C6	X	X		X		X
C7	X	X			X	X

The construction noise source group noise emissions and the location of the noise sources within the Project site are presented in detail in **Table 28** and **Figure 17 (Appendix D)**.

It is worth noting that:

- The predicted noise levels in the following sections are based on the assumption that all equipment for a given construction source group is operating simultaneously and at full load, and **not** concurrent to another construction source group, with the exception of the static equipment which has been assumed to be required throughout the construction.

⁶ AS 2436-2010 Guide to Noise And Vibration Control on Construction, Demolition and Maintenance Sites.

⁷ UK Department for Environment, Food and Rural Affairs Update of Noise Database for Prediction Of Noise On Construction And Open Sites.

- The construction noise modeling also includes continuous operational noise from the existing LNG Plant as both construction of the new facilities and operations of the existing facility will occur simultaneously.
- Construction activities are anticipated to occur over a 10-hour workday, 6 days a week with overhead construction operations would normally occur at night and other exceptional activity which may require night time work e.g.. large foundation casting, therefore Construction noise has been assessed considering the worst-case scenario of all the noise sources operating 24 hours.

Marine piling has been excluded from assessment as this noise source is not identified in the latest issue of the Noise Emission Inventory Summary SMR+. If marine piling is identified to be required in future, noise monitoring may also be implemented to quantify the noise at the receptors during the early stages in order to determine further management measures, such as day time only piling.

Further, transportation of personnel and equipment would not be expected to involve all vehicles being on site at the same time (or running at the highest emission); therefore, the actual noise emission from these sources is to be expected to be much lower than the value presented in **Table 28** and that of the other construction source groups which would present cumulative emission. As such, the noise emission from transportation has not been assessed further.

6.4 Noise Emission During Project Operation

The Project includes a large number of processes, activities and equipment which produce noise.

The significant noise generating equipment associated with the Project is primarily associated with the new trains and associated piping, and includes the new flares, ancillary equipment required to prepare the gas for export, upgrades to the boil-off gas (BOG) system, power generation, etc.

The equipment noise emission data for continuous noise associated with the plant upgrade is reproduced from document PGLP-CC-SRVIB-903001 - Noise Emissions Inventory Summary SMR+, Rev 0 of 30-09-2022 in **Table 29 (Appendix D)**.

6.4.1 Normal Operation

Normal operation is the everyday operation of the plant, not requiring gas flaring. The following has been assumed:

- The new trains will be operated simultaneously. This is the worst-case noise emission.
- Where an item of plant is identified as on “Standby” in **Table 29**, it has been assumed that this item replaces another identical item temporarily during maintenance; therefore, both items do not operate simultaneously. As such, plant items noted as ‘standby’ have not been incorporated in the computer model.
- Normal operation for the Combined Cycle Power Plant (CCPP) will be “Power Share,” where the CCPP produces enough electricity to supply power to the existing LNG Plant. This may allow the existing GTGs at LNGP to be shut down or put on standby. For the purpose of this study, the worst case scenario was evaluated with the existing LNGP GTGs online.

- Various plant items are shown with “HOLD” in their coordinate values. In the absence of further information, the location and elevation of these noise sources has been estimated from the location of other similar sources in the plot plan drawing PGLP-CC-LDLAY-903001-n_0_001.dwg and as specified in **Table 29**. Given the large concentration of noise sources within a relatively small area and the large distance between the plant and the NSR, any discrepancies between the assumed and actual location/height of the noise sources are not considered to be of consequence to the modelled results.
- The 58 MW power plant operated by NiuPower operates normally.

6.4.2 Upset Operation

Upset operation is a stoppage of the plant production, requiring the flaring (burn) of gas contained within the system. To assess this condition, the following has been assumed:

- During the New Trains Upset condition, Trains 1 and 2 remains under normal operation (without Train 1 and 2 flare).
- The New Trains plant is not operational, ie the equipment listed in **Table 29** generates no noise emission, excepting the flares.
- The dry flare noise level in **Table 29** has been used as it results in the contribution at the NSRs from this noise source (this is considered to be conservative for assessment purposes. The wet flare noise emission has not been assessed).
- The noise emission of the dry flare has been reproduced in the computer model as specified in **Table 29 (APPENDIX D)**. The noise emission of 92 dBA and 98 dBA (dry and wet flare respectively) is low; therefore, it is assumed that flares will be designed with noise controls to achieve these values and not exceed the Project Design Specification limit of 115 dB (A).
- During the upset operation, three (3) diesel generators will also be in operation in addition to the flare noise sources. Details of the noise emission of these diesel generators are unknown. In the absence of any details for the diesel generators, the noise emission for the 700 KVA ultraquiet generators presented in **Table 30 (Appendix D)** has been assumed per unit for the diesel generators during upset operation.
- The 58 MW power plant operated continues to operate normally.

The operational noise scenarios modelled to reflect reflecting the above assumptions are shown in **Table 18**. The scenarios have been chosen to present the noise emission of the individual source groups, as well as to assess the cumulative noise emission (Scenarios O6-O7).

Table 18 Summary of Operational Noise Scenarios

Scenario	Existing LNG Train 1-2 (normal operation)	58 MW Power Plant	New Trains (Normal operation)	New Trains Upset operation (dry flare + gensets)
O1	X			
O2		X		
O3	X	X		
O4			X	
O5				X
O6	X	X	X	
O7	X	X		X

7 Noise Prediction Results

7.1 Construction Noise Predictions

Construction noise levels have been predicted at the closest NSR locations (see **Section 2.5**). The results are presented as follows:

- The LAeq noise levels of the individual construction source groups predicted at the closest noise NSR under prevailing weather conditions are presented in **Table 19**. These results are presented for information.
- The LAeq noise levels of the individual construction source groups predicted at the closest NSR under adverse noise propagation conditions are presented in **Table 20**.
- The LAeq noise levels of the cumulative noise pertaining the existing plant (Train 1-2 and 58 MW power station) and the individual construction source groups predicted at the closest NSR under prevailing weather conditions are presented in **Table 21**.
- The LAeq noise levels of the cumulative noise pertaining the existing plant (Train 1-2 and 58 MW power station) and the individual construction source groups predicted at the closest NSR under adverse noise propagation conditions are presented in **Table 22**.

Where exceedances have been identified in the tables, these are shown in **red text**.

Noise contour maps for all the above scenarios are provided in **Appendix E**. Noise levels predicted at the LNG perimeter fence line observed from these maps and are also presented at the bottom of the tables. The following is noted:

- The highest noise levels in the ranges presented in the tables at the perimeter fence line are predicted to the East where the boundary is located closer to the plant and where there are no NSR nearby; therefore, they are not indicative of a high noise impact at a NSR.
- The noise levels at the perimeter fence line near the closest NSR to the North are represented by the lowest values in the range.

The noise predictions have been assessed against the 45 dBA LAeq noise limit. As noted previously, construction activities are anticipated to occur over a 10-hour workday, 6 days a week. A nightshift may be required for key activities as a schedule mitigation measure, if required. Therefore, the worst-case scenario was modelled assuming a 24 hr per day construction program.

Table 19 Predicted LAeq Construction Noise Levels Under Prevailing weather Noise Propagation Conditions, dBA

NSR	Receptor Name	NSR adopted RBL and noise limit, dBA		C1 Mobile Equipment (incl. Liquefaction New Trains)	C2 Mobile Equipment CCPP	C3 Mobile Equipment Utility and offsite	C4 Static equipment
		RBL	Noise limit				
NSR1	Boera 1	45	48	32	29	30	< 10
NSR2	Boera 2	45	48	33	29	30	< 10
NSR3	Boera 3	45	48	26	19	27	< 10
NSR4	Boera 4	45	48	33	30	30	< 10
NSR5	Edai Town	38	45	30	26	26	< 10
NSR6	Papa 1	38	45	38	35	34	< 10
NSR7	Papa 2	43	46	38	34	35	< 10
NSR8	Papa 3	43	46	44	40	42	14
NSR9	Papa 4	43	46	45	41	41	13
NSR10	Papa 5	43	46	41	37	38	12
NSR11	Porebada 2 ⁸	38	45	24	21	19	< 10
NSR12	Residence 1	43	45	48	44	45	22
NSR13	Residence 2	43	45	46	42	43	20
NSR14	Residence 3	43	45	45	41	44	17
NSR15	Residence 4	43	45	47	43	43	15
NSR16	Metago Bible College	38	45	41	38	37	< 10
Total exceedances of 45 dBA at the NSR				3	0	0	0
Noise levels at the LNG plant Perimeter fence line				45 - 60	45 - 55	45 - 65	30-40
Project component noise level close to or less than 10dBA LAeq is considered to be inaudible.							

⁸ Porebada 1 is located further from the Plant than Porebada 2. Any assessment of noise levels for Porebada 2 would also apply at Porebada 1.

Table 20 Predicted LAeq Construction Noise Levels Under Adverse Noise Propagation Conditions, dBA

NSR	Receptor Name	NSR adopted RBL and noise limit, dBA		C1 Mobile Equipment (incl. Liquefaction New Trains)	C2 Mobile Equipment CCPP	C3 Mobile Equipment Utility and offsite	C4 Static equipment
		RBL	Noise limit				
NSR1	Boera 1	45	48	32	29	30	< 10
NSR2	Boera 2	45	48	33	29	30	< 10
NSR3	Boera 3	45	48	26	19	27	< 10
NSR4	Boera 4	45	48	33	30	30	< 10
NSR5	Edai Town	38	45	30	26	26	< 10
NSR6	Papa 1	38	45	38	35	34	< 10
NSR7	Papa 2	43	46	38	34	35	< 10
NSR8	Papa 3	43	46	44	40	42	14
NSR9	Papa 4	43	46	45	41	41	13
NSR10	Papa 5	43	46	41	37	38	12
NSR11	Porebada 2 ⁹	38	45	24	21	19	< 10
NSR12	Residence 1	43	45	48	44	45	22
NSR13	Residence 2	43	45	46	42	43	20
NSR14	Residence 3	43	45	45	41	44	17
NSR15	Residence 4	43	45	47	43	43	15
NSR16	Metago Bible College	38	45	41	38	37	< 10
Total exceedances of 45 dBA at the NSR				3	0	0	3
Noise levels at the LNG plant Perimeter fence line				45 - 60	45 - 55	45 - 65	45 - 60
Project component noise level close to or less than 10dBA LAeq is considered to be inaudible.							

⁹ Porebada 1 is located further from the Plant than Porebada 2. Any assessment of noise levels for Porebada 2 would also apply at Porebada 1.

Table 21 Predicted LAeq Cumulative Construction Noise Levels Under Prevailing Weather Noise Propagation Conditions, dBA

NSR	Receptor Name	NSR adopted RBL and noise limit, dBA		C5 (C1, C4, Train 1-2 normal operation and 58MW power station)	C6 (C2, C4, Train 1-2 normal operation and 58MW power station)	C7 (C3, C4, Train 1-2 normal operation and 58MW power station)
		RBL	Noise limit			
NSR1	Boera 1	45	48	33	31	32
NSR2	Boera 2	45	48	33	30	31
NSR3	Boera 3	45	48	28	24	28
NSR4	Boera 4	45	48	33	31	31
NSR5	Edai Town	38	45	30	27	27
NSR6	Papa 1	38	45	39	37	37
NSR7	Papa 2	43	46	38	36	37
NSR8	Papa 3	43	46	45	42	43
NSR9	Papa 4	43	46	46	43	43
NSR10	Papa 5	43	46	42	39	40
NSR11	Porebada 2 ¹⁰	38	45	25	22	21
NSR12	Residence 1	43	45	49	46	46
NSR13	Residence 2	43	45	47	45	45
NSR14	Residence 3	43	45	46	44	45
NSR15	Residence 4	43	45	48	45	45
NSR16	Metago Bible College	38	45	42	41	40
Total exceedances of 45 dBA at the NSR				5	1	1
Noise levels at the LNG plant Perimeter fence line				50-60	45-60	45-60

¹⁰ Porebada 1 is located further from the Plant than Porebada 2. Any assessment of noise levels for Porebada 2 would also apply at Porebada 1.

Table 22 Predicted LAeq Cumulative Construction Noise Levels Under Adverse Noise Propagation Conditions

NSR	Receptor Name	NSR adopted RBL and noise limit, dBA		C5 (C1, C4, Train 1-2 normal operation and 58MW power station)	C6 (C2, C4, Train 1-2 normal operation and 58MW power station)	C7 (C3, C4, Train 1-2 normal operation and 58MW power station)
		RBL	Noise limit			
NSR1	Boera 1	45	48	33	31	32
NSR2	Boera 2	45	48	33	30	31
NSR3	Boera 3	45	48	28	24	28
NSR4	Boera 4	45	48	33	31	31
NSR5	Edai Town	38	45	30	27	27
NSR6	Papa 1	38	45	39	37	37
NSR7	Papa 2	43	46	38	36	37
NSR8	Papa 3	43	46	45	42	43
NSR9	Papa 4	43	46	46	43	43
NSR10	Papa 5	43	46	42	39	40
NSR11	Porebada 2 ¹¹	38	45	25	22	21
NSR12	Residence 1	43	45	49	46	46
NSR13	Residence 2	43	45	47	45	45
NSR14	Residence 3	43	45	46	44	45
NSR15	Residence 4	43	45	48	45	45
NSR16	Metago Bible College	38	45	42	41	40
Total exceedances of 45 dBA at the NSR				5	1	1
Noise levels at the LNG plant Perimeter fence line				50-60	45-60	45-60

7.2 Operational Noise Predictions

Operational noise levels have been predicted for the scenarios detailed in **Section 6.4**. The results are presented as follows:

- The individual and cumulative noise levels predicted at the NSR under prevailing weather conditions are presented in **Table 23**.
- The individual and cumulative noise levels predicted at the NSR under adverse weather conditions are presented in **Table 24**.

The noise predictions have been assessed against the 45 dBA LAeq noise limit. Where exceedances have been found, these are shown in **red text**.

Noise contour maps for all the above scenarios are provided in **Appendix E**.

¹¹ Porebada 1 is located further from the Plant than Porebada 2. Any assessment of noise levels for Porebada 2 would also apply at Porebada 1.

Table 23 Predicted Operational LAeq Noise Levels Under Prevailing Weather Noise Propagation Conditions, dBA

NSR	Receptor Name	NSR adopted RBL and noise limit, dBA		O1 Existing LNG Train 1-2 (normal operation)	O2 58 MW Power Plant	O3 LNG Train 1-2 (normal operation) + 58 MW Power Plant	O4 New Trains Normal operation	O5 New Trains Upset operation	O6 (O3,O4) LNG Train 1-2, 58MW power station, and New Trains under normal operation	O7 (O3,O5) LNG Train 1-2 normal operation, 58MW power station and New Trains upset operation	Noise increase during normal operation, LAeq (O6-O3)
		RBL	Noise limit								
NSR1	Boera 1	45	48	26	15	26	28	< 10	30	26	4
NSR2	Boera 2	45	48	25	14	25	27	< 10	29	25	4
NSR3	Boera 3	45	48	22	< 10	22	23	< 10	26	22	4
NSR4	Boera 4	45	48	25	16	25	28	< 10	30	25	4
NSR5	Edai Town	38	45	20	13	21	24	< 10	25	21	4
NSR6	Papa 1	38	45	30	31	33	33	< 10	36	33	3
NSR7	Papa 2	43	46	30	21	31	33	< 10	35	31	4
NSR8	Papa 3	43	46	37	26	37	39	< 10	41	37	4
NSR9	Papa 4	43	46	37	31	38	40	< 10	42	38	4
NSR10	Papa 5	43	46	36	26	36	37	< 10	39	36	3
NSR11	Porebada 2	38	45	14	< 10	15	18	< 10	20	15	5
NSR12	Residence 1	43	45	42	29	42	44	11	46 ¹	42	4
NSR13	Residence 2	43	45	40	29	40	42	< 10	44	40	4
NSR14	Residence 3	43	45	40	28	40	41	< 10	44	40	3
NSR15	Residence 4	43	45	39	31	40	42	12	44	40	5
NSR16	Metago Bible College	38	45	32	36	37	36	< 10	40	37	2
Total exceedances of 45 dBA at the NSR				0	0	0	0	0	1	0	
Noise levels at the LNG plant Perimeter fence line				35-55	35-40	40-55	45-60	30	45-60	40-55	
Project noise level close to or less than 10dBA LAeq is considered to be inaudible.						1.- As discussed in Section 8.3, an applicable criteria of 46 dBA may apply at NSR12, in which case compliance would be predicted.					

Table 24 Predicted Operational Noise Levels Under Adverse Noise Propagation Conditions, dBA

NSR	Receptor Name	NSR adopted RBL and noise limit, dBA		O1 Existing LNG Train 1-2 (normal operation)	O2 58 MW Power Plant	O3 LNG Train 1-2 (normal operation) + 58 MW Power Plant	O4 New Trains Normal operation	O5 New Trains Upset operation	O6 (O3,O4) LNG Train 1-2, 58MW power station, and New Trains under normal operation	O7 (O3,O5) LNG Train 1-2 normal operation, 58MW power station and New Trains upset operation	Noise increase during normal operation, LAeq (O6-O3)
		RBL	Noise limit								
NSR1	Boera 1	45	48	26	15	26	28	< 10	30	26	4
NSR2	Boera 2	45	48	25	14	25	27	< 10	29	25	4
NSR3	Boera 3	45	48	22	< 10	22	23	< 10	26	22	4
NSR4	Boera 4	45	48	25	16	25	28	< 10	30	25	4
NSR5	Edai Town	38	45	20	13	21	24	< 10	25	21	4
NSR6	Papa 1	38	45	30	31	33	33	< 10	36	33	3
NSR7	Papa 2	43	46	30	21	31	33	< 10	35	31	4
NSR8	Papa 3	43	46	37	26	37	39	< 10	41	37	4
NSR9	Papa 4	43	46	37	31	38	40	< 10	42	38	4
NSR10	Papa 5	43	46	36	26	36	37	< 10	39	36	3
NSR11	Porebada 2	38	45	14	< 10	15	18	< 10	20	15	5
NSR12	Residence 1	43	45	42	29	42	44	11	46 ¹	42	4
NSR13	Residence 2	43	45	40	29	40	42	< 10	44	40	4
NSR14	Residence 3	43	45	40	28	40	41	< 10	44	40	3
NSR15	Residence 4	43	45	39	31	40	42	12	44	40	5
NSR16	Metago Bible College	38	45	32	36	37	36	< 10	40	37	2
Total exceedances of 45 dBA at the NSR				0	0	0	0	0	1	0	
Noise levels at the LNG plant Perimeter fence line				35-55	35-40	40-55	45-60	30	45-60	40-55	
Project noise level close to or less than 10dBA LAeq is considered to be inaudible.						1.- As discussed in Section 8.3, an applicable criteria of 46 dBA may apply at NSR12, in which case compliance would be predicted.					

8 Discussion

A discussion is presented in the sections below for the predicted noise levels presented in **Section 7** and the contour maps presented in **Appendix E-F**.

It is noted that compliance with the Environmental Permit condition (ie a noise level no greater than 45 dBA noise limit at the perimeter fence line) is not predicted to be achievable using reasonable and feasible noise mitigation. As typically project noise criteria would apply at the noise sensitive receptor (as per the WHO, IFC Guidelines etc) and not at the boundary, this assessment has focused on assessing the project noise emissions against the 45 dBA night time noise criteria (from the WHO and IFC guidelines) at the closest NSR. The exception to the 45 dBA noise criteria at the closest NSR is where the existing RBL + 3 dBA noise level is already higher than 45 dBA. In those instances the background + 3 dBA noise criteria from the IFC Guideline has been proposed.

8.1 Existing Plant Under (Normal) Operation

With reference to the combined noise from the normal operation of Train 1-2 and the third party 58MW power station (Scenario O3), the following is observed:

- The 55 dBA LAeq (7am-10pm) noise limit is predicted to be achieved during prevailing weather and adverse noise propagation conditions at the closest NSR.
- The 45 dBA LAeq (10pm-7am) noise limit is predicted to be achieved during prevailing weather conditions at the closet NSR. The compliance is consistent with the noise measurements conducted at the perimeter fence line which are also below the noise limit.
- The 45 dBA LAeq (10pm-7am) noise limit is predicted to be achieved during adverse noise propagation conditions at the closest NSR. The predicted noise levels show compliance with a minimum safety margin of 3 dBA at NSR14 (the worst affected NSR). For reference, a 3 dBA safety margin allows for a duplication of the number of noise sources at the same location and operating under the same conditions before the noise limit is exceeded.
- The 45 dBA LAeq (10pm-7am) noise limit is predicted to be exceeded at the perimeter fence line during prevailing and adverse noise propagation conditions. Noise levels up to 55 dBA have been predicted at the perimeter fence line which exceeds the Environmental Permit condition during the night time.

In summary, whilst the 45 dBA noise limit lime is predicted to extend beyond the perimeter fence line as shown in the **Appendix F** noise contours, the normal operation of the existing Train 1-2 and 58MW power plant alone (Scenario O3) is predicted to meet the 45 dBA LAeq (10pm-7am) noise limit at NSR under prevailing weather and adverse noise propagation conditions.

8.2 Construction Noise

Construction noise contribution (Noise levels without existing plant)

With reference to the noise predictions of construction emissions noise alone (ie excluding the existing plant noise emission) the following is observed from the noise predictions:

- The LAeq 45 dBA noise emission contour extends beyond the perimeter fence line in scenarios C1-C3. Noise levels between 45-65 dBA have been predicted, which exceed the Environmental Permit condition during the daytime and the night time.
- The 55 dBA LAeq (7am-10pm) noise limit is predicted to be achieved during prevailing weather and adverse noise propagation conditions at all sensitive receptor locations.
- The construction noise levels during Scenario C1 are predicted to exceed the 45 dBA LAeq (10pm-7am) noise limit at NSR 12, NSR 13 and NSR 15 by up to 3 dBA. This occurs during prevailing weather and adverse noise propagation conditions.
- Compliance at some Papa receptors (NSR8 and NSR9) is also predicted to be marginal (0-1 dBA).
- Compliance with the 45 dBA LAeq (10pm-7am) noise limit during Scenarios C2-C3 at NSR12 and NSR14 is marginally achieved (0-1 dBA).
- The background +3 dBA criteria is predicted to be exceeded at night, at NSR12 and NSR15 by up to 2 dBA. Exceedances are caused by the Construction Scenario C1.
- Scenario C4 results in the lowest noise emission with levels well below the 45 dBA LAeq (10pm-7am) limit at all receptors, as well as 45 dBA noise limit line within the perimeter fence line.

Cumulative noise levels with existing plant

With reference to the noise predictions of cumulative noise levels resulting from construction noise emissions and existing plant operation (Scenarios C5-C7), the following is observed from the noise predictions:

- The 55 dBA LAeq (7am-10pm) noise limit is predicted to be achieved during prevailing weather and adverse noise propagation conditions at all sensitive receptor locations. Compliance is achieved by a minimum margin of 6 dBA at NSR12-15 (worst-affected receptors).
- The cumulative construction noise levels are predicted to exceed the 45 dBA LAeq (10pm-7am) noise limit at NSR12-15 and NSR9 by up to 4 dBA for Scenario C5 and by 1 dBA at NSR12 during Scenarios C6-C7 under prevailing weather and adverse noise propagation conditions. The predicted cumulative noise levels comply with the 45 dBA LAeq (10pm-7am) noise limit at all other NSR.
- The background +3 dBA criteria is predicted to be exceeded at NSR12-13 and NSR15-16 by up to 3 dBA. Exceedances are caused by the Construction Scenario C1.
- Construction works are predicted to be the dominant noise source at the NSR. The highest construction noise contributor at the receptors is the Scenario C1 - Mobile Equipment (including liquefaction New Trains).
- The predicted noise levels at the perimeter fence line range between 45-60 dBA pending the construction scenario and location along the fence line. The noise levels exceed the Environmental Permit condition during the daytime and the night time.

Based on the above findings, the Environmental Permit EP-L3(210) is predicted to be exceeded when assessed at the perimeter fence line during construction. However, it is noted that the WHO and IFC / World Bank Guidelines apply the criteria at the receptor, as opposed to the perimeter fence line as documented in Environmental Permit EP-L3(210).

If the 45 dBA noise limit were to be applied at the receptors, noise mitigation measures could be implemented to reduce the noise emissions in order to achieve compliant noise levels at most if not at all times, noting that the exceedances up to 4 dBA were predicted on conservative assumptions such as 24hr construction with all the construction equipment assessed under each scenario operating at the same time. This is unlikely to occur in reality, whereby the use of a large number of high noise emitting equipment will be exceptional and lower noise levels are expected to be experienced. For example, a 3 dBA noise reduction will be achieved when 50% of the equipment is in continuous use. Further noise reductions are expected to be achievable with adequate equipment management. This is discussed in **Section 8.5**.

In summary, whilst the Environmental Permit is not predicted to be met at the perimeter fence line, it is considered that 24hr construction should be permissible where reasonable and feasible noise mitigation measures and controls are put in place to ensure night time levels are compliant with the recommended 45 dBA LAeq noise limit at the NSR. Otherwise, 7am-10pm only construction activities would allow compliance with the 55 dBA LAeq noise level applied at the NSR.

8.3 Operational Noise

New Trains noise levels

With reference to the operation of the new plant alone, the following is observed from the noise predictions:

- The Environmental Permit criteria is exceeded by up to 5 dBA and 15 dBA at the perimeter fence line during the 7am-10pm and 10pm-7am periods, respectively.
- The normal operation of the New Trains plant alone (Scenario O4) is predicted to meet the 55 dBA LAeq (7am-10pm) and 45 dBA LAeq (10pm-7am) noise limit at the NSR under prevailing weather and adverse noise propagation conditions. Compliance with the 45 dBA limit is marginal by 1 dBA at NSR12 and by 3-4 dBA at NSR13-15.
- The upset operation scenario for New Trains plant alone (Scenario O5) is predicted to meet the 55 dBA LAeq (7am-10pm) and 45 dBA LAeq (10pm-7am) noise limit at NSR under prevailing weather and adverse noise propagation conditions.

The Environmental Permit criteria is predicted to be achieved at the perimeter fence line during the 7am-10pm and 10pm-7am periods with a 25 dBA and 15 dBA margin, respectively.

- The background +3 dBA criterion is predicted to be achieved at all NSR under both Normal and Upset operation.

Cumulative noise levels

With reference to the cumulative noise resulting from simultaneous operation of the existing and new plant, the following is observed from the noise predictions:

During normal operation, the cumulative levels from Train 1-2, 58MW power plant and New Trains (Scenario O6) are predicted to exceed the 45 dBA LAeq (10pm-7am) noise limit at NSR12 by a marginal 1 dBA. It is noted that:

- This noise prediction is considered slightly conservative in comparison to the operation of all GTGs and CCPP for power generation instead of modelling the Power Share scenario and 1 dBA exceedance would not be perceptible.
- The adopted background noise level is 43 dBA at this receptor, which would result in a RBL + 3 dBA noise criterion of 46 dBA at this receptor. On this basis, compliance would be achieved with 0 dB margin based on the current predicted noise level. Given the marginal compliance with the noise criteria, further noise monitoring at this receptor could be conducted to confirm both the project noise emissions and the applicable background noise level at this receptor.
- At all other receptors where the operational noise levels comply with the 45 dBA operation, compliance with the background (RBL) + 3 dBA criteria has also been predicted.
- With reference to the predicted noise levels at the worst-affected receptor (NSR12), the highest noise contributions from the Project are as per the below groups (in order of noise level contribution):

• 666: Refrigeration	39 dBA	• 941: Hot Oil	22 dBA
• 833: Main Generation	36 dBA	• 949: Boiler Water	22 dBA
• 948: Boiler	35 dBA	• 961: Nitrogen Generation	21 dBA
• 691: LNG Storage & Loading	33 dBA	• 955: Air Compressors	21 dBA
• 666: Inlet Chilling System	33 dBA	• 973: Sanitary Drains and Caissons	21 dBA
• 665 / 695: Gas Liquefaction	32 dBA	• 631: Deisopentanize	20 dBA
• 631: Plant Condensate Stabilization	28 dBA	• 923 : Cooling Towers	19 dBA
• 623: Inlet Facility	28 dBA	• 987: Steam Condensate	17 dBA
• 945: Boiler Feed Water System	26 dBA	• 661: Gas Dehydration	16 dBA
• 922: Tempered Water	26 dBA	• 698: Refrigerant Storage	< 10 dBA

If noise control was applied to source group 666: Refrigeration achieving a noise reduction of 4 dBA for this group, the cumulative noise level is predicted to result in compliance with the proposed criteria at NSR 12.

- During normal operation, the cumulative levels from Train 1-2, 58MW power plant and New Trains (Scenario O6) are predicted to be marginally below the 45 dBA LAeq (10pm-7am) noise limit at NSR13-15 by 1 dBA.
- During New Trains upset operation, the cumulative levels from Train 1-2 (normal), 58MW power plant and New Trains Upset (Scenario O7) are predicted to meet the 45 dBA LAeq (10pm-7am) noise limit at NSR by a minimum margin of 3 dBA.
- The predicted noise increases at the NSR during normal operation due to the introduction of the New Trains plant compared to the existing normal operation ranges between 2-5 dBA.
- The background +3 dBA criteria are predicted to be achieved at all NSR under both normal and upset operation.
- During normal operation, the 45 dBA LAeq (10pm-7am) noise limit is predicted to be exceeded by up to 15 dBA at the perimeter fence line during prevailing and adverse noise propagation conditions, as shown in the noise contours. The 55 dBA LAeq (7am-10pm) noise limit is predicted to be exceeded by up to 5 dBA at the perimeter fence line.

- During upset operation of the new trains, the cumulative noise levels are predicted to exceed the 45 dBA LAeq (10pm-7am) noise limit by up to 10 dBA at the perimeter fence line during prevailing and adverse noise propagation conditions. However, the exceedance is predicted to be caused by the Train 1-2 operation alone.

In summary, the cumulative noise resulting from the existing Train 1-2, the 58MW power plant and the New Trains (normal operation) is predicted to exceed the Environmental Permit as applied at the perimeter fence line. However, noise predictions are compliant with the noise limits where these are applied at the NSR, with the exception of NSR12 where a 1 dBA exceedance to the 45 dBA night time limit has been predicted to be caused by the introduction of the New Trains, whereby adequate noise control and/or noise management of the loudest New Trains source group is expected to result in compliance with the limits (refer to **Section 8.4**).

Noise control of the loudest New Trains source group would also reduce the noise exposure at NSR13-15 where the cumulative noise levels of the normal operation of the plant are predicted to meet the 45 dBA LAeq limit, but only marginally by 1 dBA.

8.4 Noise Assessment Summary

Following the assessment presented in the sections above, the following key observations are made:

Construction noise levels

- Noise emissions during construction are predicted to exceed the 45 dBA LAeq noise limits during the night time at up to five NSR (depending on the specific construction scenario).
- The background +3 dBA criteria is also predicted to be exceeded during the night.
- Since the predicted exceedances are minor and the noise predictions have been based on the conservative assumptions and the expectation that there should be very limited construction activity at night, it is expected that normal best practice noise management measures will result in noise levels that are compliant with the noise limits, which would permit 24hr construction activities.

Operational noise levels

- The normal operation of the existing Train 1-2 and 58 MW power plant has been predicted to meet the 45 dBA LAeq (10pm to 7am) as well as the background + 3 dBA criteria at all NSR but is predicted to be exceeded at the plant perimeter fence line.
- It is noted that the assessment has been based on noise predictions using a noise model which has been validated using short-term attended measurements around the perimeter fence line conducted during mostly calm atmospheric conditions. Long-term monitoring at the perimeter fence line during the prevailing weather has not been conducted at this stage; therefore, the noise assessment under the prevailing weather conditions presents only a prediction of the long-term current state of compliance of the existing operation (noting that noise monitoring has not been undertaken under prevailing weather conditions to confirm this predicted exceedances).
- The normal operation of New Trains is predicted to be compliant with the noise limits where these are applied at the NSR, but it exceeds the 45 dBA LAeq noise limit noise at the perimeter fence line.

- The cumulative (normal operation) noise emission is predicted to marginally exceed (by 1 dBA) the 45 dBA LAeq noise limit applicable between 10pm-7am at one receptor only, NSR12. However, if the RBL + 3 dBA criteria of 46 dBA were to be applied, compliance is predicted with 0 dB margin.
- From the above it follows that the Project could be designed and operated at a compliant level where the limits are applied at NSR as applied by international Guidelines like WHO and IFC World Bank. A noise reduction of 4 dBA to the loudest New Trains source group is predicted to result in compliant cumulative noise levels at NSR12 (the closest sensitive receptor) during the 10pm-7am period. A reduction in noise emission of 4 dBA from the New Trains source group would ensure compliance with the 45 dBA noise time noise criteria is achieved at all other noise sensitive receptors, based on the noise predictions.
- The current Environmental Permit EP-L3(210) noise limits are predicted to be exceeded at the perimeter fence line during operation of the Project during the 7am-10pm and 10pm-7am periods, by up to 5 dBA and 15 dBA respectively.

Gas flaring noise levels

- During Upset operation of the new plant, gas flaring noise levels have been predicted below the noise limits at NSR as well as the property fence line. The noise emission specified for the New Trains flares is low in comparison to unmitigated flares. A maximum sound power level of 127 dBA has been predicted to be emitted in order not to exceed the 45 dBA LAeq noise limit at the closest NSR for the upset operation of New Trains. The calculation assumed only one flare is in operation.
- The actual noise emitted by the existing Train 1-2 flares is unknown. Given the similar distances of the existing and new flares to the NSR, the maximum sound power level stated above would also apply to the Train 1-2 flare to meet the 45 dBA LAeq noise limit at night at the closest NSR.

8.5 Recommendations

Following the assessment presented in the sections above, the following recommendations are made:

Compliance

- Based on the noise predictions of the current operation, the existing operation Environmental Permit would be exceeded at the perimeter fence line during prevailing weather conditions. Long-term noise monitoring should be conducted at a sample of locations along the perimeter fence line to confirm this conclusion. If the Environmental Permit is shown to be exceeded, it follows that the construction and operation of the Project will also not be achievable at the perimeter fence line.
- Following the above, consider an amendment to the current Environmental Permit whereby the noise limit is to be applied at the NSR, **not** at the perimeter fence line, in a similar manner to the noise criteria from WHO and IFC/World Bank Guidelines. The noise limits are proposed to be applied to the component noise level (i.e. Project noise only). This is particularly relevant considering that ambient noise levels conducted at NSR locations have shown noise levels exceeding the Environmental Permit limits without the influence of the existing LNG plant already.

Construction

- Prepare and implement a Construction Noise Management Plan, considering:

- Noise monitoring to quantify the cumulative noise levels during the early operation of heavy machinery on site and quantify future construction noise levels during work intensification, e.g., noise level increase due to the introduction of additional plant of similar noise emission or the maximum number of plant permitted to meet criteria.
- Ongoing (attended and/or unattended) noise monitoring during the planned works which include high noise emitting equipment, where the early monitoring results have shown expected exceedances during intensification, or as a response to noise complaints.
- Limit construction works at night where practicable and only undertake night time work with prior approval.
- Whilst the construction will largely be conducted on shifts between 6am and 6pm, plan the loudest noise emitting activities to occur within 7:00 am to 4:00 pm, i.e. outside the night time and early morning period and outside the evening period, where possible, and between Monday to Friday. Community notification will be provided in advance of anticipated high noise events.
- Use of lowest possible noise emitting plant and equipment that can economically and efficiently undertake the work should be selected, wherever possible and implementation of a maintenance programme to keep these in good working order and operating at the lowest feasible noise level.
- Limit the number of equipment to be used concurrently at any given time, where practical.
- Locate generators (if required) and other 'fixed' sources as far as practical from adjacent receptors. Procure 'low noise' generators as specified within the assessment support documentation. Where 'low noise' fixed plant is not available investigate the use of portable and non-portable noise barriers (eg shipping containers) to provide local noise attenuation.
- Adequate design of truck travel within the site to minimise the use of reversing alarms.
- Do not permit idle plant and equipment unless this is strictly required.
- Notify affected receptors of the proposed works and duration where high noise emitting construction work may result in adverse impacts.
- Manage potential noise complaints via the existing grievance management system, typically including date and time of complaint, method by which the complaint was made, personal details of the complainant (if provided), nature of the complaint, weather conditions corresponding to the time of the complaint, action taken by the site and any follow up actions.
- Site induction training and workshops to create awareness of the issues above and the workers responsibilities in relation to the noise emissions.

Normal and Upset Operation

- Design the most significant noise generating equipment associated with the new plant (ie. refrigeration, main generation, boilers etc) in order to allow for noise controls such as equipment enclosures, noise screens around loud plant, acoustic silencers, pile lagging, etc to be incorporated in the future if required.

-
- In general, implement a 'low noise' plant procurement process (ie request the specification of noise emissions from manufacturers and add a low noise emission to the selection criteria).
 - Management of operational noise emissions to compliant noise levels:
 - Manage the potential noise exceedances at the closest NSR, if any, after the Front End Engineering Design (FEED) has been completed. Consider relocation or relocation schemes where they remain impacted.

This should apply to existing receptors only, excluding future receptors which may further encroach the LNG Project after construction.
 - Quantify the existing Train 1-2 gas flaring noise emission via noise measurement at the closest NSR12 for a range of gas flaring rates to confirm compliance. For reference, a maximum noise emission of 127 dBA sound power level has been calculated to result in compliant noise levels at the closest NSR (assuming one flare emitting noise at night). Noise monitoring at this receptor is also recommended to confirm the RBL and applicable criterion levels.
 - If marine piling is identified to be required in future, noise monitoring may also be implemented quantify the noise at the receptors during the early stages in order to determine further management measures such as day time marine piling only, which is the typically expected occurrence of this activity.

9 CONCLUSION

A noise assessment of the construction and operation of the proposed Papua LNG Project – Downstream (the Project) has been conducted. The assessment comprised the quantification of existing noise levels on site, as well as at external receptors, and the prediction of the future noise emission starting from a computational noise model of the existing operation.

The assessment showed that the noise emission resulting from the existing (normal) operation of the plant exceeds the Environmental Permit EP-L3(210) during the night time at the perimeter fence line. However, where the noise limits are applied at the NSR in line with WHO and IFC / World Bank Guidelines, the noise limit is predicted to be achieved for existing (normal) operations. Long-term noise monitoring is recommended to be conducted to confirm that compliance with the noise criteria is achieved.

The noise limits are also predicted to be exceed the Environmental Permit EP-L3(210) as well as the limits applied at the closest NSR during construction of the new plant and will be required to be managed with best practice noise management measures.

Noise emissions during normal operation of the new plant alone are predicted to exceed the Environmental Permit EP-L3(210) at the perimeter fence line. From this it flows that the cumulative noise levels will also exceed the Environmental Permit at the perimeter fence line.

The introduction of the new (New Trains) plant produces a noise increase in the cumulative noise emission by up to 5 dBA which results in a marginal predicted exceedance to the night time 45 dBA noise limit at one NSR during normal operation of the plant. However, the background + 3 dBA noise limit is achieved.

Compliance with the 45 dBA limit is also predicted to be marginal at another three of the closest NSR to the Project.

Noise control and noise management measures which have been recommended for construction and operational phases of the project are expected to result in compliant noise levels at the NSR.

The upset operational scenario has been predicted to meet the noise criteria. A maximum gas flaring noise emission of 127 dBA sound power level has been calculated to result in compliance with the 45 dBA limit at all NSR (assuming a single flare noise emission at a time). Preferably, the gas flaring noise emissions specified by the client which form the basis of this noise assessment should not be exceeded.

Where exceedances to the noise limits were found, these were small; therefore, it can be expected that the construction as well as the operation of the Project can be conducted at compliant noise levels at the noise sensitive receptor areas if suitable mitigation measures are adequately implemented. This report provides an overview of reasonable and feasible measures that can be further developed during the design of the plant and during the construction planning or this purpose.

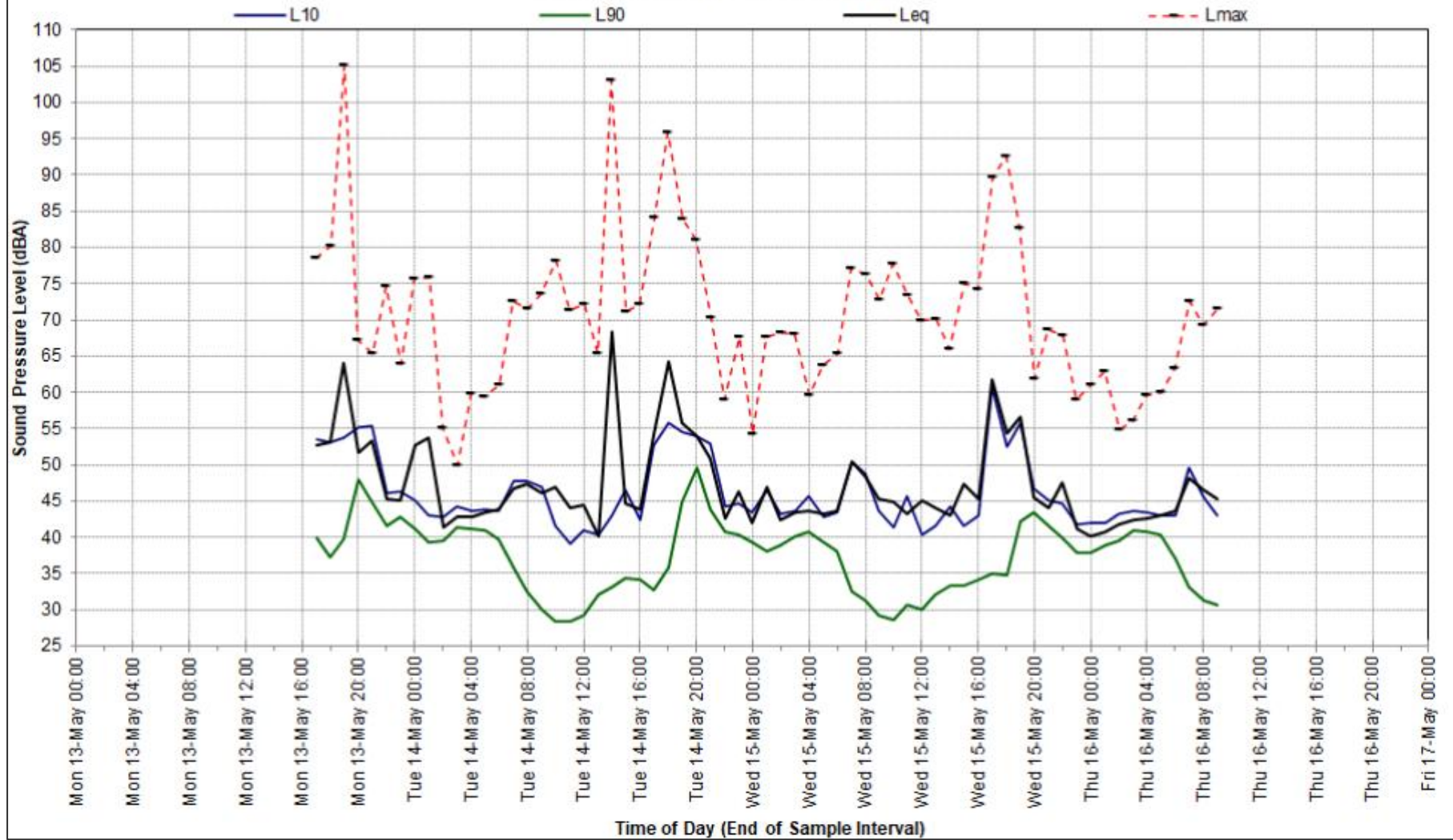
It is noted that the noise limits in the Environmental Permit EP-L3(210) are derived from international Guidelines which apply the limits at the NSR; therefore, it is recommended that the compliance assessment locations be renegotiated to apply at a location which is consistent with international standards (i.e. at the NSR).

APPENDIX A

Background Noise Monitoring Time Traces

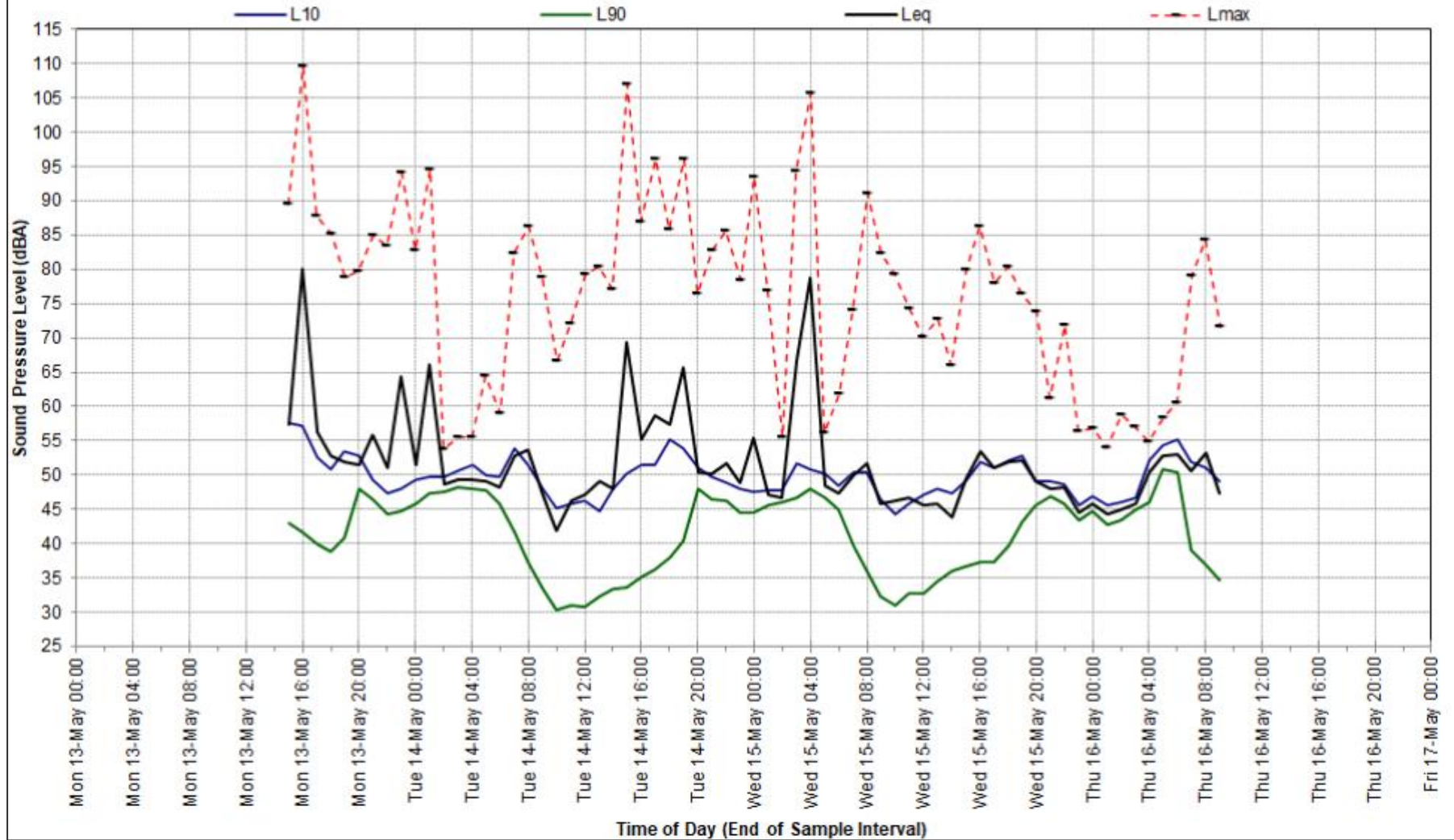
Ambient Noise Levels

Location: Metago - 13-16 May 2019



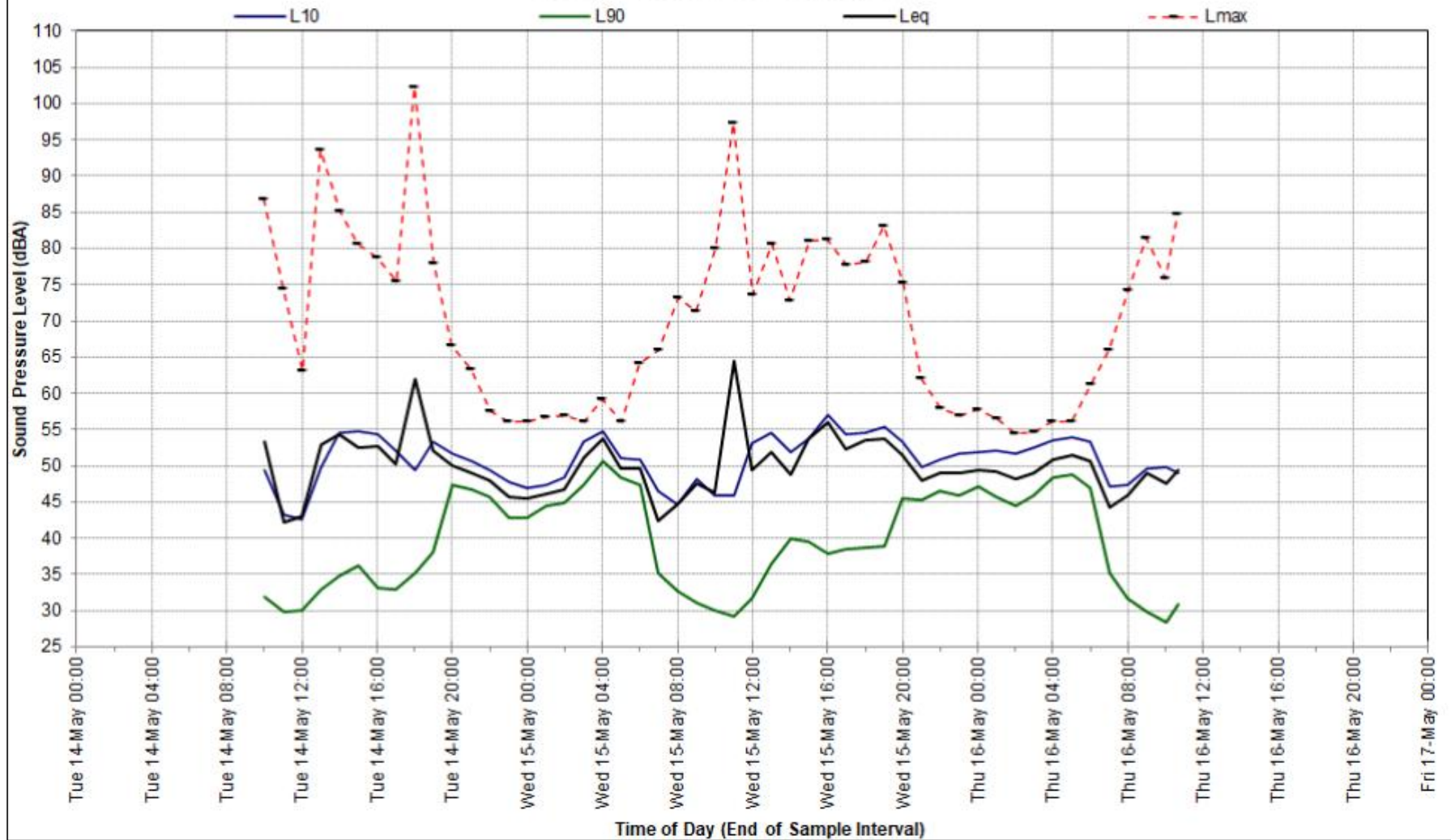
Ambient Noise Levels

Location: Papa - 13-16 May 2019



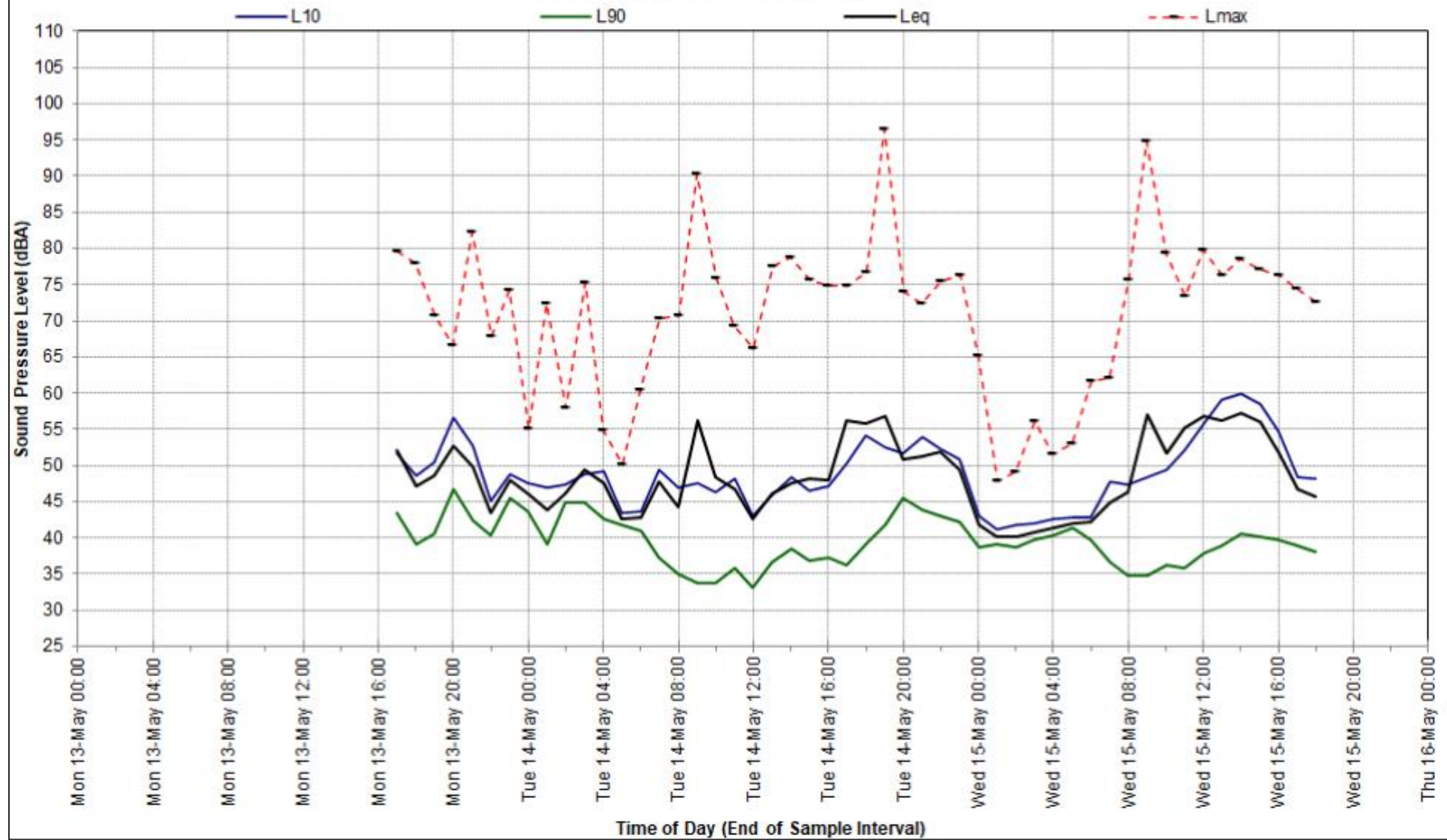
Ambient Noise Levels

Location: Boera - 14-16 May 2019



Ambient Noise Levels

Location: Lea Lea - 13-15 May 2019



APPENDIX B

LNG Plant Attended Noise Measurement Results

Table 25 Attended noise measurement results.

Location, Date, Time	Measurement Details	Photograph
Ref. location UTM (Zone 55) Coordinates: E: 502184, N: 8967824 14/05/2019 10:45h 7 min duration	Description: Reference location at 130140 metres from MR and PR compressors. Measured Noise Level: LA90 = 66 dBA LAeq = 67 dBA Comments: Calm wind, overcast. Constant noise from Train 2 (compressors dominant), approx. 65 dBA. Slight tone at 2 kHz. Vent noise from gas turbine area for approx. 3 seconds. Intermittent low level insect and grasshopper noise.	View from measurement location within LNGP site looking west towards plant 
Boundary 01 UTM (Zone 55) Coordinates: E: 503660, N: 8965716 15/05/2019 09:43h 10 min duration	Description: LNGP boundary near Gate 1. Measured Noise Level: LA90 = 39 dBA LAeq = 49 dBA Comments: Calm wind, sunny. Traffic on main road 52-60 dBA. Minibus leaving site, approx. 42 dBA. Constant insect noise, 38-42 dBA. Occasional birdsong, approx. 45 dBA. LNG plant inaudible.	View from measurement location near perimeter fence line looking NW towards plant 
Boundary 02 UTM (Zone 55) Coordinates: E: 503824, N: 8965439 15/05/2019 10:02h 10 min duration	Description: LNGP boundary near Gate 1. Measured Noise Level: LA90 = 31 dBA LAeq = 54 dBA Comments: Calm wind, sunny. Constant insect noise, 32-35 dBA. Vehicles on main road 57-63 dBA. Occasional birdsong 37-44 dBA. LNG plant inaudible. Truck on main road, up to 75 dBA.	View from measurement location near perimeter fence line looking SE away from plant 

Location, Date, Time	Measurement Details	Photograph
Boundary 03 UTM (Zone 55) Coordinates: E: 503292, N: 8965517 15/05/2019 10:21h 10 min duration	Description: LNGP boundary approx. 380 metres SW of Gate 1. Measured Noise Level: LA90 = 29 dBA LAeq = 34 dBA Comments: Calm wind, sunny. Constant insect noise and birdsong 28-36 dBA. Cars on main road barely audible. Minivan on main road, up to 36 dBA. Nearby birds, up to 40 dBA.	View from measurement location near perimeter fence line looking NW towards plant 
Boundary 04 UTM (Zone 55) Coordinates: E: 502770 N: 8966420 15/05/2019 11:00h 10 min duration	Description: LNGP boundary approx. 200 metres SW of Admin Building. Measured Noise Level: LA90 = 30 dBA LAeq = 33 dBA Comments: Slight breeze, sunny. Trees rustling in wind. Insect noise, approx. 33 dBA. Birdsong, approx. 39 dBA. Constant LNG plant noise, approx. 30 dBA. Occasional vent noise from gas turbine area, approx. 38 dBA. No obvious audible noise from Admin Building.	View from measurement location near perimeter fence line looking NE towards Admin Building. 
Boundary 05 UTM (Zone 55) Coordinates: E: 502419 N: 8966667 15/05/2019 11:15h 10 min duration	Description: LNGP boundary approx. 800 metres SE of Gas Turbine Generators. Measured Noise Level: LA90 = 32 dBA LAeq = 36 dBA Comments: Slight breeze, sunny. Occasional vent noise from gas turbine area 40-42 dBA. One aircraft flyover, up to 50 dBA. Occasional wind gust, up to 38 dBA. Constant LNG plant noise, approx. 32 dBA. Slight tone at 500-630 Hz. Nearby birdsong, approx. 34 dBA.	View from measurement location near perimeter fence line looking north towards plant. 

Location, Date, Time	Measurement Details	Photograph
Boundary 06 UTM (Zone 55) Coordinates: E: 503265, N: 8968706 15/05/2019 12:50h 10 min duration	Description: LNGP boundary near Gate 2. Measured Noise Level: LA90 = 40 dBA LAeq = 45 dBA Comments: Moderate SW wind, sunny. Possible low-frequency wind-induced mic noise. Constant LNG plant noise and nearby transformer (similar contribution), approx. 44 dBA combined. Steel sheds occasionally creaking in wind. Insects audible. Occasional vent noise from gas turbine area. Occasional birdsong.	View from measurement location near perimeter fence line looking west towards plant. 
Boundary 07 UTM (Zone 55) Coordinates: E: 502955, N: 8969066 15/05/2019 13:10h 5 min duration	Description: LNGP boundary approx. 400 metres NW of Gate 2. Location is approx. 1.5 km from Train 2. Measured Noise Level: LA90 = 38 dBA LAeq = 40 dBA Comments: Light breeze, sunny. Constant LNG plant noise 38-40 dBA. Occasional mowing / line trimming from near Gate 2, up to 43 dBA. Occasional trees rustling in wind 37-43 dBA.	View from measurement location near perimeter fence line looking SW towards plant. 
Boundary 08 UTM (Zone 55) Coordinates: E: 502403 N: 8969316 15/05/2019 13:38h 5 min duration	Description: LNGP boundary approx. 400 metres NW of Gate 2. Location is approx. 1.4 km NE of Train 2 and approx. 750 metres from flare. Measured Noise Level: LA90 = 39 dBA LAeq = 42 dBA Comments: Constant LNG plant noise 38-40 dBA, including tone at 500-630 Hz. Occasional vent / purging noise, up to 53 dBA. Insect noise barely audible. Occasional trees rustling in wind, approx. 43 dBA.	View from measurement location near perimeter fence line looking south towards plant. 

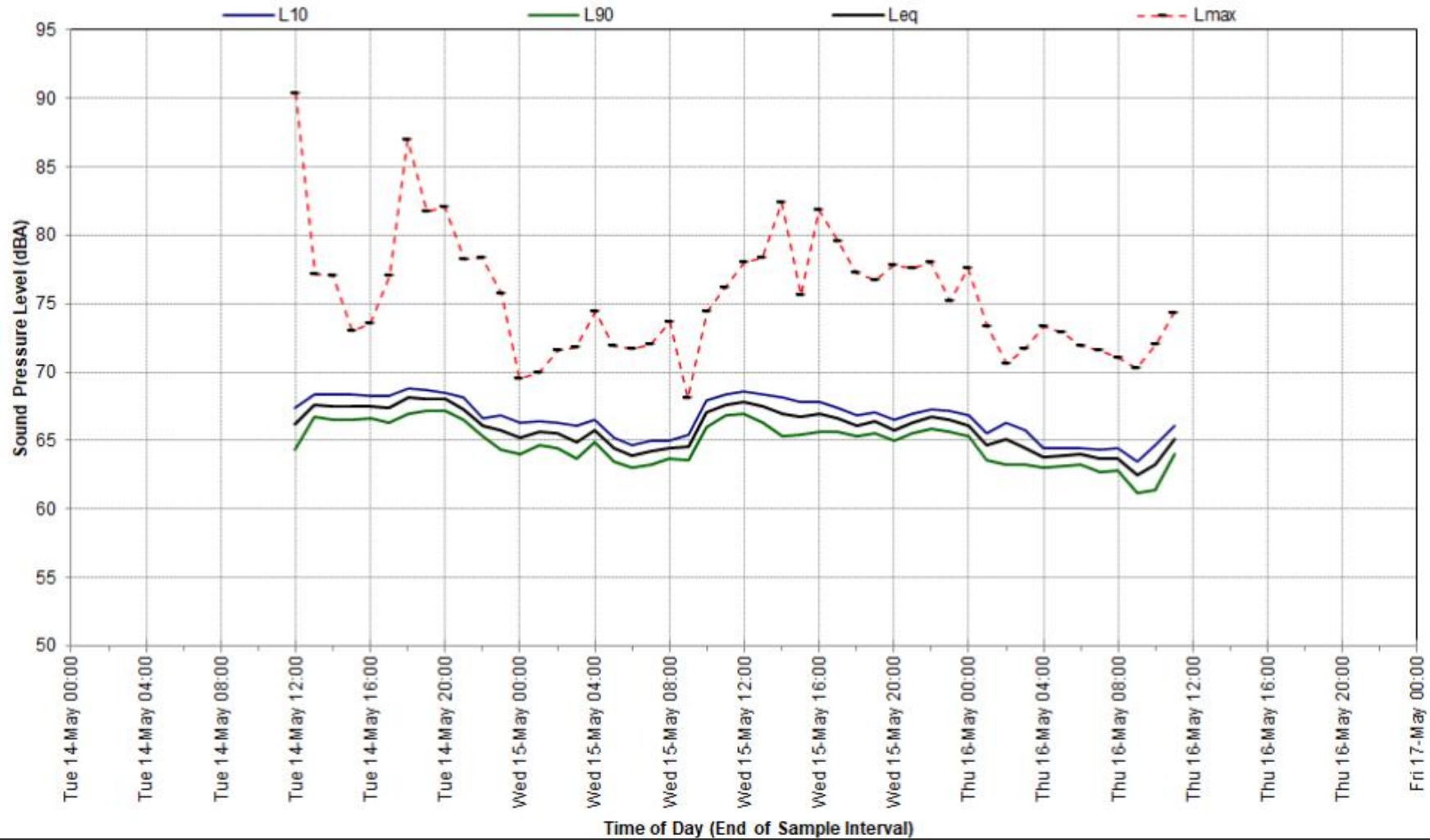
Location, Date, Time	Measurement Details	Photograph
Boundary 09 UTM (Zone 55) Coordinates: E: 501968 N: 8969327 15/05/2019 13:51h 4 min duration	Description: LNGP boundary midway between Gate 2 and Gate 3. Location is approx. 1.3 km NE of Train 2 and approx. 650 metres from flare. Measured Noise Level: LA90 = 40 dBA LAeq = 42 dBA Comments: Slight S wind. Occasional vent / purging noise, up to 50 dBA. Continuous LNG plant noise, 40-44 dBA. Insect noise barely audible. Occasional wind gusts, up to 47 dBA.	View from measurement location near perimeter fence line looking south towards plant. 
Boundary 10 UTM (Zone 55) Coordinates: E: 501561 N: 8969227 15/05/2019 14:06h 4 min duration	Description: LNGP boundary Gate 3. Location is approx. 1.5 km north of LNGP. Measured Noise Level: LA90 = 41 dBA LAeq = 44 dBA Comments: Calm, sunny. Frequent earthmoving equipment noise from neighbouring property 40-50 dBA. Intermittent birdsong, up to 47 dBA. Constant noise from LNG plant, approx. 40 dBA.	View from measurement location near perimeter fence line looking south towards plant. 
Boundary 11 UTM (Zone 55) Coordinates: E: 501238 N: 8969361 15/05/2019 14:21h 5 min duration	Description: LNGP boundary in line with Papa Village. Location is approx. 1.8 km NNW of LNGP. Measured Noise Level: LA90 = 36 dBA LAeq = 40 dBA Comments: Calm, sunny. Constant LNG plant noise, approx. 37 dBA. LNG plant is partially shielded by 4 metre high berm on fence line. Frequent tractor noise from neighbouring property 37-40 dBA. Birdsong up to 44 dBA. Occasional car horn on main road, up to 43 dBA.	View from measurement location near perimeter fence line looking south towards plant. 

APPENDIX C

Reference Location Noise Monitoring Results

Ambient Noise Levels

Location: LNG reference location - 14-16 May 2019



APPENDIX D

Noise Source Emissions Applied in Noise Modelling

Table 26 Existing LNG Plant Modelled (Normal) Noise Emission

Source name	Source type	Sound power level, per unit dBA								
		Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Small Compressors	Point	92	69	75	76	79	82	88	87	83
Small Compressors	Point	92	69	75	76	79	82	88	87	83
BOG Compressor (Compressor Side)	Area	98	60	69	74	83	87	92	95	75
BOG Compressor (Compressor Side)	Area	98	60	69	74	83	87	92	95	75
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Compressor Side)	Area	98	60	69	74	83	87	92	95	75
BOG Compressor (Compressor Side)	Area	98	60	69	74	83	87	92	95	75
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Compressor Top)	Area	98	61	70	75	83	87	93	96	76
BOG Compressor (Turbine Side)	Area	95	67	79	80	85	91	91	85	70
BOG Compressor (Turbine Side)	Area	95	67	79	80	85	91	91	85	70
BOG Compressor (Turbine Intake)	Area	90	72	74	82	82	85	84	81	65
BOG Compressor (Turbine Intake)	Area	90	72	74	82	82	85	84	81	65
BOG Compressor (Turbine Side)	Area	95	67	79	80	85	91	91	85	70
BOG Compressor (Turbine Side)	Area	95	67	79	80	85	91	91	85	70
BOG Compressor (Turbine Intake)	Area	90	72	74	82	82	85	84	81	65
BOG Compressor (Turbine Intake)	Area	90	72	74	82	82	85	84	81	65
BOG Compressor (Turbine Side)	Area	95	67	79	80	85	91	91	85	70
BOG Compressor (Turbine Side)	Area	95	67	79	80	85	91	91	85	70
33 KVA Transformer Loud Side Fans	Area	70	62	60	60	67	59	53	46	38
33KVA Transformer Quite Side	Area	55	38	46	45	53	45	38	37	23
33KVA Transformer Quite Side	Area	55	38	46	45	53	45	38	37	23
33KVA Transformer Quite Side	Area	55	38	46	45	53	45	38	37	23

Source name	Source type	Sound power level, per unit dBA								
		Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
FIN Fans	Area	105	86	91	95	98	99	99	95	82
FIN Fans	Area	105	86	91	95	98	99	99	95	82
GTG2 Exhaust	Point	102	80	83	93	97	98	87	92	72
GTG3 East (exhaust)	Area	82	68	63	73	77	76	70	76	62
GTG3 North	Area	106	77	85	95	98	99	94	103	89
GTG3 Roof	Area	106	77	85	95	98	99	94	103	89
GTG3 South	Area	106	77	85	95	98	99	94	103	89
GTG3 West (Intake)	Area	102	74	83	89	90	88	89	101	81
GTG4 East (exhaust)	Area	82	68	63	73	77	76	70	76	62
GTG4 East (exhaust)	Area	82	68	63	73	77	76	70	76	62
GTG4 East (exhaust)	Area	82	68	63	73	77	76	70	76	62
GTG4 East (exhaust)	Area	82	68	63	73	77	76	70	76	62
GTG4 Exhaust	Point	102	80	83	93	97	98	87	92	72
GTG4 Exhaust	Point	102	80	83	93	97	98	87	92	72
GTG4 North	Area	106	77	85	95	98	99	94	103	89
GTG4 North	Area	106	77	85	95	98	99	94	103	89
GTG4 North	Area	106	77	85	95	98	99	94	103	89
GTG4 North	Area	106	77	85	95	98	99	94	103	89
GTG4 Roof	Area	106	77	85	95	98	99	94	103	89
GTG4 Roof	Area	106	77	85	95	98	99	94	103	89
GTG4 Roof	Area	106	77	85	95	98	99	94	103	89
GTG4 Roof	Area	106	77	85	95	98	99	94	103	89
GTG4 South	Area	106	77	85	95	98	99	94	103	89
GTG4 South	Area	106	77	85	95	98	99	94	103	89
GTG4 South	Area	106	77	85	95	98	99	94	103	89
GTG4 South	Area	106	77	85	95	98	99	94	103	89
GTG4 West (Intake)	Area	102	74	83	89	90	88	89	101	81
GTG4 West (Intake)	Area	102	74	83	89	90	88	89	101	81
GTG4 West (Intake)	Area	102	74	83	89	90	88	89	101	81

Source name	Source type	Sound power level, per unit dBA								
		Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
GTG4 West (Intake)	Area	102	74	83	89	90	88	89	101	81
GTG5 Exhaust	Point	102	80	83	93	97	98	87	92	72
GTG6 Exhaust	Point	102	80	83	93	97	98	87	92	72
MR Comp T1-1 NW - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-1 Roof - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-1 SE - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-1 SW - MR Compressor (SW LP Stage)	Area	100	63	73	82	90	90	94	97	86
MR Comp T1-2 NW - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-2 Roof - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-2 SE - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-2 SW - MR Compressor (SW LP Stage)	Area	100	63	73	82	90	90	94	97	86
MR Comp T1-3 NW - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-3 Roof - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-3 SE - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T1-3 SW - MR Compressor (SW LP Stage)	Area	100	63	73	82	90	90	94	97	86
MR Comp T2-2 NW - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-2 NW - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-2 Roof - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-2 Roof - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-2 SE - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-2 SE - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-2 SW - MR Compressor (SW LP Stage)	Area	100	63	73	82	90	90	94	97	86
MR Comp T2-2 SW - MR Compressor (SW LP Stage)	Area	100	63	73	82	90	90	94	97	86
MR Comp T2-3 NW - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-3 Roof - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-3 SE - MR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
MR Comp T2-3 SW - MR Compressor (SW LP Stage)	Area	100	63	73	82	90	90	94	97	86
MR Compressor Exhaust	Point	105	90	100	97	99	97	95	87	67
MR Compressor Exhaust	Point	105	90	100	97	99	97	95	87	67

Source name	Source type	Sound power level, per unit dBA								
		Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
MR Compressor Exhaust	Point	105	90	100	97	99	97	95	87	67
MR Compressor Exhaust	Point	105	90	100	97	99	97	95	87	67
MR Compressor Exhaust	Point	105	90	100	97	99	97	95	87	67
MR Compressor Exhaust	Point	105	90	100	97	99	97	95	87	67
MR T1-1 East	Area	107	73	81	91	99	98	100	103	95
MR T1-1 North	Area	107	73	81	91	99	98	100	103	95
MR T1-1 Roof	Area	107	73	81	91	99	98	100	103	95
MR T1-1 South	Area	107	73	81	91	99	98	100	103	95
MR T1-2 East	Area	107	73	81	91	99	98	100	103	95
MR T1-2 North	Area	107	73	81	91	99	98	100	103	95
MR T1-2 Roof	Area	107	73	81	91	99	98	100	103	95
MR T1-2 South	Area	107	73	81	91	99	98	100	103	95
MR T1-3 East	Area	107	73	81	91	99	98	100	103	95
MR T1-3 North	Area	107	73	81	91	99	98	100	103	95
MR T1-3 Roof	Area	107	73	81	91	99	98	100	103	95
MR T1-3 South	Area	107	73	81	91	99	98	100	103	95
MR T2-2 East	Area	107	73	81	91	99	98	100	103	95
MR T2-2 East	Area	107	73	81	91	99	98	100	103	95
MR T2-2 North	Area	107	73	81	91	99	98	100	103	95
MR T2-2 North	Area	107	73	81	91	99	98	100	103	95
MR T2-2 Roof	Area	107	73	81	91	99	98	100	103	95
MR T2-2 Roof	Area	107	73	81	91	99	98	100	103	95
MR T2-2 South	Area	107	73	81	91	99	98	100	103	95
MR T2-2 South	Area	107	73	81	91	99	98	100	103	95
MR T2-3 East	Area	107	73	81	91	99	98	100	103	95
MR T2-3 North	Area	107	73	81	91	99	98	100	103	95
MR T2-3 Roof	Area	107	73	81	91	99	98	100	103	95
MR T2-3 South	Area	107	73	81	91	99	98	100	103	95
NW MP/HP Stage	Area	104	64	78	83	94	95	102	94	83

Source name	Source type	Sound power level, per unit dBA								
		Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
NW MP/HP Stage	Area	104	64	78	83	94	95	102	94	83
NW MP/HP Stage	Area	104	64	78	83	94	95	102	94	83
NW MP/HP Stage	Area	104	64	78	83	94	95	102	94	83
PR Compressor 2 East	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 East	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 East	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 East	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 North	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 North	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 North	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 North	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 Roof	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 Roof	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 Roof	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 Roof	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 South	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 South	Area	108	72	85	95	96	100	105	98	87
PR Compressor 2 South	Area	108	72	85	95	96	100	105	98	87
PR Compressor Exhaust	Point	103	83	86	91	100	97	92	90	59
PR Compressor Exhaust	Point	103	83	86	91	100	97	92	90	59
PR Compressor Exhaust	Point	103	83	86	91	100	97	92	90	59
PR Compressor Exhaust	Point	103	83	86	91	100	97	92	90	59
Rec Gas Compressor Comp Side	Area	94	64	72	79	82	89	90	88	81
Rec Gas Compressor Comp Side	Area	94	64	72	79	82	89	90	88	81
Rec Gas Comp Side	Area	96	67	76	84	85	89	91	88	82
Rec Gas Compressor Comp Side	Area	94	64	72	79	82	89	90	88	81
Rec Gas Compressor Comp Side	Area	94	64	72	79	82	89	90	88	81
Rec Gas Comp Side	Area	96	67	76	84	85	89	91	88	82

Source name	Source type	Sound power level, per unit dBA								
		Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Rec Gas Comp Side	Area	96	67	76	84	85	89	91	88	82
Rec Gas Compressor Comp Side	Area	94	64	72	79	82	89	90	88	81
Rec Gas Compressor Inlet	Area	87	60	70	77	77	80	82	78	75
PR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
33 KVA Transformer Loud Side Fans	Area	70	62	60	60	67	59	53	46	38
PR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
PR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
PR Compressor (MP/HP Stage)	Area	104	64	78	83	94	95	102	94	83
SE MH/HP Stage	Area	104	64	78	83	94	95	102	94	83
SE MH/HP Stage	Area	104	64	78	83	94	95	102	94	83
SE MH/HP Stage	Area	104	64	78	83	94	95	102	94	83
SE MH/HP Stage	Area	104	64	78	83	94	95	102	94	83
SW LP Stage	Area	100	64	75	86	88	91	98	89	79
SW LP Stage	Area	100	64	75	86	88	91	98	89	79
SW LP Stage	Area	100	64	75	86	88	91	98	89	79
SW LP Stage	Area	100	64	75	86	88	91	98	89	79

Table 27 NiuPower 58 MW Power Plant Modelled Noise Emission

Source name	Source type	EAST [m]	NORTH [m]	Elevation above sea level, m	Sound power level, per unit dBA								
					Overall	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Power Station Exhaust	Point	504022.5	8969508.2	53.0	98	97	79	78	83	87	86	76	-
Power Station Exhaust	Point	504008.4	8969505.0	52.8	98	97	79	78	83	87	86	76	-
Power Station Exhaust	Point	504008.4	8969507.9	52.8	98	97	79	78	83	87	86	76	-
Power Station Exhaust	Point	504037.2	8969509.0	53.2	98	97	79	78	83	87	86	76	-
Power Station Exhaust	Point	504037.2	8969506.0	53.1	98	97	79	78	83	87	86	76	-
Power Station Exhaust	Point	504022.6	8969505.4	52.9	98	97	79	78	83	87	86	76	-
Power Plant Internal Engine Room	Area	504000.0	8969489.2	24.9	95	77	80	85	86	92	82	75	68
Power Plant Internal Engine Room	Area	504021.1	8969478.8	24.9	98	80	83	88	89	95	85	78	71
Power Plant Internal Engine Room	Area	504042.0	8969489.5	24.9	95	77	80	85	86	92	82	75	68
Power Plant Internal Engine Room	Area	504020.9	8969499.8	24.9	98	80	83	88	89	95	85	78	71
Power Plant Fin Fans	Area	504021.2	8969489.4	32.9	109	104	99	96	93	92	91	86	76
Power Plant Intake	Point	504022.2	8969537.0	31.4	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504022.3	8969531.9	31.3	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504016.6	8969536.9	31.3	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504016.4	8969531.9	31.3	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504049.8	8969537.5	31.7	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504049.9	8969532.4	31.6	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504044.0	8969532.4	31.6	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504044.1	8969537.4	31.6	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504030.4	8969531.9	31.4	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504030.6	8969537.0	31.5	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504036.4	8969532.0	31.5	104	74	78	70	79	96	98	101	93
Power Plant Intake	Point	504036.3	8969537.0	31.5	104	74	78	70	79	96	98	101	93
Power Station Pressure Reduction	Point	503970.7	8969503.6	22.4	96	58	64	72	78	91	94	88	-
Power Plant Internal Engine Room Roof	Area	504021.0	8969489.3	28.9	105	88	91	96	97	103	93	86	79

Table 28 Construction Noise Source Emission Database

Source group	Plant item	Location	Number of plant	Sound power level, per unit dBA								
				Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Mobile Equipment (incl. Liquefaction New Trains)	Air compressor	AA	30	101	82	81	87	87	87	93	96	98
	Bulldozer	AA	0	108	80	95	98	101	105	98	92	85
	Compactor/vibrator	AA	8	108	74	96	100	103	103	98	94	87
	Cranes below 100t	AA	26	104	88	90	96	98	99	97	92	82
	Cranes over 100t	AA	6	104	88	90	96	98	99	97	92	82
	Dump truck	AA	4	108	88	94	98	101	103	101	98	91
	Electrical Generator (200kva)	AA	24	105	89	97	101	97	94	93	88	81
	Excavator	AA	12	107	87	90	96	102	101	100	97	90
	Forklift	AA	8	105	87	87	94	99	98	99	97	88
	Grader	AA	2	110	74	91	97	102	107	103	100	90
	Manlift	AA	2	105	81	88	92	98	101	99	93	89
	Payloader	AA	14	108	104	101	94	96	91	87	84	79
	Pump	AA	16	102	67	80	90	96	97	96	93	85
	Road roller	AA	2	108	97	99	97	102	103	99	93	86
	Welding machine	AA	158	105	73	84	92	97	101	99	94	87
	CUMULATIVE NOISE LEVEL			130	116	117	120	122	125	123	119	115
Mobile Equipment CCPP	Air compressor	AN	15	101	82	81	87	87	87	93	96	98
	Bulldozer	AN	0	108	80	95	98	101	105	98	92	85
	Compactor/vibrator	AN	4	108	74	96	100	103	103	98	94	87
	Cranes below 100t	AN	13	104	88	90	96	98	99	97	92	82
	Cranes over 100t	AN	3	104	88	90	96	98	99	97	92	82
	Dump truck	AN	2	108	88	94	98	101	103	101	98	91
	Electrical Generator (200kva)	AN	12	105	89	97	101	97	94	93	88	81
	Excavator	AN	6	107	87	90	96	102	101	100	97	90
	Forklift	AN	4	105	87	87	94	99	98	99	97	88
	Grader	AN	1	108	72	89	95	100	105	101	98	88

Source group	Plant item	Location	Number of plant	Sound power level, per unit dBA								
				Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
	Manlift	AN	1	105	81	88	92	98	101	99	93	89
	Payloader	AN	7	107	103	100	93	95	90	86	83	78
	Pump	AN	8	102	67	80	90	96	97	96	93	85
	Road roller	AN	1	108	97	99	97	102	103	99	93	86
	Welding machine	AN	79	105	73	84	92	97	101	99	94	87
	CUMULATIVE NOISE LEVEL			127	113	113	117	119	122	120	116	112
Mobile Equipment Utility and offsite	Air compressor	AH,AD	15	101	82	81	87	87	87	93	96	98
	Bulldozer	AH,AD	0	108	80	95	98	101	105	98	92	85
	Compactor/vibrator	AH,AD	4	108	74	96	100	103	103	98	94	87
	Cranes below 100t	AH,AD	13	104	88	90	96	98	99	97	92	82
	Cranes over 100t	AH,AD	3	104	88	90	96	98	99	97	92	82
	Dump truck	AH,AD	0	108	88	94	98	101	103	101	98	91
	Electrical Generator (200kva)	AH,AD	12	105	89	97	101	97	94	93	88	81
	Excavator	AH,AD	6	107	87	90	96	102	101	100	97	90
	Forklift	AH,AD	4	105	87	87	94	99	98	99	97	88
	Grader	AH,AD	1	108	72	89	95	100	105	101	98	88
	Manlift	AH,AD	1	105	81	88	92	98	101	99	93	89
	Payloader	AH,AD	7	107	103	100	93	95	90	86	83	78
	Pump	AH,AD	8	102	67	80	90	96	97	96	93	85
	Road roller	AH,AD	1	108	97	99	97	102	103	99	93	86
	Welding machine	AH,AD	79	105	73	84	92	97	101	99	94	87
	CUMULATIVE NOISE LEVEL			127	113	113	117	119	122	120	116	112
Transportation	Bus	Site and camp	37	107	81	89	95	99	103	101	95	82
	Pickup/truck	Site and Laydown	163	60	40	42	49	54	53	54	52	0
	Sedan	Site and Camp	91	60	40	42	49	54	53	54	52	0
	Trailer truck	Site and Laydown	89	108	82	90	96	100	104	102	96	83
	CUMULATIVE NOISE LEVEL			129	103	111	116	121	125	123	117	104

Source group	Plant item	Location	Number of plant	Sound power level, per unit dBA								
				Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Static equipment	Electrical generator (700kva) ¹	556,647.79 E 8,213,027.36 N	35	81	72	75	74	75	71	68	65	61
	Waste incinerator	501,225.00 E 8,969,075.00 N	1	60	44	52	56	52	49	48	43	36
	CUMULATIVE NOISE LEVEL			97	87	90	89	90	86	83	80	76

Notes:

Sound power for 700 KVA electrical generator was calculated from a sound pressure level of 60 dBA at 1m distance of unit with ultraquiet enclosure.

Figure 17 Focused Area of Mobile Equipment for Construction Activities (yellow shaded areas) (source: Tetra Tech Coffey)

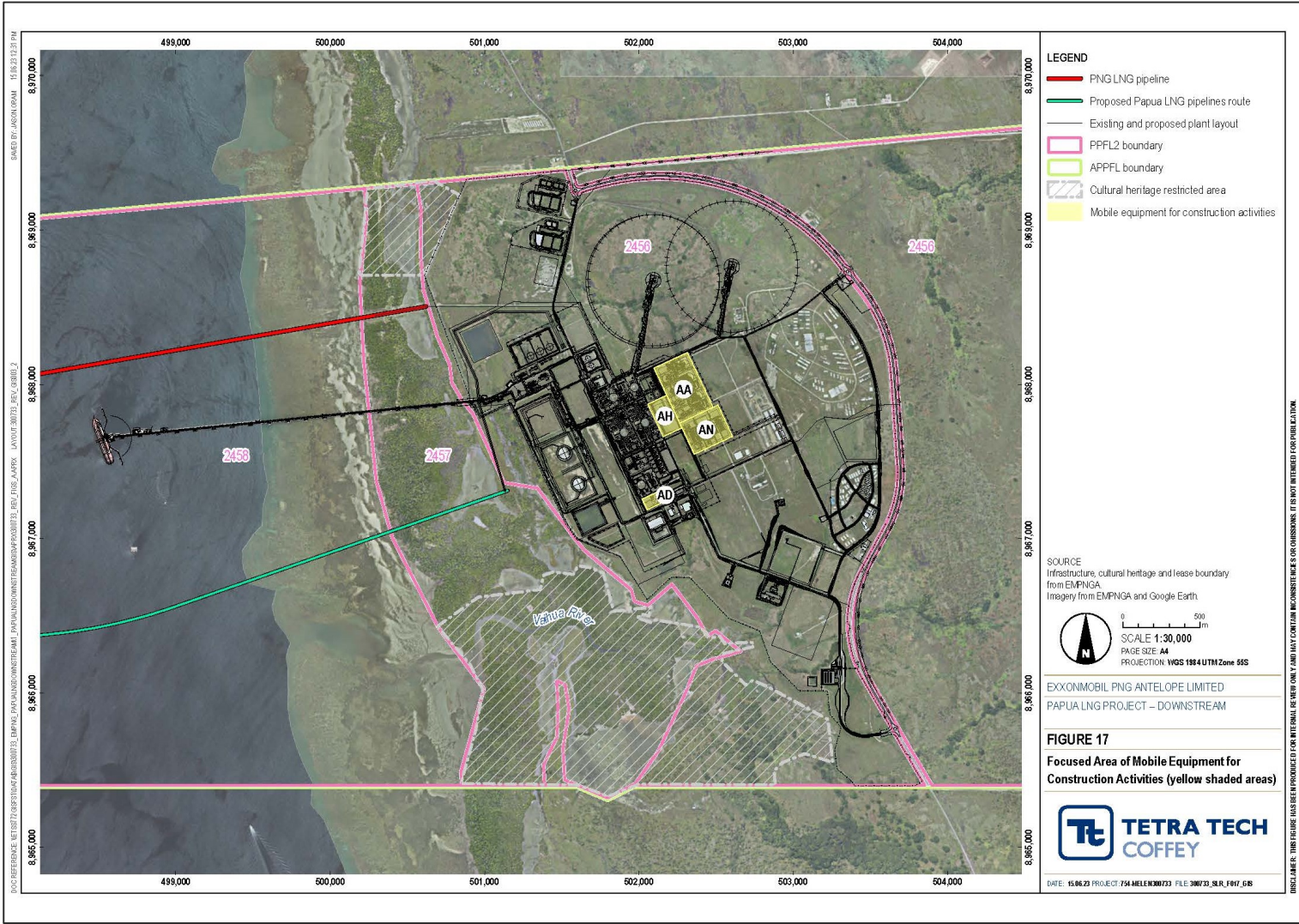


Table 29 Plant Noise Emission Data for Normal Operation (Source: Reproduced from PGLP-CC-SRVIB-903001)

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
623: Inlet Facility (for Papua LNG)	93-VEAL62330	Inlet Liquid Separator Thermal Oxidizer	Package	N/A	10419.8	10641.0	HOLD	90	112	103	100	102	105	108	106	102	99	
661: Gas Dehydration (Identical for all Trains)	93-HFF66130-01	Regeneration Gas Cooler	AFC	18.5	10567.8	10711.6	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF66130-02	Regeneration Gas Cooler	AFC	18.5	10567.8	10707.6	3	80	95	97	97	95	92	89	88	83	78	
665 / 695: Gas Liquefaction	93-CAE69530	Feed Gas Booster Compressor	Compressor	19 MW	10630.3	10733.1	18	90	112	103	100	102	105	108	106	102	99	
	93-CAE69530	Feed Gas Booster Compressor - Gear	Gear	N/A	10629.5	10729.1	18	83	100	90	93	96	98	95	92	89	83	
	93-CAE69530	Feed Gas Booster Compressor - Motor	Motor	-	10629.5	10724.7	18	83	100	90	93	96	98	95	92	89	83	
	93-HFF69530-01	Feed Gas Booster Compressor Aftercooler	AFC	37	10575.6	10719.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-02	Feed Gas Booster Compressor Aftercooler	AFC	37	10585.9	10725.4	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-03	Feed Gas Booster Compressor Aftercooler	AFC	37	10580.8	10719.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-04	Feed Gas Booster Compressor Aftercooler	AFC	37	10585.9	10712.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-05	Feed Gas Booster Compressor Aftercooler	AFC	37	10585.9	10719.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-06	Feed Gas Booster Compressor Aftercooler	AFC	37	10580.8	10725.4	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-07	Feed Gas Booster Compressor Aftercooler	AFC	37	10575.6	10725.4	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-08	Feed Gas Booster Compressor Aftercooler	AFC	37	10575.6	10712.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF69530-09	Feed Gas Booster Compressor Aftercooler	AFC	37	10580.8	10712.8	25	80	95	97	97	95	92	89	88	83	78	
	93-TGT69531	LNG liquid Expander	Turbine	N/A	10566.0	10684.7	HOLD	90	112	103	100	102	105	108	106	102	99	
666: Inlet Chilling System	93-CAE66640	Propane Refrigerant Compressor	Compressor	20 MW	10513.8	10622.2	15	90	112	103	100	102	105	108	106	102	99	
	93-CAE66640	Propane Refrigerant Compressor-Gear	Gear	N/A	10513.0	10617.9	15	83	100	90	93	96	98	95	92	89	83	
	93-CAE66640	Propane Refrigerant Compressor-Motor	Motor	-	10513.0	10613.5	15	83	100	90	93	96	98	95	92	89	83	
	93-CAE66640	Propane Refrigerant Compressor-Lube oil Unit	Lube Oil Unit	-	10500.3	10620.7	15	80	95	97	97	95	92	89	88	83	78	
	93-PBA66660	Propane Transfer Pump	Pump (Centri.)	18.5	10562.0	10575.2	1.5	80	95	97	97	95	92	89	88	83	78	
	93-HFF66640-01	Propane Desuperheater	AFC	18.5	10580.8	10627.3	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66640-02	Propane Desuperheater	AFC	18.5	10585.9	10627.3	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66640-03	Propane Desuperheater	AFC	18.5	10575.7	10627.3	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-01	Propane Condenser	AFC	37	10575.7	10605.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-02	Propane Condenser	AFC	37	10585.9	10610.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-03	Propane Condenser	AFC	37	10580.8	10605.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-04	Propane Condenser	AFC	37	10575.7	10594.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-05	Propane Condenser	AFC	37	10585.9	10605.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-06	Propane Condenser	AFC	37	10580.8	10615.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-07	Propane Condenser	AFC	37	10575.7	10615.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-08	Propane Condenser	AFC	37	10585.9	10615.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-09	Propane Condenser	AFC	37	10580.8	10610.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-10	Propane Condenser	AFC	37	10575.7	10610.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-11	Propane Condenser	AFC	37	10580.8	10583.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-12	Propane Condenser	AFC	37	10575.7	10583.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-13	Propane Condenser	AFC	37	10585.9	10583.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-14	Propane Condenser	AFC	37	10580.8	10578.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-15	Propane Condenser	AFC	37	10575.7	10578.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-16	Propane Condenser	AFC	37	10585.9	10594.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-17	Propane Condenser	AFC	37	10580.8	10594.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-18	Propane Condenser	AFC	37	10575.7	10589.2	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-19	Propane Condenser	AFC	37	10585.9	10589.2	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-20	Propane Condenser	AFC	37	10580.8	10589.2	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-21	Propane Condenser	AFC	37	10585.9	10621.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-22	Propane Condenser	AFC	37	10580.8	10599.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-23	Propane Condenser	AFC	37	10575.7	10599.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-24	Propane Condenser	AFC	37	10585.9	10599.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-25	Propane Condenser	AFC	37	10580.8	10621.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-26	Propane Condenser	AFC	37	10575.7	10621.1	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-27	Propane Condenser	AFC	37	10585.9	10567.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-28	Propane Condenser	AFC	37	10580.8	10567.8	25	80	95	97	97	95	92	89	88	83	78	

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	93-HFF66661-29	Propane Condenser	AFC	37	10575.7	10562.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-30	Propane Condenser	AFC	37	10585.9	10562.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-31	Propane Condenser	AFC	37	10580.8	10562.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-32	Propane Condenser	AFC	37	10575.7	10573.2	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-33	Propane Condenser	AFC	37	10585.9	10578.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-34	Propane Condenser	AFC	37	10580.8	10573.2	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-35	Propane Condenser	AFC	37	10575.7	10567.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66661-36	Propane Condenser	AFC	37	10585.9	10573.2	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66662-01	Propane Subcooler	AFC	33	10585.9	10641.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66662-02	Propane Subcooler	AFC	33	10580.8	10641.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66662-03	Propane Subcooler	AFC	33	10575.7	10634.4	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66662-04	Propane Subcooler	AFC	33	10585.9	10634.4	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66662-05	Propane Subcooler	AFC	33	10580.8	10634.4	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF66662-06	Propane Subcooler	AFC	33	10575.7	10641.5	25	80	95	97	97	95	92	89	88	83	78	
	83-CAE66611	LP MR Compressor	Compressor	18.5 MW	10630.2	10639.5	4	90	112	103	100	102	105	108	106	102	99	Train 3
	83-CAE66611	LP MR Compressor - Gear	Gear	N/A	10633.2	10640.0	4	83	100	90	93	96	98	95	92	89	83	Train 3
	83-CAE66611	LP MR Compressor - Motor	Motor	-	10638.7	10640.5	4	83	100	90	93	96	98	95	92	89	83	Train 3
	83-CAE66611	LP MR Compressor - LO Unit	Lube Oil Unit	-	10612.6	10641.2	4	80	95	97	97	95	92	89	88	83	78	Train 3
	84-CAE66611	LP MR Compressor	Compressor	18.5 MW	10630.2	10573.5	4	90	112	103	100	102	105	108	106	102	99	Train 4
	84-CAE66611	LP MR Compressor - Gear	Gear	N/A	10633.2	10573.9	4	83	100	90	93	96	98	95	92	89	83	Train 4
	84-CAE66611	LP MR Compressor - Motor	Motor	-	10638.7	10574.4	4	83	100	90	93	96	98	95	92	89	83	Train 4
	84-CAE66611	LP MR Compressor - LO Unit	Lube Oil Unit	-	10612.6	10575.2	4	80	95	97	97	95	92	89	88	83	78	Train 4
	85-CAE66611	LP MR Compressor	Compressor	18.5 MW	10630.2	10507.5	4	90	112	103	100	102	105	108	106	102	99	Train 5
	85-CAE66611	LP MR Compressor - Gear	Gear	N/A	10633.2	10508.0	4	83	100	90	93	96	98	95	92	89	83	Train 5
	85-CAE66611	LP MR Compressor - Motor	Motor	-	10638.7	10508.5	4	83	100	90	93	96	98	95	92	89	83	Train 5
	85-CAE66611	LP MR Compressor - LO Unit	Lube Oil Unit	-	10612.6	10509.2	4	80	95	97	97	95	92	89	88	83	78	Train 5
	86-CAE66611	LP MR Compressor	Compressor	18.5 MW	10630.2	10441.5	4	90	112	103	100	102	105	108	106	102	99	Train 6
	86-CAE66611	LP MR Compressor - Gear	Gear	N/A	10633.2	10442.0	4	83	100	90	93	96	98	95	92	89	83	Train 6
	86-CAE66611	LP MR Compressor - Motor	Motor	-	10638.7	10442.5	4	83	100	90	93	96	98	95	92	89	83	Train 6
	86-CAE66611	LP MR Compressor - LO Unit	Lube Oil Unit	-	10612.6	10443.2	4	80	95	97	97	95	92	89	88	83	78	Train 6
	83-CAE66612	HP MR Compressor	Compressor	12.8 MW	10627.7	10639.5	4	90	112	103	100	102	105	108	106	102	99	Train 3
	84-CAE66612	HP MR Compressor	Compressor	12.8 MW	10627.7	10573.5	4	90	112	103	100	102	105	108	106	102	99	Train 4
	85-CAE66612	HP MR Compressor	Compressor	12.8 MW	10627.7	10507.5	4	90	112	103	100	102	105	108	106	102	99	Train 5
	86-CAE66612	HP MR Compressor	Compressor	12.8 MW	10627.7	10441.5	4	90	112	103	100	102	105	108	106	102	99	Train 6
	83-HFF66613-01	LP MR Desuperheater	AFC	18.5	10643.0	10661.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66613-02	LP MR Desuperheater	AFC	18.5	10638.5	10661.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66613-03	LP MR Desuperheater	AFC	18.5	10638.5	10655.4	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66613-04	LP MR Desuperheater	AFC	18.5	10643.0	10655.4	25	80	95	97	97	95	92	89	88	83	78	Train 3
	84-HFF66613-01	LP MR Desuperheater	AFC	18.5	10643.0	10589.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66613-02	LP MR Desuperheater	AFC	18.5	10638.5	10589.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66613-03	LP MR Desuperheater	AFC	18.5	10643.0	10595.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66613-04	LP MR Desuperheater	AFC	18.5	10638.5	10595.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	85-HFF66613-01	LP MR Desuperheater	AFC	18.5	10638.5	10529.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66613-02	LP MR Desuperheater	AFC	18.5	10643.0	10529.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66613-03	LP MR Desuperheater	AFC	18.5	10643.0	10523.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66613-04	LP MR Desuperheater	AFC	18.5	10638.5	10523.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	86-HFF66613-01	LP MR Desuperheater	AFC	18.5	10638.5	10463.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66613-02	LP MR Desuperheater	AFC	18.5	10638.5	10457.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66613-03	LP MR Desuperheater	AFC	18.5	10643.0	10463.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66613-04	LP MR Desuperheater	AFC	18.5	10643.0	10457.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	83-HFF66614-01	LP MR Intercooler	AFC	37	10627.0	10655.4	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66614-02	LP MR Intercooler	AFC	37	10627.0	10661.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66614-03	LP MR Intercooler	AFC	37	10632.5	10661.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66614-04	LP MR Intercooler	AFC	37	10632.5	10655.4	25	80	95	97	97	95	92	89	88	83	78	Train 3

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	83-HFF66614-05	LP MR Intercooler	AFC	37	10616.0	10655.4	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66614-06	LP MR Intercooler	AFC	37	10621.5	10661.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66614-07	LP MR Intercooler	AFC	37	10621.5	10655.4	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66614-08	LP MR Intercooler	AFC	37	10616.0	10661.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	84-HFF66614-01	LP MR Intercooler	AFC	37	10616.0	10595.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-02	LP MR Intercooler	AFC	37	10616.0	10589.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-03	LP MR Intercooler	AFC	37	10621.5	10595.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-04	LP MR Intercooler	AFC	37	10632.5	10589.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-05	LP MR Intercooler	AFC	37	10632.5	10595.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-06	LP MR Intercooler	AFC	37	10621.5	10589.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-07	LP MR Intercooler	AFC	37	10627.0	10589.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66614-08	LP MR Intercooler	AFC	37	10627.0	10595.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	85-HFF66614-01	LP MR Intercooler	AFC	37	10621.5	10529.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-02	LP MR Intercooler	AFC	37	10616.0	10529.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-03	LP MR Intercooler	AFC	37	10616.0	10523.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-04	LP MR Intercooler	AFC	37	10621.5	10523.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-05	LP MR Intercooler	AFC	37	10627.0	10529.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-06	LP MR Intercooler	AFC	37	10627.0	10523.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-07	LP MR Intercooler	AFC	37	10632.5	10523.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66614-08	LP MR Intercooler	AFC	37	10632.5	10529.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	86-HFF66614-01	LP MR Intercooler	AFC	37	10632.5	10457.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-02	LP MR Intercooler	AFC	37	10632.5	10463.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-03	LP MR Intercooler	AFC	37	10627.0	10457.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-04	LP MR Intercooler	AFC	37	10621.5	10457.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-05	LP MR Intercooler	AFC	37	10616.0	10457.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-06	LP MR Intercooler	AFC	37	10627.0	10463.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-07	LP MR Intercooler	AFC	37	10621.5	10463.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66614-08	LP MR Intercooler	AFC	37	10616.0	10463.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	83-HFF66615-01	HP MR Desuperheater	AFC	37	10642.2	10671.4	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66615-02	HP MR Desuperheater	AFC	37	10642.2	10677.6	25	80	95	97	97	95	92	89	88	83	78	Train 3
	84-HFF66615-01	HP MR Desuperheater	AFC	37	10642.2	10611.6	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66615-02	HP MR Desuperheater	AFC	37	10642.2	10605.4	25	80	95	97	97	95	92	89	88	83	78	Train 4
	85-HFF66615-01	HP MR Desuperheater	AFC	37	10642.2	10545.6	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66615-02	HP MR Desuperheater	AFC	37	10642.2	10539.4	25	80	95	97	97	95	92	89	88	83	78	Train 5
	86-HFF66615-01	HP MR Desuperheater	AFC	37	10642.2	10479.6	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66615-02	HP MR Desuperheater	AFC	37	10642.2	10473.4	25	80	95	97	97	95	92	89	88	83	78	Train 6
	83-HFF66616-01	HP MR Aftercooler	AFC	30	10635.4	10678.7	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-02	HP MR Aftercooler	AFC	30	10635.4	10674.5	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-03	HP MR Aftercooler	AFC	30	10635.4	10670.3	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-04	HP MR Aftercooler	AFC	30	10629.8	10670.3	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-05	HP MR Aftercooler	AFC	30	10613.0	10674.5	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-06	HP MR Aftercooler	AFC	30	10624.2	10678.7	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-07	HP MR Aftercooler	AFC	30	10624.2	10674.5	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-08	HP MR Aftercooler	AFC	30	10624.2	10670.3	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-09	HP MR Aftercooler	AFC	30	10629.8	10678.7	25	80	95	97	97	95	92	89	88	83	78	Train 3
	83-HFF66616-10	HP MR Aftercooler	AFC	30	10629.8	10674.5	25	80	95	97	97	95	92	89	88	83	78	Train 3
	84-HFF66616-01	HP MR Aftercooler	AFC	30	10635.4	10604.3	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-02	HP MR Aftercooler	AFC	30	10635.4	10612.7	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-03	HP MR Aftercooler	AFC	30	10613.0	10608.5	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-04	HP MR Aftercooler	AFC	30	10613.0	10604.3	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-05	HP MR Aftercooler	AFC	30	10613.0	10612.7	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-06	HP MR Aftercooler	AFC	30	10629.8	10608.5	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-07	HP MR Aftercooler	AFC	30	10624.2	10604.3	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-08	HP MR Aftercooler	AFC	30	10629.8	10612.7	25	80	95	97	97	95	92	89	88	83	78	Train 4

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	84-HFF66616-09	HP MR Aftercooler	AFC	30	10635.4	10608.5	25	80	95	97	97	95	92	89	88	83	78	Train 4
	84-HFF66616-10	HP MR Aftercooler	AFC	30	10629.8	10604.3	25	80	95	97	97	95	92	89	88	83	78	Train 4
	85-HFF66616-01	HP MR Aftercooler	AFC	30	10613.0	10546.7	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-02	HP MR Aftercooler	AFC	30	10613.0	10542.5	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-03	HP MR Aftercooler	AFC	30	10613.0	10538.3	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-04	HP MR Aftercooler	AFC	30	10618.6	10546.7	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-05	HP MR Aftercooler	AFC	30	10618.6	10542.5	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-06	HP MR Aftercooler	AFC	30	10618.6	10538.3	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-07	HP MR Aftercooler	AFC	30	10635.4	10542.5	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-08	HP MR Aftercooler	AFC	30	10629.8	10538.3	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-09	HP MR Aftercooler	AFC	30	10635.4	10546.7	25	80	95	97	97	95	92	89	88	83	78	Train 5
	85-HFF66616-10	HP MR Aftercooler	AFC	30	10635.4	10538.3	25	80	95	97	97	95	92	89	88	83	78	Train 5
	86-HFF66616-01	HP MR Aftercooler	AFC	30	10618.6	10480.7	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-02	HP MR Aftercooler	AFC	30	10618.6	10476.5	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-03	HP MR Aftercooler	AFC	30	10618.6	10472.3	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-04	HP MR Aftercooler	AFC	30	10624.2	10480.7	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-05	HP MR Aftercooler	AFC	30	10624.2	10476.5	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-06	HP MR Aftercooler	AFC	30	10613.0	10476.5	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-07	HP MR Aftercooler	AFC	30	10613.0	10472.3	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-08	HP MR Aftercooler	AFC	30	10613.0	10480.7	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-09	HP MR Aftercooler	AFC	30	10635.4	10472.3	25	80	95	97	97	95	92	89	88	83	78	Train 6
	86-HFF66616-10	HP MR Aftercooler	AFC	30	10635.4	10480.7	25	80	95	97	97	95	92	89	88	83	78	Train 6
	83-PBA66611	LP MR Pump	Pump (Centri.)	180	10593.0	10656.7	1	83	100	90	93	96	98	95	92	89	83	Train 3
	84-PBA66611	LP MR Pump	Pump (Centri.)	180	10593.0	10590.7	1	83	100	90	93	96	98	95	92	89	83	Train 4
	85-PBA66611	LP MR Pump	Pump (Centri.)	180	10593.0	10524.7	1	83	100	90	93	96	98	95	92	89	83	Train 5
	86-PBA66611	LP MR Pump	Pump (Centri.)	180	10593.0	10458.7	1	83	100	90	93	96	98	95	92	89	83	Train 6
	83-PBA66613	HP MR Pump	Pump (Centri.)	180	10592.0	10669.7	1	83	100	90	93	96	98	95	92	89	83	Train 3
	84-PBA66613	HP MR Pump	Pump (Centri.)	180	10593.0	10603.7	1	83	100	90	93	96	98	95	92	89	83	Train 4
	85-PBA66613	HP MR Pump	Pump (Centri.)	180	10593.0	10537.7	1	83	100	90	93	96	98	95	92	89	83	Train 5
	86-PBA66613	HP MR Pump	Pump (Centri.)	180	10593.0	10471.7	1	83	100	90	93	96	98	95	92	89	83	Train 6
	83-PBA66671	MR Accumulator Pump	Pump (Centri.)	30	10592.0	10680.7	1	80	95	97	97	95	92	89	88	83	78	Train 3
	84-PBA66671	MR Accumulator Pump	Pump (Centri.)	30	10593.0	10613.7	1	80	95	97	97	95	92	89	88	83	78	Train 4
	85-PBA66671	MR Accumulator Pump	Pump (Centri.)	30	10593.0	10547.7	1	80	95	97	97	95	92	89	88	83	78	Train 5
	86-PBA66671	MR Accumulator Pump	Pump (Centri.)	30	10593.0	10481.7	1	80	95	97	97	95	92	89	88	83	78	Train 6
	83-TGT66670	MR Liquid Expander	Turbine	N/A	10609.5	10656.2	5	80	97	78	81	84	87	90	93	90	87	
	84-TGT66670	MR Liquid Expander	Turbine	N/A	10609.5	10590.2	5	80	97	78	81	84	87	90	93	90	87	
	85-TGT66670	MR Liquid Expander	Turbine	N/A	10609.5	10524.2	5	80	97	78	81	84	87	90	93	90	87	
	86-TGT66670	MR Liquid Expander	Turbine	N/A	10609.5	10458.2	5	80	97	78	81	84	87	90	93	90	87	
691: LNG Storage & Loading	98-VCAE69165	BOG Compressor Package	Package	9500	HOLD	HOLD	4.4	90	111	91	92	95	98	103	106	104	98	
	98-CAE69166	LP Casing for BOG Compressor	Compressor	-	9722.4	11119.2	4.4	85	108	92	96	97	98	100	102	101	93	Included in 98-VCAE69165
	98-CAE69167	HP Casing for BOG Compressor	Compressor	-	9719.5	11119.2	4.4	85	108	92	96	97	98	100	102	101	93	Included in 98-VCAE69165
	98-CAE69167	HP Casing for BOG Compressor-Gear	Gear	N/A	9724.9	11119.6	4.4	83	100	90	93	96	98	95	92	89	83	
	98-CAE69167	HP Casing for BOG Compressor-Motor	Motor	-	9728.8	11119.7	4.4	83	100	90	93	96	98	95	92	89	83	
	98-CAE69167	HP Casing for BOG Compressor-LO Pump	Lube Oil Unit	-	9738.0	11121.3	4.4	80	95	97	97	95	92	89	88	83	78	
	98-CAE69167	HP Casing for BOG Compressor-LO Cooler	Lube Oil Unit	-	9745.5	11118.8	4.4	80	95	97	97	95	92	89	88	83	78	
	98-CAE69167	HP Casing for BOG Compressor-LO Cooler	Lube Oil Unit	-	9745.5	11120.9	4.4	80	95	97	97	95	92	89	88	83	78	
	98-HFF69168-01	BOG Compressor Aftercooler	AFC	11	9700.4	11122.4	17	80	95	97	97	95	92	89	88	83	78	
	98-HFF69168-02	BOG Compressor Aftercooler	AFC	11	9706.9	11122.4	17	80	95	97	97	95	92	89	88	83	78	
	98-HFF69168-03	BOG Compressor Aftercooler	AFC	11	9703.6	11122.4	17	80	95	97	97	95	92	89	88	83	78	
698: Refrigerant Storage	98-PBA69127/ 28	LNG Quench Transfer Pump	Pump (Centri.)	55	9691.1	11131.3	1	83	100	90	93	96	98	95	92	89	83	28 is on standby
698: Refrigerant Storage	93-PBA69830	ios-Pentane Make-up Pump	Pump (Centri.)	11	10410.3	10538.7	1	80	94	71	70	66	68	74	83	91	89	
631: Plant Condensate Stabilization	93-CAE63171	Fractionation Column OVHD Compressor	Compressor	1000	10642.0	10732.4	4.8	90	111	91	92	95	98	103	106	104	98	

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	93-CAE63171	Fractionation Column OVHD Compressor-Gear	Gear	N/A	10642.0	10730.5	4.8	83	100	90	93	96	98	95	92	89	83	
	93-CAE63171	Fractionation Column OVHD Compressor-Motor	Motor	-	10642.0	10728.3	4.8	83	100	90	93	96	98	95	92	89	83	
	93-CAE63171	Fractionation Column OVHD Compressor-LO Unit	Lube Oil Unit	-	10642.0	10725.4	4.8	80	95	97	97	95	92	89	88	83	78	
	93-HFF63171-01	Fractionation Column OVHD Condenser	AFC	7.5	10586.3	10743.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63171-02	Fractionation Column OVHD Condenser	AFC	7.5	10582.3	10743.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63173-01	Plant Condensate Cooler	AFC	7.5	10583.2	10748.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63173-02	Plant Condensate Cooler	AFC	7.5	10586.6	10748.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63173-03	Plant Condensate Cooler	AFC	7.5	10579.8	10748.5	25	80	95	97	97	95	92	89	88	83	78	
	93-PBA63171/ 72	Fractionation Column Reflux Pump	Pump (Centri.)	11	10607.0	10760.4	1.5	83	100	90	93	96	98	95	92	89	83	72 is on standby
	93-PBA63173/ 74	LPG Recycle Pump	Pump (Centri.)	7.5	10651.7	10767.2	1.2	83	100	90	93	96	98	95	92	89	83	74 is on standby
	93-HFF63174-01	Fractionation Column OVHD Compressor 1st Aftercooler	AFC	0.75	10645.0	10746.8	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63174-02	Fractionation Column OVHD Compressor 1st Aftercooler	AFC	0.75	10645.0	10748.5	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63175-01	Fractionation Column OVHD Compressor 2nd Aftercooler	AFC	11	10641.5	10748.0	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63175-02	Fractionation Column OVHD Compressor 2nd Aftercooler	AFC	11	10641.5	10752.0	25	80	95	97	97	95	92	89	88	83	78	
631: Deisopentanize	93-HFF63181-01	Deisopentanizer Condenser	AFC	22	10580.9	10734.0	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63181-02	Deisopentanizer Condenser	AFC	22	10585.7	10734.0	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63183-01	Deisopentanizer Bottom Cooler	AFC	7.5	10586.7	10739.0	25	80	95	97	97	95	92	89	88	83	78	
	93-HFF63183-02	Deisopentanizer Bottom Cooler	AFC	7.5	10583.8	10739.0	25	80	95	97	97	95	92	89	88	83	78	
	93-PBA63185/86	Deisopentanizer Bottom Pump	Pump (Centri.)	5.5	10610.5	10741.7	1	80	94	71	70	66	68	74	83	91	89	86 is on standby
	93-PBA63181/82	Deisopentanizer Reflux Pump	Pump (Centri.)	11	10600.1	10741.8	1	80	94	71	70	66	68	74	83	91	89	82 is on standby
	93-PBA63183/84	Isopentane Transfer Pump	Pump (Centri.)	0.75	10594.4	10718.2	1	80	94	71	70	66	68	74	83	91	89	84 is on standby
634: Condensate Storage	94-PBA63421/ 22	Sour Condensate Loading Pump	Pump (Centri.)	1300	HOLD	HOLD	3	90	109	121	117	113	104	102	98	97	92	22 is on standby
612: HP Flare	97-XAW61270	Dry Flare	Flare	N/A	HOLD	HOLD	93	87	98	79	66	60	71	81	89	93	95	
	97-XAW61280	Wet Flare	Flare	N/A	HOLD	HOLD	93	81	92	77	65	56	65	75	83	87	89	
	93-PBE61281 / 82	Wet Flare KO Drum Pump	Pump (Centri.)	30	10573.2	10763.8	2.4	83	100	90	93	96	98	95	92	89	83	82 is on standby
941: Hot Oil	93-EAW94150	Hot Oil Furnace	Furnace	N/A	10369.8	10636.5	1.4	80	100	90	94	99	101	93	87	84	82	
	93-PBE94161	Hot Oil Drain Drum Pump	Pump (Centri.)	HOLD	10545.5	10760.1	1	83	100	90	93	96	98	95	92	89	83	
833: Main Generation	96-VTAN83390	Main Turbo Generator Package	Package	N/A	HOLD	HOLD	23	90	109	121	117	113	104	102	98	97	92	
	96-TGT83390	Gas Turbine Driver for Main Turbo Generator Package	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83390
	96-TAN83390	Generator for Main Turbo Package Generator	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83390
	96-VTST83390	Steam Turbine Generator for Main Turbo Package Generator		N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83390
	96-VTAN83391	Main Turbo Generator Package	Package	N/A	HOLD	HOLD	23	90	109	121	117	113	104	102	98	97	92	
	96-TGT83391	Gas Turbine Driver for Main Turbo Generator Package	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83391
	96-TAN83391	Generator for Main Turbo Package Generator	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83391
	96-VTST83391	Steam Turbine Generator for Main Turbo Package Generator		N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83391
	96-VTAN83392	Main Turbo Generator Package	Package	N/A	HOLD	HOLD	23	90	109	121	117	113	104	102	98	97	92	
	96-TGT83392	Gas Turbine Driver for Main Turbo Generator Package	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83392
	96-TAN83392	Generator for Main Turbo Package Generator	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83392
	96-VTST83392	Steam Turbine Generator for Main Turbo Package Generator		N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83392

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	96-VTAN83393	Main Turbo Generator Package	Package	N/A	HOLD	HOLD	23	90	109	121	117	113	104	102	98	97	92	
	96-TGT83393	Gas Turbine Driver for Main Turbo Generator Package	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83393
	96-TAN83393	Generator for Main Turbo Package Generator	Package	N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83393
	96-VTST83393	Steam Turbine Generator for Main Turbo Package Generator		N/A	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	Part of 96-VTAN83393
	96-VXC83395	Air Cooled Condensers Vacuum Package	Package	HOLD	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	
	96-VXC83396	Air Cooled Condensers Vacuum Package	Package	HOLD	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	
	96-VHFF83395	Air Cooled Condenser (ACC) Package	AFC	55	HOLD	HOLD	HOLD	80	95	97	97	95	92	89	88	83	78	
	96-HFF83395	Air Cooled Condensers Heat Exchanger	AFC	110	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	
	96-VHFF83396	Air Cooled Condenser (ACC) Package	AFC	55	HOLD	HOLD	HOLD	80	95	97	97	95	92	89	88	83	78	
	96-HFF83396	Air Cooled Condensers Heat Exchanger	AFC	110	HOLD	HOLD	HOLD	83	100	90	93	96	98	95	92	89	83	
922: Tempered Water	93-HFF92250-01	Tempered Water Air Cooler	AFC	37	10543.8	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-02	Tempered Water Air Cooler	AFC	37	10543.8	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-03	Tempered Water Air Cooler	AFC	37	10550.5	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-04	Tempered Water Air Cooler	AFC	37	10557.2	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-05	Tempered Water Air Cooler	AFC	37	10550.5	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-06	Tempered Water Air Cooler	AFC	37	10530.4	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-07	Tempered Water Air Cooler	AFC	37	10523.7	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-08	Tempered Water Air Cooler	AFC	37	10530.4	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-09	Tempered Water Air Cooler	AFC	37	10537.1	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-10	Tempered Water Air Cooler	AFC	37	10537.1	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-11	Tempered Water Air Cooler	AFC	37	10563.9	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-12	Tempered Water Air Cooler	AFC	37	10557.2	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-13	Tempered Water Air Cooler	AFC	37	10563.9	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-14	Tempered Water Air Cooler	AFC	37	10523.7	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-15	Tempered Water Air Cooler	AFC	37	10510.3	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-16	Tempered Water Air Cooler	AFC	37	10510.3	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-17	Tempered Water Air Cooler	AFC	37	10517.0	10446.7	3	80	95	97	97	95	92	89	88	83	78	
	93-HFF92250-18	Tempered Water Air Cooler	AFC	37	10517.0	10451.4	3	80	95	97	97	95	92	89	88	83	78	
	93-PBE92251	Tempered Water Circulation Pump	Pump (Centri.)	132	10512.3	10461.7	3.8	83	102	93	96	99	99	97	95	92	86	
	93-PBE92252 / 53	Tempered Water Circulation Pump	Pump (Centri.)	132	10508.5	10461.7	3.8	83	102	93	96	99	99	97	95	92	86	53 is on standby
923 : Cooling Towers	96-HXC92350	CCPP Cooling Tower	Cooling Tower	30	HOLD	HOLD	HOLD	83	102	93	96	99	99	97	95	92	86	
	96-PBE92360/61	CCPP Cooling Tower Pump	Pump (Centri.)	200	HOLD	HOLD	HOLD	83	102	93	96	99	99	97	95	92	86	61 is on standby
	96-VPAT62370	CCPP Cooling Tower Chemical Injection Package	Package	HOLD	HOLD	HOLD	1	80	94	71	70	66	68	74	83	91	89	
945: Boiler Feed Water System	96-PBE94520	BFW Pump	Pump (Centri.)	375	HOLD	HOLD	1	83	102	93	96	99	99	97	95	92	86	
	96-PBE94521	BFW Pump	Pump (Centri.)	375	HOLD	HOLD	1	83	102	93	96	99	99	97	95	92	86	
	96-PBE94522	BFW Pump	Pump (Centri.)	375	HOLD	HOLD	1	83	102	93	96	99	99	97	95	92	86	
	96-PBE94523	BFW Pump	Pump (Centri.)	375	HOLD	HOLD	1	83	102	93	96	99	99	97	95	92	86	
	96-VPAT94530	Oxygen Scavenger Injection Package	Package	0.2	HOLD	HOLD	1	80	94	71	70	66	68	74	83	91	89	
	96-VPAT94531	Ammonia Injection Package	Package	0.2	HOLD	HOLD	1	80	94	71	70	66	68	74	83	91	89	
	96-VPAT94532	Phosphate Injection Package	Package	0.2	HOLD	HOLD	1	80	94	71	70	66	68	74	83	91	89	
948: Boiler	96-VHBN94890	HRSB for Main Turbo Generator Package	Package	HOLD	HOLD	HOLD	HOLD	90	109	121	117	113	104	102	98	97	92	Included in Main Turbo Generator Package
	96-VHBN94891	HRSB for Main Turbo Generator Package	Package	HOLD	HOLD	HOLD	HOLD	90	109	121	117	113	104	102	98	97	92	Included in Main Turbo Generator Package
	96-VHBN94892	HRSB for Main Turbo Generator Package	Package	HOLD	HOLD	HOLD	HOLD	90	109	121	117	113	104	102	98	97	92	Included in Main Turbo Generator Package

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	96-VHBN94893	HRSB for Main Turbo Generator Package	Package	HOLD	HOLD	HOLD	HOLD	90	109	121	117	113	104	102	98	97	92	Included in Main Turbo Generator Package
	96-PBE94890	HRSB Blowdown Transfer Pump	Pump (Centri.)	2.2	HOLD	HOLD	1	80	94	71	70	66	68	74	83	91	89	
	96-PBE94891	HRSB Blowdown Transfer Pump	Pump (Centri.)	2.2	HOLD	HOLD	1	80	94	71	70	66	68	74	83	91	89	
949: Boiler Water	96-VABM94920	Highly Demineralized Water Generation Package	Package	HOLD	10149.1	10016.6	1	83	102	93	96	99	99	97	95	92	86	
	98-VJBM94920	Sea Water Intake Chlorination Unit	Package	HOLD	HOLD	HOLD	3.2	83	100	90	93	96	98	95	92	89	83	
	98-PBH94910/ 11	Sea Water Intake Pump	Pump (Vertical)	55	7384.7	11820.4	1	83	102	93	96	99	99	97	95	92	86	11 is on standby
955: Air Compressors	96-VCIA95550	Air Compressor Package	Package	500	10209.3	10139.5	6	80	100	114	105	103	99	91	85	86	86	
961: Nitrogen Generation	96-VMAN96145	PSA Nitrogen Generation Package	Package	HOLD	10182.2	10138.0	7	83	100	90	93	96	98	95	92	89	83	Purge Silencer
	96-VMAN96155	PSA Nitrogen Generation Package	Package	HOLD	10204.3	10130.2	7	83	100	90	93	96	98	95	92	89	83	Purge Silencer
973: Sanitary Drains and Caissons	97-VZBE97390	Bio-Treatment Unit	Package	HOLD	10094.9	10089.2	9	83	100	90	93	96	98	95	92	89	83	
	97-VZBE97394	Sludge Dewatering Unit	Package	HOLD	10094.7	10093.9	1	83	100	90	93	96	98	95	92	89	83	
	99-PBH97356	Sanitary Collection Pump -Maintenance Building Area	Pump (Centri.)	2	HOLD	HOLD	0.5	80	94	71	70	66	68	74	83	91	89	
	99-PBH97358	Sanitary Collection Pump -Turnaround Camp Area	Pump (Centri.)	15	HOLD	HOLD	0.5	83	100	90	93	96	98	95	92	89	83	
	97-PBE97365	Diesel Pump for Sludge Incinerator	Pump (Centri.)	0.75	10174.8	10033.5	2.1	80	94	71	70	66	68	74	83	91	89	
987: Steam Condensate	97-VPBH98750	Steam Blowdown Neutralization Package	Package	HOLD	10128.5	10134.4	1	80	94	71	70	66	68	74	83	91	89	
	96-PBE98720	Steam Condensate Tank Pump	Pump (Centri.)	90	HOLD	HOLD	1	83	102	93	96	99	99	97	95	92	86	
	96-PBE98721 / 22	Steam Condensate Tank Pump	Pump (Centri.)	90	HOLD	HOLD	1	83	102	93	96	99	99	97	95	92	86	22 is on standby
996: Chemical Drain	93-PBH99661/62	Chemical Water Collection Pump - Common Process Area	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	62 is on standby
	93-PBH99663/64	Chemical Water Collection Pump - Common Process Area	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	64 is on standby
997: Oily Water Handling	93-PBH99731/32	No.1 Oily Collection Pump - Common Process Area	Pump (Vertical)	22	10123.3	10154.7	1.1	83	100	90	93	96	98	95	92	89	83	32 is on standby
	93-PBH99733/34	No.2 Oily Collection Pump - Common Process Area	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	34 is on standby
	94-PBH99735/ 36	No.1 Oily Water Collection Pump - Sour Condensate Tank Area	Pump (Vertical)	15	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	36 is on standby
	94-PBH99738/ 39	No.2 Oily Water Collection Pump - Sour Condensate Tank Area	Pump (Vertical)	15	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	39 is on standby
	94-PBH99740/ 41	No.3 Oily Water Collection Pump - Sour Condensate Tank Area	Pump (Vertical)	15	10098.9	10159.2	1.1	83	100	90	93	96	98	95	92	89	83	41 is on standby
	96-PBH99751/ 52	No.1 Oily Collection Pump - CCBP Area	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	52 is on standby
	96-PBH99753/ 54	No.2 Oily Collection Pump - CCBP Area	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	54 is on standby
	96-PBH99755/ 56	No.3 Oily Collection Pump - CCBP Area	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	56 is on standby
	83-PBH99791/ 92	Oily Collection Pump -LNG Process Train 3	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	84-PBH99791/ 92	Oily Collection Pump -LNG Process Train 3	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	85-PBH99791/ 92	Oily Collection Pump -LNG Process Train 3	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	86-PBH99791/ 92	Oily Collection Pump -LNG Process Train 3	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	83-PBH99791/ 92	Oily Collection Pump -LNG Process Train 4	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	84-PBH99791/ 92	Oily Collection Pump -LNG Process Train 4	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	85-PBH99791/ 92	Oily Collection Pump -LNG Process Train 4	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	86-PBH99791/ 92	Oily Collection Pump -LNG Process Train 4	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	83-PBH99791/ 92	Oily Collection Pump -LNG Process Train 5	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	84-PBH99791/ 92	Oily Collection Pump -LNG Process Train 5	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	85-PBH99791/ 92	Oily Collection Pump -LNG Process Train 5	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	86-PBH99791/ 92	Oily Collection Pump -LNG Process Train 5	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	83-PBH99791/ 92	Oily Collection Pump -LNG Process Train 6	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	84-PBH99791/ 92	Oily Collection Pump -LNG Process Train 6	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby
	85-PBH99791/ 92	Oily Collection Pump -LNG Process Train 6	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby

Area	Item No	Noise source name	Type	Connected load (kW)	Coordinates			Overall, dBA		Estimated Sound power level spectrum, dB								Remarks / Noise mitigation measures
					EAST [m]	NORTH [m]	Equipment Height, [m]	SPL	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
	86-PBH99791/ 92	Oily Collection Pump -LNG Process Train 6	Pump (Vertical)	22	HOLD	HOLD	1.1	83	100	90	93	96	98	95	92	89	83	92 is on standby

Table 30 New Trains Diesel Generation Noise Emission (Upset Operation Only)

Source group	Plant item	Location	Number of plant	Sound power level, per unit dBA									
				Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Emergency Diesel Generators (700kva ¹ diesel electrical generator assumed)	96-VTDE83740	502,327.4 E 8,967,731.5 N	3	81	72	75	74	75	71	68	65	61	
	96-VTDE83750	502,317.4 E 8,967,726.9 N											
	96-VTDE83760	502,377.5 E 8,967,722.9 N											

Notes:

Sound power for 700 KVA electrical generator was calculated from a sound pressure level of 60 dBA at 1m distance of unit with ultraquiet enclosure.

APPENDIX E

Construction Noise Contour Maps





LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C1 - Mobile equipment (inc. liquifaction new trains)
Adverse Noise Propagation Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
002**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C2 - Mobile equipment CCPP
Prevailing Weather Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
003**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C2 - Mobile equipment CCPP
Adverse Noise Propagation Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
004**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C3 - Mobile equipment utility and offsite
Prevailing Weather Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
005**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C3 - Mobile equipment utility and offsite
Adverse Noise Propagation Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
006**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C4 - Static equipment
Prevailing Weather Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

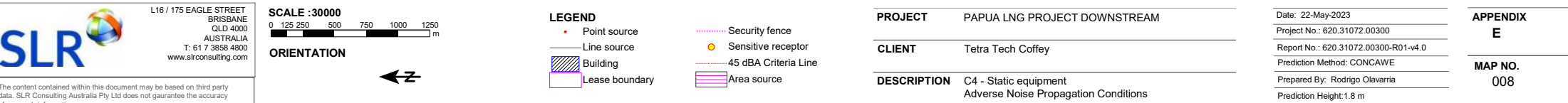
Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

APPENDIX
E

MAP NO.
007





LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C5 - Static & Mobile equip (inc. liquifaction new trains)
Existing LNG & Power Plant - Prevailing Weather

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
009**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C5 - Static & Mobile equip (inc. liquifaction new trains)
Existing LNG & Power PLant - Adverse Propagation

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

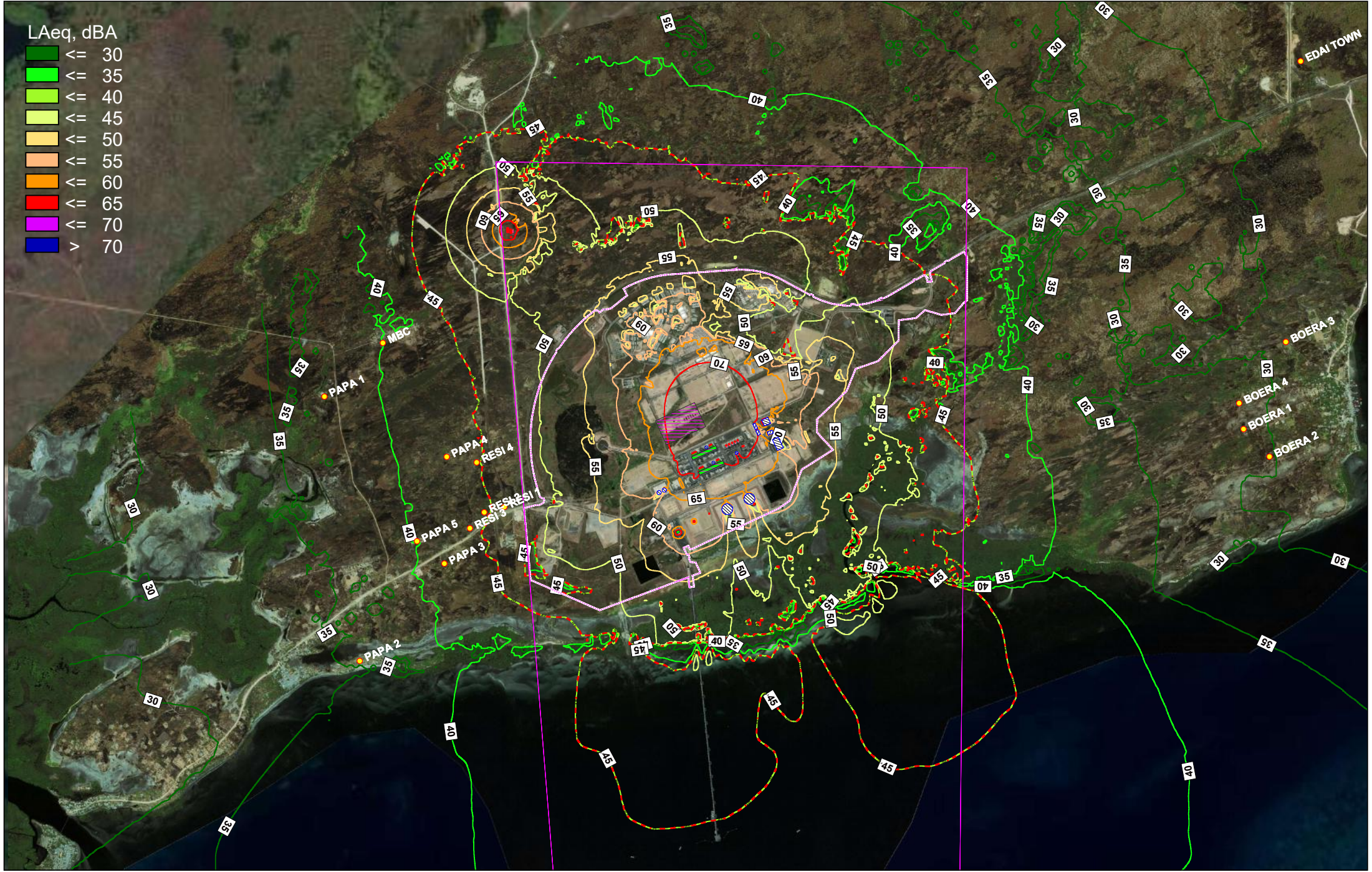
Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
010**

L_{Aeq}, dBA

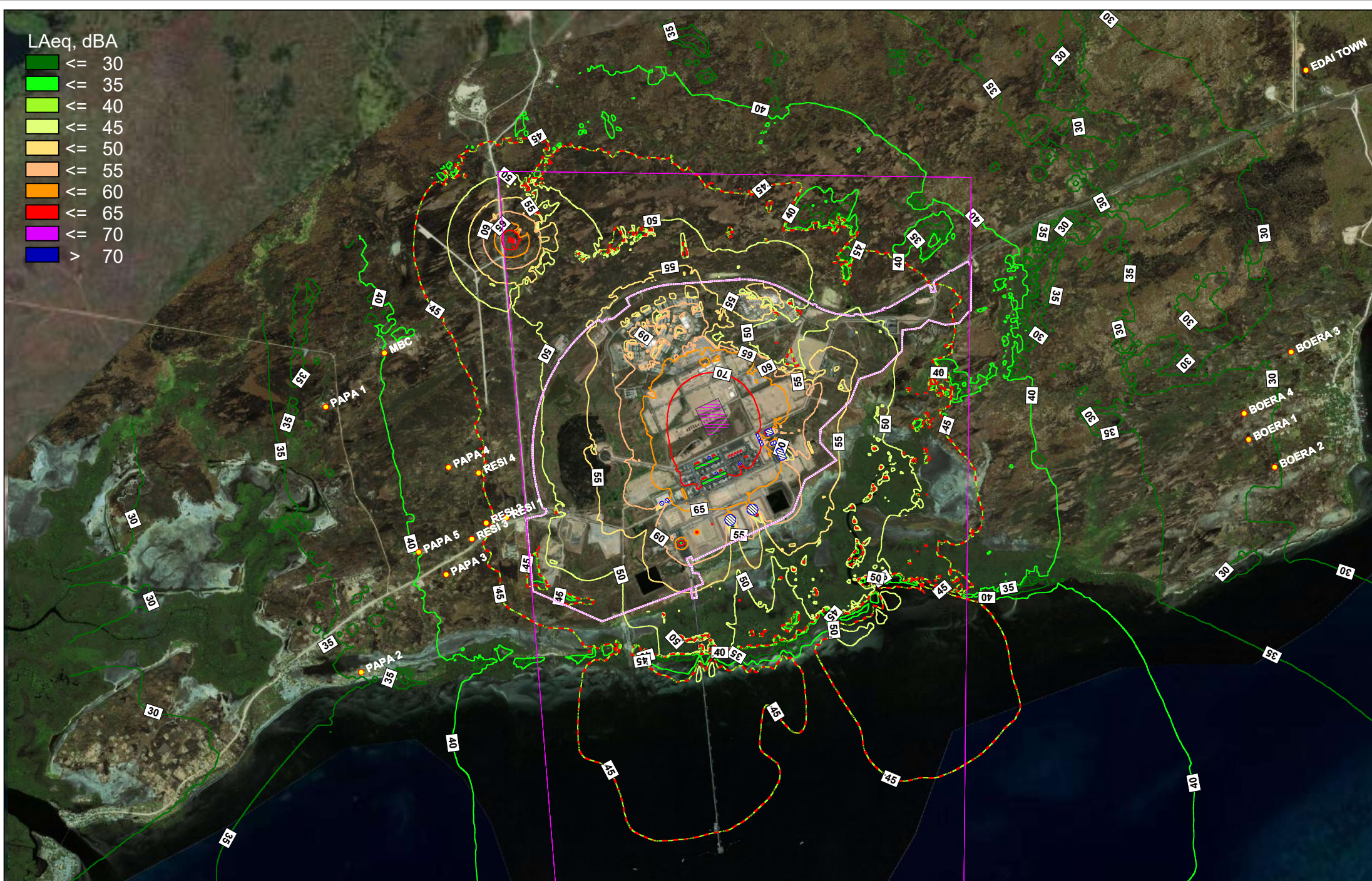


LEGEND

- Point source
- Line source
- Building
- Lease boundary
- Security fence
- Sensitive receptor
- 45 dBA Criteria Line
- Area source

PROJECT	PAPUA LNG PROJECT DOWNSTREAM
CLIENT	Tetra Tech Coffey
DESCRIPTION	C6 - Static & Mobile equip CCPP + Existing LNG + Power Plant - Prevailing Weather Conditions

Date: 22-May-2023
Project No.: 620.31072.00300
Report No.: 620.31072.00300-R01-v4.0
Prediction Method: CONCAWE
Prepared By: Rodrigo Olavarria
Prediction Height: 1.8 m



LEGEND

- | | | | |
|--|----------------|--|----------------------|
| | Point source | | Security fence |
| | Line source | | Sensitive receptor |
| | Building | | 45 dBA Criteria Line |
| | Lease boundary | | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C6 - Static & Mobile equip CCPP + Existing LNG +
Power Plant - Adverse Noise Propagation Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
012**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C7 - Static & Mobile equip Util and off site
+ Exist LNG + Power Plant - Prevailing Weather

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
E**

**MAP NO.
013**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION C7 - Static & Mobile equip Util and off site
+ Exist LNG + Power Plant - Adverse Propagation

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

APPENDIX
E

MAP NO.
014

APPENDIX F

Operational Noise Contours



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O1 - Existing LNG Train 1-2 (normal operation)
Prevailing Weather Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
F**

**MAP NO.
1**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O1 - Existing LNG Train 1-2 (normal operation)
Adverse Noise Propagation Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

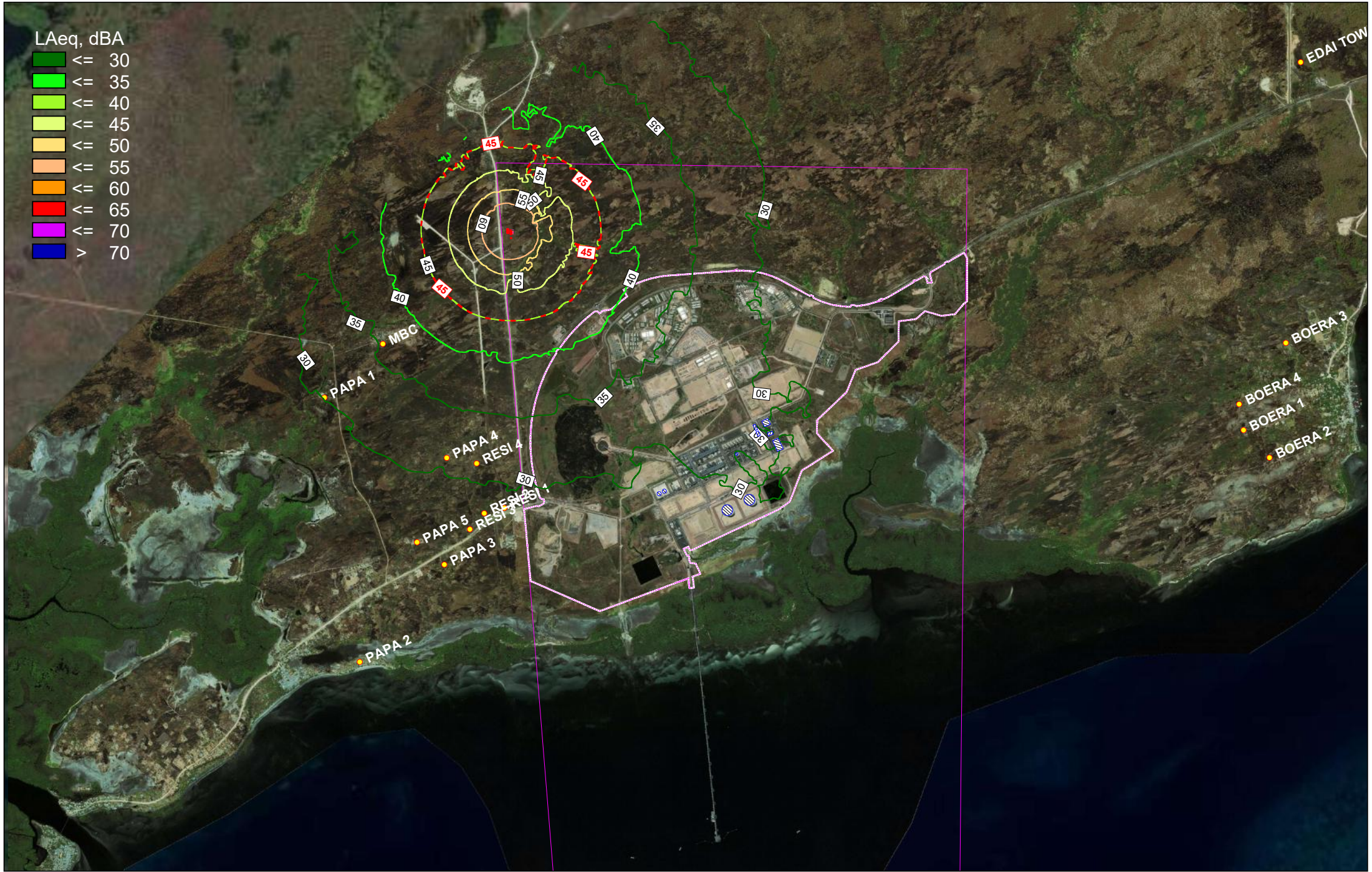
Prepared By: Rodrigo Olavarria

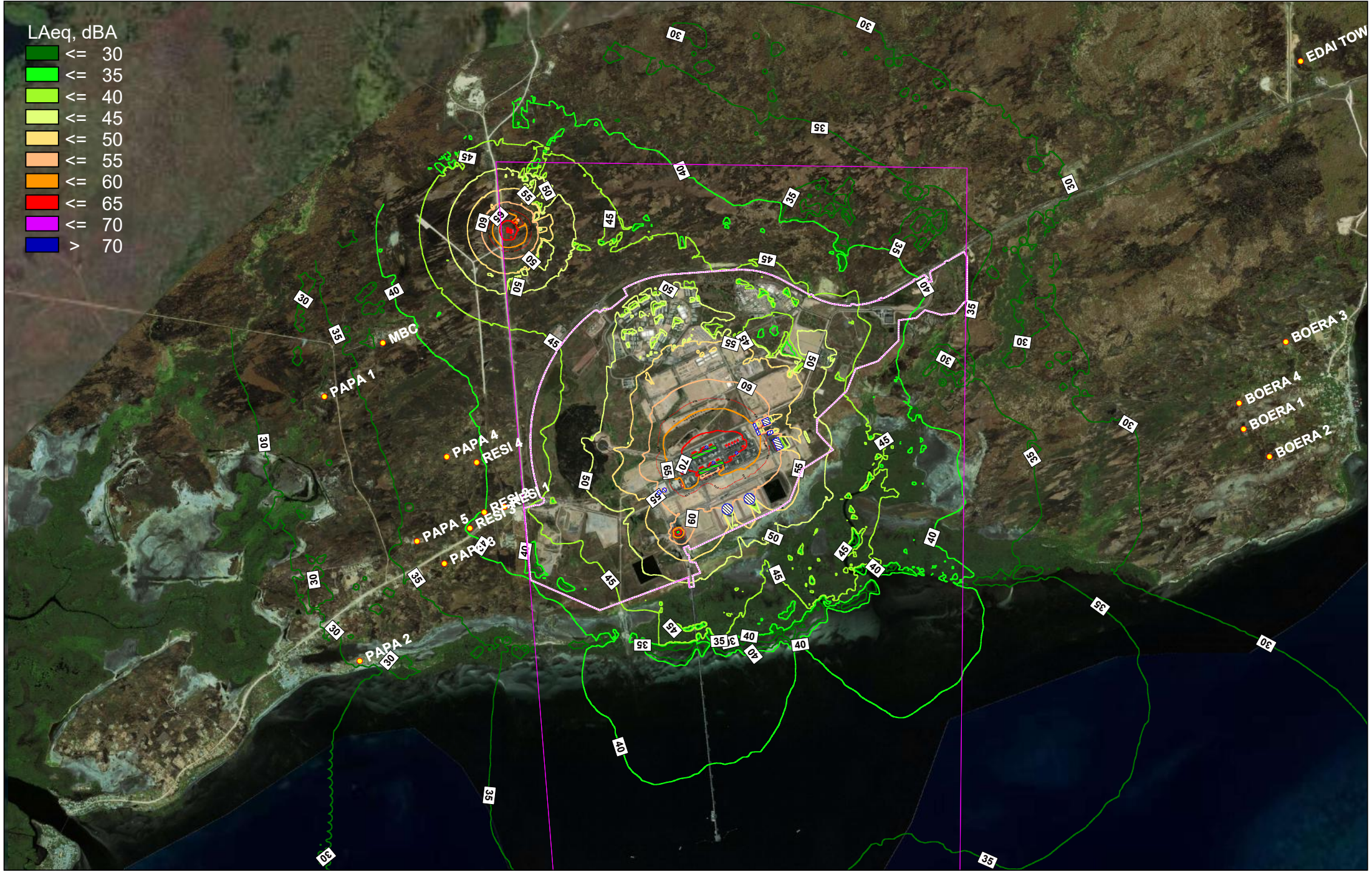
Prediction Height: 1.8 m

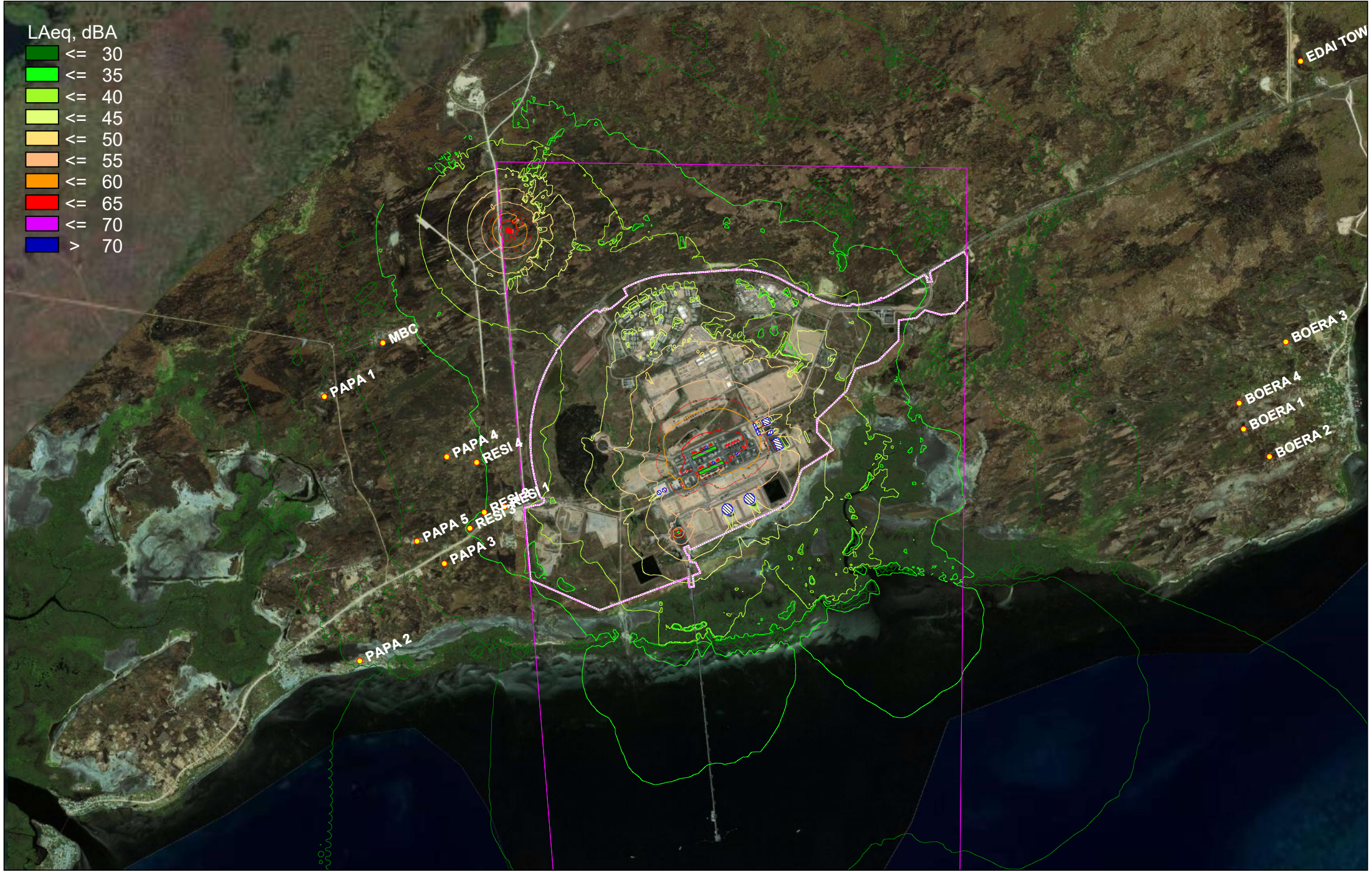
**APPENDIX
F**

**MAP NO.
2**











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QLD 4000
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SCALE : 30000
0 125 250 500 750 1000 1250
m

ORIENTATION



LEGEND

- Point source
- Line source
- Building
- Lease boundary
- Security fence
- Sensitive receptor
- 45 dBA Criteria Line
- Area source

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O4 - New trains (Normal Operation)
Prevailing Weather Conditions

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v1.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

APPENDIX
F

MAP NO.
7

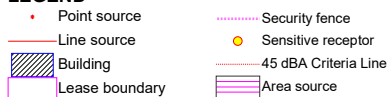


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LEGEND



PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O5 - New Trains Upset (dry flare + gensets)
Prevailing Weather Condition

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
F**

**MAP NO.
9**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O5 - New Trains Upset (dry flare + gensets)
Adverse Noise Propagation Condition

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
F**

**MAP NO.
10**



LEGEND

- | | |
|------------------|------------------------|
| • Point source | Security fence |
| — Line source | • Sensitive receptor |
| ▨ Building | — 45 dBA Criteria Line |
| ▭ Lease boundary | ▨ Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O6 - Train 1-2 + New Trains + 58MW power plant
Prevailing Weather Condition

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height:1.8 m

**APPENDIX
F**

**MAP NO.
11**



LEGEND

- | | |
|----------------|----------------------|
| Point source | Security fence |
| Line source | Sensitive receptor |
| Building | 45 dBA Criteria Line |
| Lease boundary | Area source |

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O6 - Train 1-2 + New Trains + 58MW power plant
Adverse Noise Propagation Condition

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

**APPENDIX
F**

**MAP NO.
12**



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SCALE : 30000
0 125 250 500 750 1000 1250
m

ORIENTATION



LEGEND

- Point source
- Line source
- Building
- Lease boundary
- Security fence
- Sensitive receptor
- 45 dBA Criteria Line
- Area source

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O7 - Train 1-2 (Normal) + New Trains (Upset) + 58MW Power Plant - Prevailing Weather Condition

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

APPENDIX
F

MAP NO.
13



LEGEND

- Point source
- Line source
- Building
- Lease boundary
- Security fence
- Sensitive receptor
- 45 dBA Criteria Line
- Area source

PROJECT PAPUA LNG PROJECT DOWNSTREAM

CLIENT Tetra Tech Coffey

DESCRIPTION O7 - Train 1-2 (Normal) + New Trains (Upset) + 58MW Power Plant - Adverse Noise Propagation Condition

Date: 22-May-2023

Project No.: 620.31072.00300

Report No.: 620.31072.00300-R01-v4.0

Prediction Method: CONCAWE

Prepared By: Rodrigo Olavarria

Prediction Height: 1.8 m

APPENDIX
F

MAP NO.
14

ASIA PACIFIC OFFICES

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