

Jet Zero™



NOISE AND VIBRATION ASSESSMENT



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Project Ulysses

Noise and Vibration Assessment

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Executive Summary

Vipac Engineers and Scientists Ltd was engaged to prepare a noise and vibration impact assessment to support a development application for the construction and operation of the Jet Zero 'Project Ulysses' sustainable aviation fuel (SAF) production facility to be located within the Cleveland Bay Industrial Park, Townsville, Queensland.

The purpose of this assessment is to evaluate the potential impacts of noise and vibration generated by the project and to provide recommendations to mitigate any potential impacts onto sensitive receptors.

Background noise monitoring was conducted across multiple locations surrounding the project to establish existing background noise levels in the absence of the development. The noise monitoring data was then utilised to establish the appropriate assessment criteria.

Noise modelling has been undertaken using the SoundPLAN 8.2 computational noise modelling software package for two scenarios:

- Construction of the project, and
- 24-hour operation once commissioned.

Based on the information provided and the assumptions detailed throughout this report, noise and vibration emissions have been calculated and are generally predicted to comply at all receptors during both neutral and adverse weather conditions.

Noise levels have also been predicted at the property boundary in each direction to provide an indication of potential impacts on surrounding livestock and wildlife. Refer to Section 9 for an indicative summary on impacts on fauna.

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1 Introduction

1.1 Overview

Project Ulysses (the Project) is being developed by Jet Zero Australia Pty Ltd (Jet Zero), with the aim to construct Australia's first Alcohol-To-Jet (ATJ) plant converting ethanol feedstock into Sustainable Aviation Fuel (SAF) at Townsville, Queensland. The Project includes a plant to convert ethanol derived from sustainably certified feedstocks such as agricultural byproducts including waste wheat starch, to SAF and Renewable Diesel (RD) using the LanzaJet ATJ Process. The plant will have a capacity to process a nominal 183 million litres-per-year (MLPY) of ethanol into 100MLPY of SAF and 11MLPY of RD as the primary case.

1.2 References

This assessment is based on the following:

- QLD Noise Measurement Manual v4.01(DESI 2020).
- QLD Noise and Vibration – EIS Information Guideline v1.03 (DESI 2024).
- AS1055:2018 – Acoustics – Description and measurement of environmental noise.
- EPP (Noise) 2019.
- EP Act 1994.
- Application requirements for activities with noise impacts (DESI, 2021).
- Qld Department of Transport and Main Roads - Transport Noise Management Code of Practice Volume 2 – Construction Noise and Vibration.
- AS 2436:2010 – Guide to noise and vibration control on construction, demolition and maintenance sites.
- Ecoaccess Guideline for the Assessment of Low Frequency Noise.
- BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration.
- BS 5228-2:2009 – Code of practice for noise and vibration control on construction and open sites.

2 Project Context

2.1 Site Description

The project is to be located on Lot 35 on SP341877 within Stage 3 (area 35) of the Cleveland Bay Industrial Park (CBIP) of the Townsville State Development Area (SDA) Development Scheme, which is facilitated by the Coordinator General (CG), an Agency of the Queensland Government.

The site is currently zoned High Impact Industry and Environmental Management in accordance with the Townsville SDA Development Scheme.

The project will receive feedstock including the following:

- Ethanol feedstock derived from byproducts such as waste wheat starch, will be sourced for conversion to SAF and RD.
- The expectation is that all feedstock ethanol will be sourced from an existing Australian ethanol supplier. International import is being secured as a back-up in case of operational issues and contingency.

Resulting in the following plant production:

- Sustainable Aviation Fuel (SAF): 100 ML per year.
- Renewable Diesel (RD): 11 ML per year.
- Plant feedstock of 144,700 tonnes/183 ML of anhydrous ethanol per year.

To facilitate the production of SAF, ethanol will be received via ship at the Port of Townsville and transported to site via B-doubles. SAF will then be transported from site via trucks (B-doubles) to local airports or to the Port for export. Access to the facility will be via future access roads via Ron McLean Drive.

Site elevation varies between approximately 2 and 5m AHD, and topographical conditions extending to the nearest sensitive receptors ranging from approximately 1m to 12m. There are no significant changes in terrain between the site and the receptors, with the terrain gently undulating throughout the surrounding areas.

2.2 Proposed Facilities and Infrastructure

The core infrastructure footprint includes the following:

- The facility site,
- Access roads,
- Wastewater pipeline, and
- Water supply pipeline.

The facility will incorporate the following key infrastructure:

- Eastern portion:
 - Laydown area.
- Central portion:
 - Process unit and flare.
 - Utility unit (storage tanks, pumps and boilers).
 - Storage unit (ethanol, paraffin and SAF bulk).
 - Administration unit (laboratory, process control room, warehouse workshop, security gatehouse, administration building and parking area).
 - Industrial and general site entrances from the south.
 - Two emergency exits from the south.
- Western portion:
 - Hydrogen unit and caustic basin.
 - Truck loading unit.
 - Substation and electrical cable trench.
 - Clean wastewater channel.
 - Contaminated water basin.
 - One emergency exist/fire control access (south).

Figure 2-1 shows the current conceptual site plan.

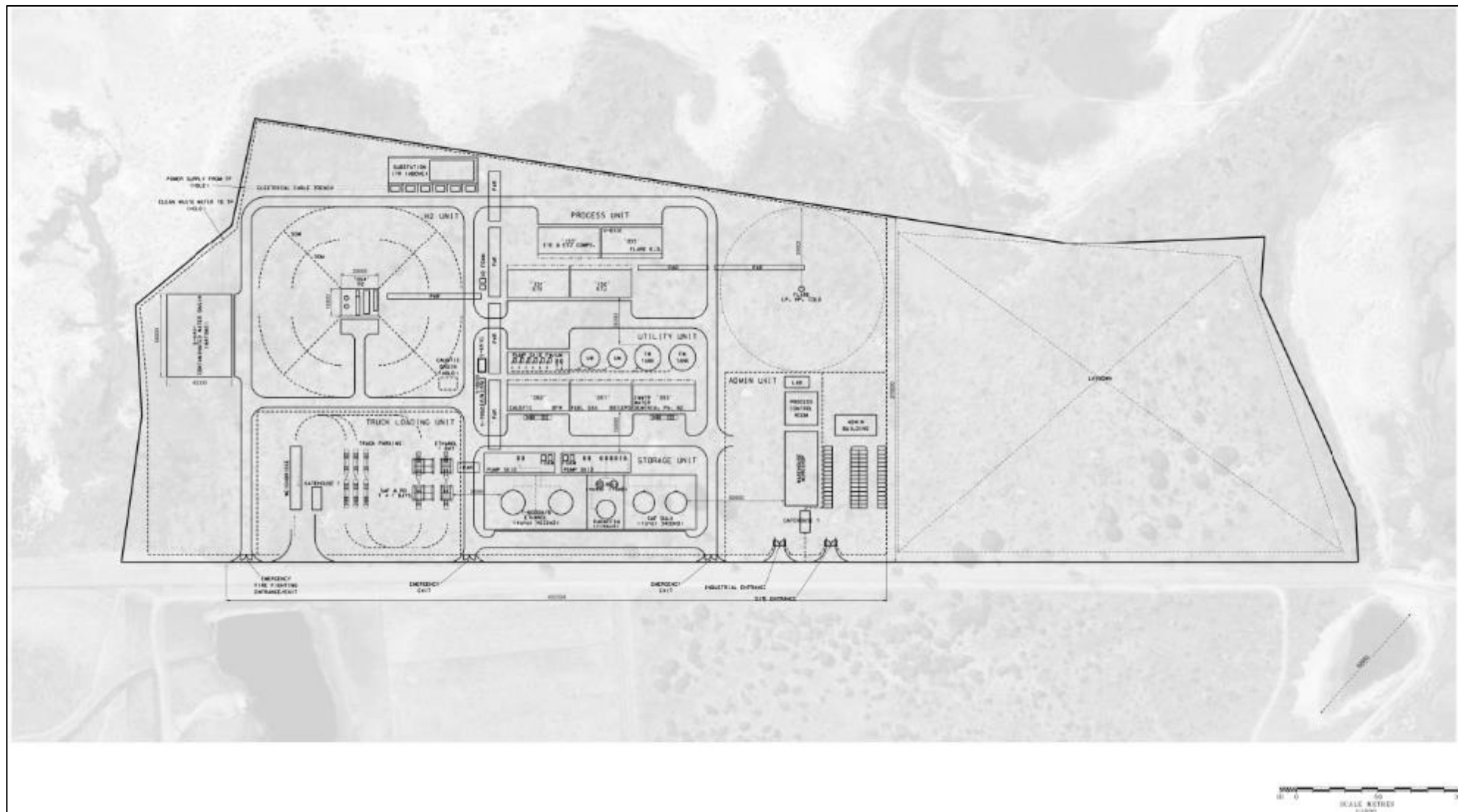


Figure 2-1 - Concept Site Plan

2.3 Site Location

Figure 2-2 shows the site location in relation to Townsville and surrounds.



Figure 2-2 - Site Location and Transport Route to Port of Townsville and Bruce Highway

2.4 Noise Sensitive Receptors

The locations of the nearest potentially affected noise sensitive receptor to the project are shown in Figure 2-3.

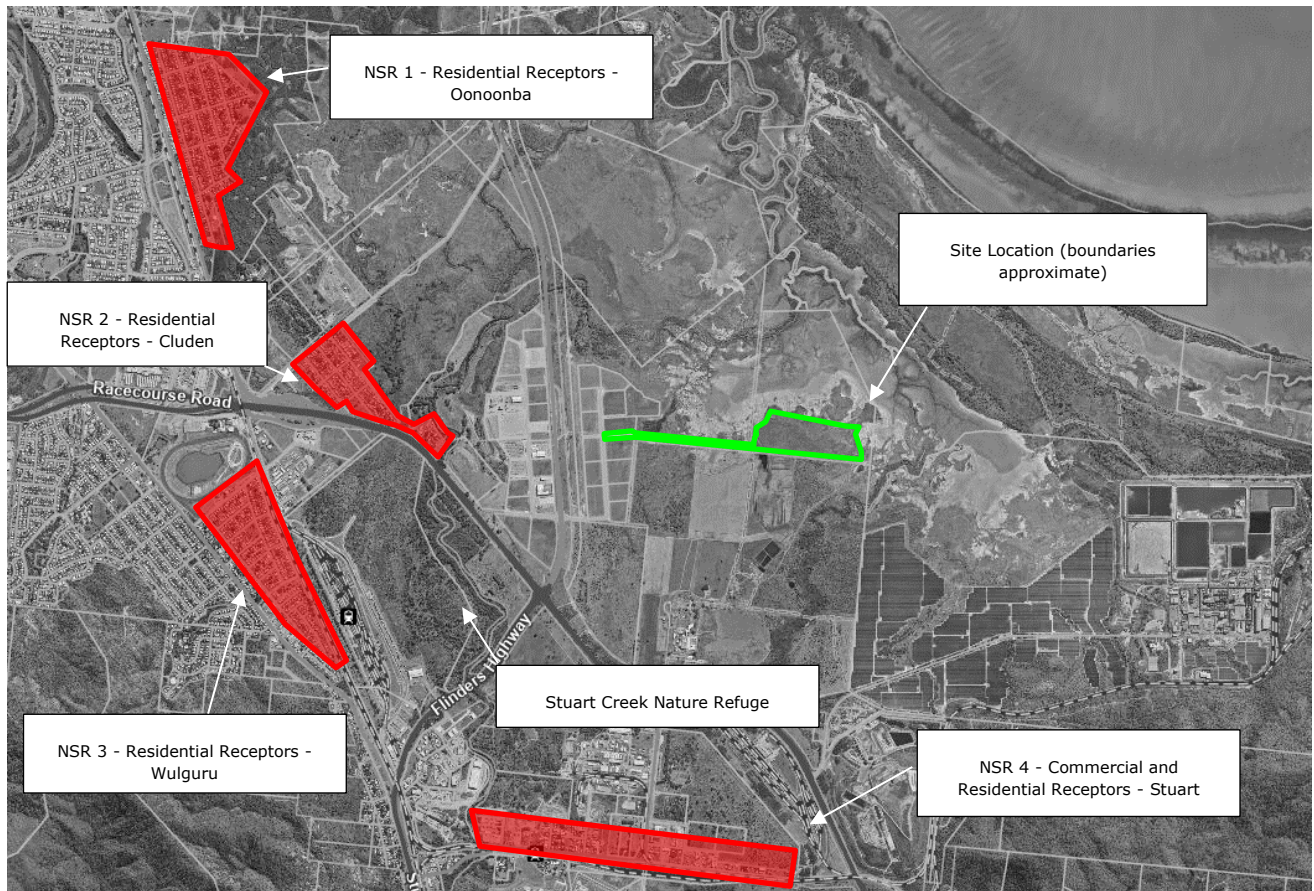


Figure 2-3 - Site Location and Nearest Sensitive Receptors

Considering the significant distances separating the site and the nearest receptors, receptors have been grouped into their associated suburbs/localities:

- NSR 1 – Oonoonba. Closest receptors approximately 4.2km from nearest site boundary.
- NSR 2 – Cluden. Closest receptors (Big 4 Holiday Park) approximately 2.2km from nearest site boundary.
- NSR 3 – Wulguru. Closest receptors approximately 3.5km from nearest site boundary.
- NSR 4 – Stuart. Closest receptors approximately 3.0km from nearest site boundary.

The following ecological areas (environmentally sensitive receptors) are also considered within this assessment:

- Wildlife adjacent the Project site.
- Wildlife within the Stuart Creek Nature Refuge, approximately 2.1km from the nearest site boundary.

There are no sensitive receptors located to the east within 5km of the site. If compliance can be demonstrated at the NSR locations above, then all other receptors at greater distances are expected to comply due to greater distance attenuation.

3 Existing Noise Environment

3.1 Noise Monitoring

Environmental noise monitoring took place at a total of five (5) locations within each residential area identified in Figure 2-3, including one on site. Noise monitoring was also conducted at a location on site to gauge influence on any existing industrial noise within the vicinity to provide potential insight for the cumulative noise impact.

Noise monitoring locations were selected based on establishing conservative scenarios within each area. For example, specific monitoring locations within each area were chosen to avoid significant influence of dominating noise sources such as road/rail traffic and industrial noise, when it is more than likely that the majority of sensitive receptors within the locality are unlikely to experience the same influence. Consequently, noise monitoring locations were selected to be as far as possible from any of these potential noise sources that would dominate the background noise environment, but the final specific addresses chosen were limited to resident availability and security of the monitoring equipment.

Noise monitoring was conducted between the 16th and 24th of October (inclusive), 2024 at the locations detailed in Figure 3-1 to Figure 3-5. The noise loggers were configured to measure instantaneous broadband and 1/3 octave band noise levels with a 'Fast' time weighting and 'A' frequency weighting over 15-minute intervals in accordance with the 'Noise and vibration – EIS information guideline' v1.03 (DESI 2024). A field reference check was conducted for each microphone immediately before and after the measurement sequence and the microphones were appropriately fitted with a windshield. Microphones were approximately 1.5m above ground level. Measurements were conducted in general accordance with AS1055 Acoustics - Description and Measurement of Environmental Noise.

Weather data during the monitoring period was obtained from the closest Bureau of Meteorology weather station 'Townsville AERO BOM Station' (Station ID: 032040). No significant rainfall was recorded during the monitoring period; however, wind speeds occasionally exceeded the Qld Noise Measurement Manual, 2020 limit guide of 5m/s. For the purposes of a conservative assessment, where wind speeds exceeded this limit, noise data captured in these periods has been excluded across all monitoring sites and is represented as '/' in the tabulated data.

Table 3-1: Equipment List

Instrument	Location	Approximate Logger Coordinates	Serial Number	Calibration Due Date
Norsonic NOR139 Class1 Sound Level Meter/Logger	Logger/NSR 1: 10 Jordan Street, Oonoonba	55481385E, 7866310S	1392998	15/05/2026
Norsonic NOR140 Class1 Sound Level Meter/Logger	Logger/NSR 2: 18 Mineham Street, Cluden	55482299E, 7864421S	1404703	08/03/2026
Norsonic NOR139 Class1 Sound Level Meter/Logger	Logger/NSR 3: 6 Powell Street, Wulguru	55480876E, 7863000S	1393030	27/01/2025
Norsonic NOR139 Class1 Sound Level Meter/Logger	Logger/NSR 4: 6-8 Boyne Street, Stuart	55483902E, 7860919S	1393022	05/09/2026
Norsonic NOR139 Class1 Sound Level Meter/Logger	Logger 5: Project Site	55485703E, 7863621S	1392780	26/04/2026
Brüel & Kjær 2270 Class 1 Sound Level Meter	All	Attended Measurements	3028505	27/09/2025
ONO SOKKI SC-2120 Acoustic Calibrator	-		35100926	21/11/2024

All equipment was calibrated by a NATA accredited laboratory. Refer to Appendix H for current calibration certificates of all applicable equipment.

The following sections present descriptions of the existing noise environment and summaries of the current noise levels at all monitoring locations.

3.2 Logger Location 1 - Oonoonba



Figure 3-1 - Noise Monitoring Location 1

Table 3-2 - Attended Measurement Summary - Logger Location 1

Date and Time	L _{Aeq}	L _{AMax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	Measurement Notes
16/10, 16:37	49	74	34	59	51	38	Wind in vegetation and bird activity in trees dominating background noise. No observable noise from traffic or industry within surrounding environment. Single train horn observed once.

Table 3-3 - Unattended Measurement Summary - Logger Location 1

Dates	L _{Aeq} , dB(A)			L _{A10} , dB(A)			L _{A90} , dB(A)			ABL, dB(A)		
	Day	Eve.	Night	Day	Eve.	Night	Day	Eve.	Night	Day	Eve.	Night
16/10	/	41	45	/	40	46	/	37	38	/	/	36
17/10	54	40	45	57	41	45	42	37	38	37	/	36
18/10	56	41	45	60	41	45	42	37	38	/	36	36
19/10	49	41	47	51	42	48	37	38	38	36	36	36
20/10	50	41	45	52	42	45	38	38	38	35	/	35
21/10	52	/	46	55	/	47	40	/	38	36	/	36
22/10	56	38	43	58	39	43	39	36	38	/	35	36
23/10	61	43	41	52	42	42	39	37	37	38	36	36
24/10	48	/	/	49	/	/	38	/	/	/	/	/
Log Average	55	41	45	56	41	45	40	37	38			
Rating Background Level										36	36	36

3.3 Logger Location 2 – Cluden



Figure 3-2 - Noise Monitoring Location 2

Table 3-4 - Attended Measurement Summary - Logger Location 2

Date and Time	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	Measurement Notes
16/10, 17:14	47	66	38	57	50	42	Distant traffic noise and infrequent industrial noise potentially from heavy vehicle gravel unloading at Roadtek to the south. Both potentially impacted by wind speed and direction as levels would occasionally surge.

Table 3-5 - Unattended Measurement Summary - Logger Location 2

Dates	Leq			L10			L90			ABL		
	D	E	N	D	E	N	D	E	N	D	E	N
16/10	49	42	46	47	41	48	40	38	42	/	/	34
17/10	42	40	46	44	43	50	38	37	39	37	/	34
18/10	41	42	44	42	43	46	36	39	36	/	36	32
19/10	44	43	44	45	44	46	35	39	35	32	35	29
20/10	44	44	44	43	47	47	34	39	39	31	/	32
21/10	45	/	44	46	/	47	37	/	39	34	/	34
22/10	41	42	45	42	41	49	34	37	38	/	35	33
23/10	57	46	42	47	48	43	38	43	35	37	37	34
24/10	42	-	-	44	-	-	36	-	-	-	-	-
Log Average	49	43	45	45	45	47	37	39	38			
RBL										34	36	33

3.4 Logger Location 3 – Wulguru



Figure 3-3 - Noise Monitoring Location 3

Table 3-6 - Attended Measurement Summary - Logger Location 3

Date and Time	L _{Aeq}	L _{AMax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	Measurement Notes
16/10, 16:37	49	74	34	59	51	38	Distant traffic noise from Stuart Drive dominant background. Bird noise frequent, wind in trees, occasional dog barking, relatively typical suburban environment.

Table 3-7 - Unattended Measurement Summary - Logger Location 3

Dates	Leq			L10			L90			ABL		
	D	E	N	D	E	N	D	E	N	D	E	N
16/10	/	38	/	/	40	/	/	34	/	/	/	/
17/10	50	39	42	48	41	42	39	35	33	37	/	29
18/10	57	58	/	53	59	/	37	53	/	/	33	/
19/10	51	52	44	50	54	48	40	38	35	35	33	31
20/10	49	54	/	49	58	/	37	39	/	34	/	/
21/10	49	/	42	50	/	44	39	/	35	37	/	30
22/10	52	58	44	47	59	49	39	53	35	/	36	31
23/10	58	55	44	52	57	47	40	50	37	38	36	32
24/10	52	/	/	49	/	/	40	/	/	38	/	/
Log Average	54	54	43	50	56	47	39	49	35			
RBL										37	35	31

3.5 Logger Location 4 – Stuart



Figure 3-4 - Noise Monitoring Location 4

Table 3-8 - Attended Measurement Summary - Logger Location 4

Date and Time	L _{Aeq}	L _{AMax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	Measurement Notes
16/10, 15:00	52	66	46	62	53	48	Distant industrial noise from refinery to the north dominating background levels. Wind in trees also prevalent, birds in trees chirping. No audible noise from activity on site (no activity on site during attendance)

Table 3-9 - Unattended Measurement Summary - Logger Location 4

Dates	Leq			L10			L90			ABL		
	D	E	N	D	E	N	D	E	N	D	E	N
16/10	59	42	/	62	43	/	48	38	/	/	/	/
17/10	53	50	49	54	49	53	46	42	42	43	/	39
18/10	52	45	/	54	45	/	41	40	/	/	39	/
19/10	52	46	/	53	48	/	41	42	/	40	39	/
20/10	53	48	49	55	46	52	42	42	41	39	/	38
21/10	55	/	51	58	/	55	44	/	42	42	/	38
22/10	53	46	/	56	47	/	45	42	/	/	41	/
23/10	52	49	/	51	51	/	46	45	/	45	42	/
24/10	54			57			46			45		
Log Average	54	47	50	57	48	53	45	42	42			
RBL										43	40	38

3.6 Logger Location 5 – Project Site



Figure 3-5 - Noise Monitoring Location 5

Table 3-10 - Attended Measurement Summary - Logger Location 5

Date and Time	L _{Aeq}	L _{AMax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	Measurement Notes
17/10, 09:19	38	62	27	49	39	29	Quiet. Distant industry noise from Townsville dump and/or Sun Metals. Dominant background when wind coming from that direction (east/southeast). Wind in vegetation dominant all other times. Very quiet in general.

Table 3-11 - Unattended Measurement Summary - Logger Location 5

Dates	Leq			L10			L90			ABL		
	D	E	N	D	E	N	D	E	N	D	E	N
17/10	37	47	44	41	49	43	30	45	35	/	/	/
18/10*	/	47	42	/	48	40	/	44	32	/	35	29
19/10	42	47	41	40	48	40	31	44	31	27	28	29
20/10	44	49	48	44	50	47	35	46	42	26	/	27
21/10	38	/	48	40	/	41	30	/	32	28	/	29
22/10	36	50	43	37	49	44	29	45	39	/	37	29
23/10	48	47	60	50	49	45	37	44	39	34	31	30
24/10	42	-	-	43	-	-	32	-	-	-	-	-
Log Average	47	48	52	46	49	44	36	44	38			
RBL										28	31	29

*Noise monitor malfunction resulted in data loss between 00:00 and 16:30 on 18/10.

3.7 Noise Measurement Summary

Overall observations and analysis of unattended measurements indicate background noise levels are typical of each environment the noise monitoring devices were located in.

A notable observation was the presence of seasonal influence identified in the data captured at the Project Site. Measurement results indicate an increase in noise levels, specifically at 4kHz, from approximately 6:30pm until 10:30pm on most days. This increase was likely caused by the presence of cicadas at this time of year.

Further inspection of the data captured at all other sites to determine the influence of insect noise around the same time of day was required.

Results indicate the noise monitor in Cluden was the only site to potentially have been impacted by insect noise in the evening period, resulting in a slightly higher average L_{90} in the evening period compared to the day and night periods.

Note – the high evening L_{90} observed in Wulguru does not show any increase in noise levels around 4kHz and is expected to be attributed to a regulated device occurring at certain times of the evening period.

To avoid the influence of seasonal variation on background noise levels, criteria establishment should take into consideration the most stringent time of day for each location and utilise the most stringent results for determination of compliance (e.g. the evening period at Cluden should not be utilised when selecting the most stringent background levels when setting criteria).

4 Regulatory Framework

4.1 Noise

4.1.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is the principle environmental legislative instrument in Queensland. The EP Act provides the legislative framework for the assessment and management of environmental noise emissions in the State. It has the objective of regulating activities conducted in the State of Queensland and minimising environmental harm and nuisance from such activities. Section 319 states that "A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm." This is known as the General Environmental Duty. Compliance with subordinate legislation and guidelines is generally accepted as proof of compliance with this General Environmental Duty.

The EP Act does not directly provide any specific noise or vibration criteria specific to this Project.

Noise criteria is also obtained from the *Environmental Protection Regulation 2019* (EP Regulation), and through appropriate departmental guidelines or the application of objectives contained within the Environmental Protection (Noise) Policy 2019 (EPP Noise).

4.1.2 Environmental Protection Regulation 2019

The EP regulation in Queensland serves as subordinate legislation under the EP Act 1994. The EP regulation provides details to support the implementation of the overarching objectives of the Act.

EP Regulation's objective is to facilitate the effective management of potential environmental impacts associated with ERAs and other activities which may have the potential to cause 'environmental harm'. The EP regulation details the requirements for obtaining environmental approvals (EAs) and provides rules and criteria for conducting these activities in a manner that minimises environmental harm.

The Environmental Objectives and Performance Outcomes outlined in Division 1, Part 3 of the EP Regulation states for operational assessment of noise, the environmental objective is:

- The activity will be operated in a way that protects the environmental values of the acoustic environment.

This includes the following performance outcomes:

1. Sound from the activity is not audible at a sensitive receptor.
2. The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

4.1.3 Environmental Protection (Noise) Policy 2019

The purpose of the EPP Noise is to achieve the objective of the Act in relation to the acoustic environment. This policy provides specific noise levels which, if complied with, would be considered achieving the objective of the EP Act, namely, to not cause environmental nuisance or harm.

EPP Noise identifies the environmental values to be enhanced or protected relating to the qualities of the acoustic environment that are conducive to:

- Protecting the health and biodiversity of ecosystems,
- Human health and wellbeing,
- Protecting the amenity of the community.

The policy defines the following as noise sensitive receptors:

- Residence,
- Library and educational institution (including a school, college and university),
- Childcare centre or kindergarten,
- School or playground,
- Hospital, surgery or other medical institution,
- Commercial and retail activity,
- Protected area or critical area,
- Marine park,

- Park or garden that is open to the public (whether or not on payment of an amount) for use other than for sport or organised entertainment.

The acoustic quality objectives (AQO) are a measurement of an acoustic descriptor at a sensitive receptor. Table 4-1 details the acoustic quality objectives for each type of sensitive receptor. Time periods are defined as follows:

- Day – 7am to 6pm
- Evening – 6pm to 10pm
- Night – 10pm to 7am.

Table 4-1 - EPP (Noise) 2019 - Acoustic Quality Objectives

Receptor	Location	Time of Day	Acoustic Quality Objectives (measured at receptor)		
			L _{Aeq,adj,1hr}	L _{A10,adj,1hr}	L _{A1,adj,1hr}
Residence	Outdoors	Day and Evening	50	55	65
	Indoors		35	40	45
			Night	30	35
Library and educational institution (including a school, college and university)	Indoors	When open for business or when classes are being offered	35	-	
Childcare centre or Kindergarten	Indoors	When open for business other than when the children usually sleep	35		
		When the children usually sleep	30		
School or playground	Outdoors	When the children usually play outside	55		
Hospital, surgery or other medical institution	Indoors	Visiting hours	35		
	Indoors	Anytime, other than visiting hours	30		
Commercial and retail activity	Indoors	When the activity is open for business	45		
Protected area or critical area	-	Anytime	The level of noise that preserves the amenity of the existing area or place		
Marine Park		Anytime	The level of noise that preserves the amenity of the existing marine park		
Park or garden that is open to the public (whether or not on payment of an amount) for use other than for sport or organised entertainment		Anytime	The level of noise that preserves the amenity of the existing garden or park		

4.1.3.1 EPP (Noise) Background Creep

EPP Noise states in Section 9.2.b that background creep, for noise in an area or place is defined as a gradual increase in the total amount of background noise in the area or place as measured under the Noise Measurement Manual. While EPP 2019 does not explicitly state Background Creep criteria, EPP Noise 2008 will be referred to, which states the following:

Noise from an activity must not be:

- For noise that is continuous noise, measured by $L_{A90,T}$, more than nil dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$; or
- For noise that varies over time, measured by $L_{Aeq,adj,T}$, more than 5dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$.

Note – the time period (T) is considered to be a time interval of at least 15 minutes, or if the noise continues for less than 15 minutes, the duration of the noise source (in accordance with the Environmental Protection Regulation 2008).

4.2 Low Frequency Noise

4.2.1 Queensland Noise Measurement Manual v4.01, 2020

The Noise Measurement Manual defines low frequency noise as the following:

- Noise that has a dominant content less than 200Hz. Noises below 20Hz are known as infrasound and are usually not audible but rather felt as a vibration, pulsating sensation or pressure on the ears or chest. Types of activities that may produce low frequency noise include pumps, fans, boilers, ventilation plant, electrical installations and wind turbines.

The Noise Measurement Manual does not provide any criteria for low frequency noise. Recognised noise criteria for low frequency noise are provided in the withdrawn Queensland Ecoaccess Guideline:

- Low frequency noise below 200Hz emitted from mining or processing operation must not exceed the following:
 - 50dB(Z) measured inside a sensitive receptor or commercial plant; and
 - The difference between the internal A-weighted and Z-weighted noise levels is no greater than 15dB.

4.3 Construction Noise and Vibration

4.3.1 Noise

There is no specific construction noise and vibration criteria stated in the EP Act or any subordinate legislation documentation that is considered appropriate as a benchmark for this Project.

In the absence of appropriate criteria, the available criteria with the Queensland Government 'Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration' (CoP May 2023) is considered an acceptable alternative and will be used to assess noise and vibration from construction associated with the Project.

Table 4-2 below details the 'standard' and 'non-standard' hours for construction activities

Table 4-2 - Construction Hours

Work Period	General Construction	Blasting
Standard hours	Monday to Friday 7am to 6pm Saturday 8am to 1pm	Monday to Friday 9am to 3pm Saturday 9am to 1pm
Non-Standard hours – day/evening	Monday to Friday 6pm to 10pm Saturday 7am to 8am, 1pm to 10pm	Generally, blasting is not to be conducted outside Standard hours.
Non-Standard hours - night	Monday to Sunday 10pm to 7am	Any blasting outside of Standard hours must be approved by the department's project manager prior to blasting. It is noted that reduced limits may be required to be achieved outside of Standard hours.

The TMR CoP stipulates that construction activities (including blasting) should be generally undertaken within the 'standard' hours. Given blasting is not proposed for this project, it is not discussed further. Construction activities with the potential for significant impacts should be discouraged during nighttime. The use of high impact machinery such as pile driving, vibratory rollers and impact devices (rock breakers and jackhammers) should be avoided where possible for night work construction in residential or other noise and vibration sensitive areas. Where night work is required in the vicinity of residential or other sensitive sites, careful planning is required and a higher level of control is recommended, to mitigate potential complaints of sleep disturbance. However, it is noted that the closest sensitive receptors to the project are primarily future commercial/industrial land, which are not expected to be in use or occupied during nighttime hours. Additionally, the nearest residential receptors are more than two kilometres from the project site.

Table 3.2.1.1(a) in the CoP stipulates the external construction noise criteria for construction activities, reproduced in Table 4-3 below. The Rating Background Level is denoted by RBL.

Table 4-3 - Construction Noise Criteria

Work Period		External Noise Level $L_{Aeq,adj,15\text{ minute}}^{4,5}$, dB(A)	
		Lower Limit	Upper Limit
Standard Hours	Monday to Friday 7am to 6pm	RBL + 10 ^{1,2,3}	75 Where: RBL >55
	Saturday 8am to 1pm		70 Where: 40 < RBL ≤ 55
			65 Where: RBL ≤ 40
Non-Standard hours – day/evening	Monday to Friday 6pm to 10pm Saturday 7am to 8am, 1pm to 10pm	RBL+5 ³	
Non-Standard hours - night	Monday to Sunday 10pm to 7am		

Notes:

[1] RBL + 5 dB(A) should be considered where a facility, equipment and long-term earthworks are required in an area for greater than six months. Where this occurs, the minimum lower limit is 45 dB(A) for Standard hours.

[2] Where the lower limit value exceeds the upper limit value, the lower limit is taken to equal the upper limit value.

[3] Minimum lower limit is 50 dB(A) for Standard hours and 45 dB(A) for Non-Standard hours. A maximum lower limit of 75 dB(A) applies to Non-Standard hours.

[4] Noise contribution from construction activity determined as the component level (that is, noise from construction activity only)

[5] The noise level from construction includes adjustment factors from Table 2.1.2.1(b) (for example, low frequency noise, impulsivity, tonality, intermittency and modulation).

4.3.2 Vibration – Human Comfort

The appropriate vibration criteria for human comfort are stipulated in Table 3.3.1.1(a) of the CoP and are reproduced in Table 4-4.

Table 4-4 - Human Comfort Vibration Criteria

Location	Work Period	Resultant PPV, mm/s	
		Lower limit	Upper limit
Accommodation activity (including hotels or other premises which provides accommodation to the public)	Standard hours	1.0	2.0
	Non-standard hours – day/evening	0.3	1.0
	Non-standard hours - night		
Hospital and health care services (wards, surgeries, operating theatres, consulting rooms)	All	0.3	1.0
Educational establishment (rooms designated for teaching/research purposes) & childcare centres	While in Use		
Court of Law (court rooms)			

Location	Work Period	Resultant PPV, mm/s	
		Lower limit	Upper limit
Court of Law (Court reporting and transcript areas, Judges' chambers)			
Community use & place of worship		1.0	2.0
Commercial (offices) and retail facility			

4.3.3 Vibration – Building Damage

Vibration levels for potential building damage contained in British Standard BS 7385-2:1993 *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration* are referenced in British Standard BS 5228-2:2009 and Australian Standard AS 2187.2:2006. The vibration levels in BS 7385-2:1993 are adopted as building damage criteria from construction activities in the CoP and are reproduced in Table 4-5.

Table 4-5 - Building Damage Vibration Criteria

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4Hz-15Hz	15Hz and above
1	Reinforced or framed structures, Industrial and heavy commercial buildings	50mm/s at 4Hz and above	-
2	Unreinforced or light framed structure. Residential or light commercial type buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

Notes:

1 – Values referred to are at the base of the building.

2 – For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded.

4.4 Project Specific Noise Criteria

Based on previous experience in the assessment of industrial noise emissions, the L_{Aeq} acoustic quality objectives are often the most stringent compared to L_{A10} and L_{A1} given the expected nature of the noise emissions from the site, which is expected to be dominated by steady state noise sources such as pumps, fans, cooling towers, generators etc. Noise emissions as a result are expected to lack characteristics that would cause the L_{A10} and L_{A1} descriptors of the noise sources to be more than 5dB(A) above the L_{Aeq} as an L_{A10} , and more than 10dB(A) as an L_{A1} .

Consequently, for the purposes of the assessment against the Acoustic Quality Objectives, the assessment will focus on predicting compliance against the L_{Aeq} criteria, and should compliance be predicted with the L_{Aeq} criteria, compliance with the L_{A10} and L_{A1} values is expected as a result.

Table 4-6 details the project specific criteria for the closest residential and commercial receptors to the project site. Criteria based on background noise levels (Background Creep and Construction) have been established on the lowest average L_{A90} /RBL of any day period (i.e. periods of the day where background noise levels have been influenced by seasonal variation (insect noise during the evening at Cluden) or extraneous regulated devices (during the evening at Wulguru) have not been utilised).

In general, the quietest times of the day at all locations were the night period. Given the project intends to operate 24 hours a day, the nighttime noise levels have been used to establish the criteria (unless stated otherwise) as this will stipulate the most stringent criteria for a worst-case assessment.

Table 4-6 - Project Specific Noise Criteria

Receptor	Criteria						Low Frequency
	EPP AQO*, L _{Aeq} , dB(A)	Background Creep, L _{Aeq} , dB(A)		Construction, LAeq, dB(A)			
		Night	Time Varying	Steady State	Standard Hours		
Lower Limit	Upper Limit						
NSR 1 – Ooonoonba	35	42	37 ¹	46	65	41	50dB(Z), dB(Z) – dB(A) = ≤15
NSR 2 – Cluden	30**	42	37 ²	44	65	38	
NSR 3 – Wulguru	35	40	35 ³	47	65	36	
NSR 4 – Stuart	35	47	42 ³	53	70	43	

*A correction of +5dB(A) has been added to the nighttime criteria of 30dB(A) to convert the criteria from an internal criteria to an external criteria. 5dB(A) is a conservative assumption of the expected performance of a dwelling façade/transmission through an open window.

**The Cluden area includes the Townsville Big4 Holiday Park which provides for short term accommodation, including tent camping. For the purposes of a conservative assessment, no 'inside to outside' transmission loss correction has been applied for this receptor for the purposes of a conservative assessment.

¹Based on the overall 'Evening' L90.

²Based on the overall 'Daytime' L90.

³Based on the overall 'Nighttime' L90.

5 Noise Modelling

Noise level predictions were carried out using the SoundPLAN v8.2 noise modelling software and the CONCAWE algorithm (Manning, 1981) noise prediction methodology. The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes in the United Kingdom. It is especially suited to predicting noise propagation over large distances as it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

The prediction of noise in the environment requires the definition of the noise sources and sensitive receptors. Several environmental parameters affect noise propagation, including:

- Geometric spreading,
- Obstacles such as enclosures, barriers, and buildings,
- Meteorological conditions such as air absorption, wind effects, temperature gradient effects, and
- Ground effects.

The SoundPLAN software and calculation methodology allows the environmental parameters identified above to be modified.

5.1 Scenarios and Assumptions

Noise modelling has been conducted for the following scenarios:

- Construction during neutral and adverse weather conditions.
- Operation during neutral and adverse weather conditions.

All noise sources in all scenarios have been modelled as operating 100% of the time, 24 hours a day, with the following exceptions:

- Light vehicle (staff) movements:
 - Worst case assumption where full staff turnover/shift change occurs in a single assessment period i.e. 50 vehicles in, 50 vehicles out totalling 100 movements.
- Heavy vehicle movements:
 - 16 Heavy vehicles are expected to utilise the site per 24-hour period, resulting in 1.5 vehicles per hour assuming even distribution.
 - Assuming a 'peak' period, heavy vehicle movements have been based on a total of 4 movements in a peak period for the purposes of a more conservative assessment.

5.2 Geographical Data

Topographical data utilised for the noise model was obtained via the Queensland Government Spatial Catalogue 'QSpatial' and spliced with the current survey data of the site provided by Jet Zero and detailed in Table 5-1.

Table 5-1 – Topographical Data used in Noise Model

Data Source	Area	Description	Date
Queensland Spatial Catalogue (QSpatial)	From Site to NSRs	1m Contours	14/11/2024*
Existing Contours within Earthworks Layout Plan (drawing no 1241-020) by Langtree Consulting**	Project Site	0.2m Contours	28/08/2024

*Downloaded on 14/11/2024.

**Shown in Appendix B.

Site elevation varies between approximately 2 and 5m AHD, and topographical conditions extending to the nearest sensitive receptors ranging from approximately 1m to 12m. There are no significant changes in terrain between the site and the receptors, with the terrain gently undulating throughout the surrounding areas.

5.3 Weather Conditions

Noise propagation over long distances can be significantly affected by the weather conditions, mainly source-to-receiver winds and temperature inversions, as both of these conditions can increase noise levels at sensitive receptors.

The CONCAWE methodology can predict to one of six meteorological categories (CAT). To determine which category is modelled, the Pasquill Stability Classes need to be determined for the site. For this assessment the weather conditions, including stability class frequencies at the site have been obtained from The Air Pollution Model (TAPM). TAPM is a three-dimensional prognostic model developed and verified by Commonwealth Scientific and Industrial Research Organisation (CSIRO). TAPM data was generated for the air quality assessment has been used for uniformity. The wind parameters were compared for the Bureau of Meteorology (BOM) and TAPM data and were found to be very similar.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance the motion of noise. The Pasquill-Gifford Stability Classes define the amount of turbulence in the air, of which the most widely used categories are Classes A-F. The TAPM generated meteorology determined the stability class for each hour of the year. The frequency of each stability class occurrence is shown in Table 5-2. Temperature inversions are defined as Class F. These conditions only occur with clear and calm conditions during the evening and nighttime periods. During temperature inversions noise emissions from distant sources can be amplified.

Table 5-2: Annual Stability Class Distribution Predicted [TAPM, 2023]

Stability Class	Description	Frequency of Occurrence (%)	Average Wind Speed (m/s)
A	Very unstable low wind, clear skies, hot daytime conditions	0.1	2.3
B	Unstable clear skies, daytime conditions	7.6	3.2
C	Moderately unstable moderate wind, slightly overcast daytime	13.6	3.9
D	Neutral high winds or cloudy days and nights	38.9	4.2
E	Stable moderate wind, slightly overcast night-time conditions	11.6	2.9
F	Very stable low winds, clear skies, cold night-time conditions	28.3	1.7

The long-term wind roses recorded daily at the Townsville Aero station at 9am and 3pm are provided Figure 5-1. Winds are shown to be primarily from the southeast at 9am and northeast directions at 3pm. Stronger winds (>40km/hr or >11.1m/s) occur infrequently mostly from the east at 3pm.



Figure 5-2 presents the annual and seasonal wind roses from the TAPM-CALMET derived dataset for the year 2023 at the proposed Project site location. Wind roses from 9am and 3pm for the derived dataset are also provided in Figure 5-2 for comparison with the long term recorded data from the Townsville Aero Weather Station. Key features of the winds are:

- Winds are predominantly from the southeast with average wind speed of 3.2 m/s.
- Calm winds (<0.5m/s) are infrequent representing only 1.63% of the winds for the year.
- The strongest winds (>5.7m/s) occur mostly from the southeast at 9am and from the east at 3pm.
- Lighter winds (<5.7m/s) primarily from the east and southeast occur in summer and autumn; and
- The 9am and 3pm wind roses for the TAPM-CALMET derived dataset are generally consistent with the measured data from the Townsville Aero BoM Weather Station. Winds are shown to be primarily from the southeast at 9am and northeast and east directions at 3pm.

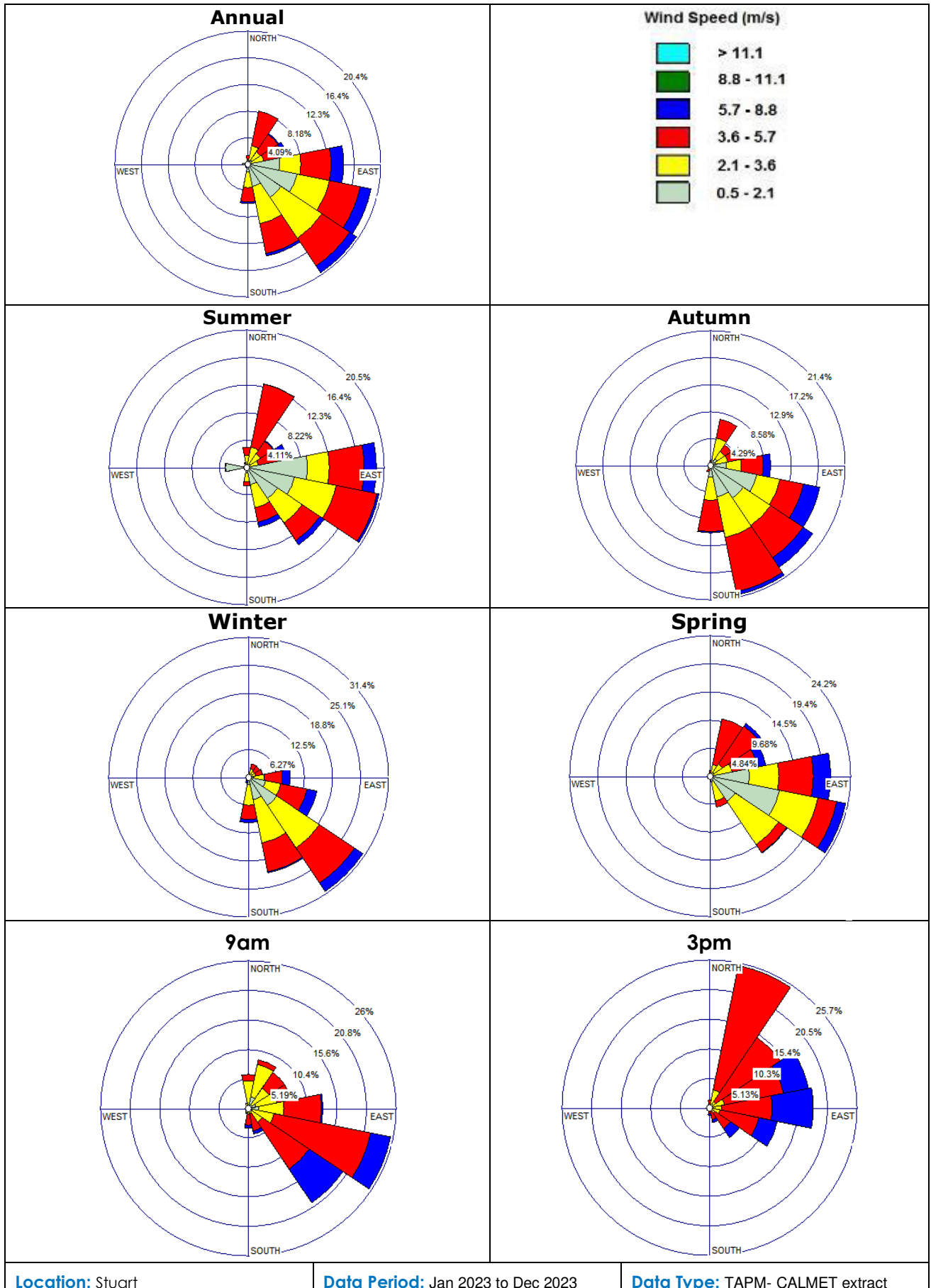


Figure 5-2: Wind Roses for the TAPM-CALMET Derived Dataset at the Project site, 2023

5.3.2 Modelled Weather Scenarios

Considering the Project intends to operate 24 hours a day, the following weather scenarios have been assessed:

Average/Neutral Climatic Conditions:

- Class D (average/neutral) conditions occur for approximately 39% of the time. Class D has been modelled for the average climatic condition scenarios for day, evening and night, with 0m/s wind speeds.

Worst Case Climatic Conditions:

- Class F (stable) conditions occur for approximately 28% of the time at the Project area and are worst case climatic conditions that occur during the evening and nighttime period. Class F has been used to assess worst case evening and nighttime noise levels affected by temperature inversion. Temperature inversion only occurs during the nighttime period. Worst case source to receptor winds have been assessed, with wind speeds modelled at 3.0m/s.

Stability classes A, B, and C are associated with an unstable atmosphere and are generally unfavourable for noise propagation. Condition D is a neutral condition for noise propagation while conditions E and F are unfavourable as stable conditions further facilitate noise propagation.

5.4 Noise Sources

5.4.1 Construction Equipment Noise Sources

At this stage of the Project, the specific equipment (and associated quantities of equipment) to be used during the construction stage is not known. Vipac have based the construction noise assessment on typical items of plant and equipment utilised for earthwork preparation, slab establishment and other general construction activities. Table 5-3 below details the typical equipment from BS5228-2 utilised in the noise model.

Table 5-3 – Sound Power Levels of Typical Construction Equipment

Equipment and Assumed Quantities	SWL dB(A) for Each Equipment	Octave band noise levels, Hz, dB(z)						
		63	125	250	500	1k	2k	4k
Dump Truck x 3	115	114	107	107	107	107	112	97
Excavator 40t x 2	107	113	106	105	105	101	99	96
Franna Crane x 2	94	94	95	88	89	90	89	78
Front end loader x 2	83	88	81	77	80	79	76	71
Grader x3	114	116	115	111	107	112	106	102
Generator x 2	101	103	100	95	96	98	94	90
Padfoot Roller x 2	109	111	105	105	104	104	103	96
Impact Piling Rig x 2	117	110	110	110	117	111	106	103
Roller 15t x 2	101	108	103	105	100	95	90	82
Truck/Heavy Vehicle x 5	118	127	123	115	114	112	111	105
Water Cart x 2	116	109	107	107	111	112	109	104

A program of the construction stage is not yet available, so for the purposes of a conservative assessment, equipment location within the model is situated primarily on the western side of the site, closest to the noise sensitive receptors.

5.4.2 Operational Equipment Noise Sources

Jet Zero have provided an initial list of expected noise sources during operation of the site:

- The total number of noise sources is approximately 200.
- The noise data supplied is shown in Appendix D, alongside spectrum data where provided, as well as source heights where stated.
- Where noise data was not provided, with a note 'Assumed Quiet', Vipac have assumed a sound power level of 70dB(A) for these noise sources.
- Where sound pressure levels were provided for equipment, conversions to sound power levels were made according to their height above ground. Any documented height greater than 3m was treated as spherical propagation, with source heights below 3m treated as hemispherical propagation.
- Specific noise source locations on site are currently unknown. Where identifiable, noise sources have been positioned on site consistent with the area designation data supplied by Jet Zer as part of the data supplied in Appendix D (i.e. process unit, utility unit, storage unit, etc).
 - Where source locations are unclear, noise sources have been positioned within the process unit.

Octave band data was not available for the vast majority of noise sources. As such, assumptions have been made in order to conduct an indicative low frequency noise impact assessment.

Considering the nature of the operations on site, it is anticipated that the primary source of noise will be the likes of electrical and mechanical pumps, compressors, coolers etc. A such, where octave band data has not been supplied, the spectrum shape of a water pump obtained from BS 5228 has been used for all other noise sources, per Table 5-4.

Table 5-4 - Spectrum Shape Utilised for Noise Sources without Supplied Octave Band Data

Noise Source	Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Water Pump, 20kW*	73	68	62	62	61	56	53	41

*BS 5228-1:2009, Table C2

6 Noise Impact Assessment

This section details the results of the noise modelling and the impacts at nearby sensitive receptors. For both construction, operation, and cumulative noise, the following scenarios have been modelled:

Neutral Climatic Conditions

- Stability Class D – Day/Evening/Night: 0m/s winds,

Worst Climatic Conditions

- Stability Class F – Evening/Night: 3.0m/s source to receptor wind.

It should be noted that actual noise levels may be lower than the predicted noise levels that are presented in the following sections. This is due to the conservative modelling assumption that all equipment will be in operation simultaneously for 100% of the time in each time period, whereas this is expected to be unlikely in actual operation.

6.1 Predicted Noise Levels – Construction

Predicted construction activity noise level results for neutral and worst-case climatic conditions are tabulated in Table 6-1 and Table 6-2. Noise contour maps for the Project's construction scenario under neutral and worst-case climatic conditions are presented in Appendix A

Table 6-1 - Predicted Construction Noise Emissions – Neutral Climatic Conditions

Receptor ID	Predicted Noise Levels L _{Aeq} dB(A)	Standard Hours		Non-Standard Hours	Complies with Criteria?		
	Neutral Climatic	Lower Limit	Upper Limit		Lower Limit	Upper Limit	Non-Standard Hours
NSR 1 – Ooonooba	25	46	65	41	✓	✓	✓
NSR 2 – Cluden	36	44	65	38	✓	✓	✓
NSR 3 – Wulguru	29	47	65	36	✓	✓	✓
NSR 4 – Stuart	31	53	70	43	✓	✓	✓

Table 6-2 - Predicted Construction Noise Emissions – Worst Climatic Conditions

Receptor ID	Predicted Noise Levels L _{Aeq} dB(A)	Standard Hours		Non-Standard Hours	Complies with Criteria?		
	Worst Climatic	Lower Limit	Upper Limit		Lower Limit	Upper Limit	Non-Standard Hours
NSR 1 – Ooonooba	31	46	65	41	✓	✓	✓
NSR 2 – Cluden	41	44	65	38	✓	✓	+3
NSR 3 – Wulguru	34	47	65	36	✓	✓	✓
NSR 4 – Stuart	36	53	70	43	✓	✓	✓

Construction noise levels are predicted to comply across the majority of conditions, with the exception of the closest receptor within the Cluden area during non-standard hours. Refer to 8 for the recommended mitigation and management measures.

6.2 Predicted Noise Levels – Operation

6.2.1 EPP - Acoustic Quality Objectives

Predicted operation activity noise level results for neutral and worst-case climatic conditions are tabulated in Table 6-3. Noise contour maps for the Project's operational scenario under neutral and worst-case climatic conditions are presented in Table 6-3.

Table 6-3: Predicted Operational Noise Emissions – Acoustic Quality Objectives

Receptor ID	Predicted Noise Levels L _{Aeq} , dB(A)		Acoustic Quality Objective Criteria L _{Aeq} , dB(A)	Complies with Criteria?
	Neutral Climatic	Worst Climatic	Night	
NSR 1 – Ooononba	13	18	35	✓
NSR 2 – Cluden	24	29	30	✓
NSR 3 – Wulguru	16	22	35	✓
NSR 4 – Stuart	18	24	35	✓

Operational noise from the Project site is predicted to comply with the Acoustic Quality Objective criteria at all receptors during neutral and worst climatic conditions without the need for site specific noise mitigation.

6.2.2 EPP – Background Creep

Table 6-4: Predicted Operational Noise Emissions – Background Creep

Receptor ID	Predicted Noise Levels L _{Aeq} dB(A)		Project Specific Background Creep Criteria		Complies with Criteria?	
	Neutral Climatic	Worst Climatic	Time Varying	Steady State	Time Varying	Steady State
NSR 1 – Ooononba	13	18	42	37	✓	✓
NSR 2 – Cluden	24	29	42	37	✓	✓
NSR 3 – Wulguru	16	22	40	35	✓	✓
NSR 4 – Stuart	18	24	47	42	✓	✓

Operational noise from the Project site is predicted to comply with the Background Creep criteria at all receptors during neutral and worst climatic conditions without the need for site specific noise mitigation.

6.2.3 Low Frequency

Table 6-5 presents the results of conducting the low frequency noise assessment by comparing the predicted noise levels in both dB(A) and dB(Z) in accordance with the criteria in Table 4-6.

Table 6-5 - Predicted Operational Noise Emissions - Low Frequency

Receptor ID	Predicted Noise Levels L _{Aeq} , dB(A)		Predicted Noise Levels L _{Aeq} , dB(Z)		dB(Z)-dB(A) ≤ 15		Complies with 50d(Z) Limit?
	Neutral Climatic	Worst Climatic	Neutral Climatic	Worst Climatic	Neutral Climatic	Worst Climatic	
NSR 1 – Ooononba	13	18	30	33	17	15	✓
NSR 2 – Cluden	24	29	40	43	16	14	✓
NSR 3 – Wulguru	16	22	33	36	17	14	✓
NSR 4 – Stuart	18	24	35	38	17	14	✓

Low frequency noise emissions are generally predicted to comply with the applicable criteria, except for NSRs 1-4 whereby the difference between dB(Z) and dB(A) is greater than 15 during neutral weather conditions. However, considering the overall predicted dB(Z) results remain under the 50dB(Z) limit, the results are considered compliant.

Likewise, with NSR 5 (Commercial), although the predicted dB(Z) levels exceed the 50dB(Z) limit, the difference between dB(A) and dB(Z) results remain within the allowable difference and therefore the overall limit exceedance is considered acceptable.

The accuracy of these predicted low frequency impacts is dependent on the accuracy of the octave band emissions from each source, and the assumptions detailed in Section 5.4.2. As the data for the operational equipment on site is limited at this time, the results above should be considered an indication of emissions. Should updated data be supplied, it is worth noting the results above may change.

6.2.4 Cumulative Impacts

It is necessary to consider the potential for cumulative industrial noise emissions at each sensitive receptor. It is acceptable to assume the background noise monitoring conducted in each representative area may contain noise associated with existing industry within the environment. To ensure that the Project does not detrimentally impact the existing noise environment at each respective receptor, a cumulative assessment should be demonstrated. Table 6-6 below presents the background noise levels at each receptor during the quietest times of the day alongside the predicted operational noise emissions of the site (as per monitoring results in Section 3). These values are then logarithmically summed to provide an indication as to whether the proposed Project detrimentally impacts the existing background noise levels by increasing them.

Table 6-6 - Predicted Cumulative Noise Emissions

Receptor ID	Predicted Noise Levels L _{Aeq} , dB(A)		Existing Background Noise Levels, L _{A90} dB(A)	Cumulative Impact		Worst Case Predicted Increase, dB(A)
	Neutral Climatic	Worst Climatic		Neutral Climatic	Worst Climatic	
NSR 1 – Oonoonba	13	18	37	37.0	37.0	+0
NSR 2 – Cluden	24	29	37	37.2	37.6	+0.6
NSR 3 – Wulguru	16	22	35	35.0	35.2	+0.2
NSR 4 – Stuart	18	24	42	42.0	42.0	+0

Indicative results show during worst case climatic conditions, background noise levels at the closest receptor within the Cluden area may experience an increase in background noise during the quietest period of the day of approximately 0.6dB(A). An increase of this size is not detectable by the human ear.

It should be noted that a comparison of predicted worst case climatic conditions to measured background noise levels may not be representative of the cumulative impact, as it is expected that in worst case climatic conditions, background noise levels at all surrounding receptors will be higher as a result. It is therefore more appropriate to consider cumulative impact comparing to neutral climatic conditions, where it is predicted the cumulative impact is at most +0.2dB(A) at the closest receptor.

It is also important to note that this is a prediction of an absolute worst-case scenario, and any predicted increase is expected to diminish entirely for the majority of receptors surrounding the project. It is therefore expected the Project will not have any significant impact on the background noise levels at the nearest sensitive receptors.

7 Vibration Impact Assessment

7.1 Construction/Operational Vibration (Non-Blasting)

Both continuous/quasi-continuous and intermittent vibration has been considered. Most machinery items are likely to generate some continuous or quasi-continuous vibration during their operation, and some intermittent or transient vibration could be caused by machinery during start-up compaction (and possibly during loading of trucks/general truck movement).

Ground-borne vibration resulting from activities on site are compared against the applicable criteria relating to human comfort and potential structural damage (usually in terms of Peak Particle Velocity, PPV). The recommended limits or guide values for transient vibration to ensure minimal risk of cosmetic damage to residential buildings (and community buildings) are in the range 15 to 20 mm/s PPV (depending on the frequency), with higher limits of 50 mms/ for industrial buildings. The stipulated human comfort criterion (lower limit) for vibration is typically 1 mm/s PPV (to an upper limit of 2 mm/s).

The ground vibration predictions for machinery were based on previously measured data by Vipac or sourced data for construction machinery from various vibration databases and literature references (Ref: *Ground Vibration Engineering* (Srbulov, 2010), *Construction Vibrations* (Dowding, 2000), *CALTRANS Construction Vibration Manual* (US CALTRANS, 2013), *US FTA Transit Noise & Vibration Manual* (2018)).

The calculation formulae used for ground vibration predictions (in terms of Peak Particle Velocity, V_{PPV} in mm/s) for vibratory compaction rollers are given as follows (Ref: BS 5228-2; Hiller & Crabb, 2000):

Table 7-1 :Ground Vibration Prediction Formulae

Normal compaction passes:	$V_{PPV} = ks * n^{0.5} * (A/(x+w))^{1.5}$	[mm/s]	ks	75	50% exceedance probability
			ks	143	33% exceedance probability
			ks	276	5% exceedance probability
Transient startup/shutdown:	$V_{PPV} = kt * n^{0.5} * (A^{1.5}/(x+w)^{1.3})$	[mm/s]	kt	65	50% exceedance probability
			kt	106	33% exceedance probability
			kt	177	5% exceedance probability
	x	distance along ground from roller to receiver (m)			
	n	number of vibrating drums in roller			
	A	nominal amplitude of vibrating roller (mm)			
	w	width of vibrating drum (m)			

* Note: The exceedance probability represents the level of conservatism in the predictions, where a 5% predicted level would be the most conservative or worst-case situation (higher prediction) to represent the maximum level predicted for 95% of possible cases and therefore only 5% of cases likely to exceed the predicted level.

A conservative prediction of the potential ground-borne vibration impacts associated with the proposed equipment on site has been made (primarily quasi-continuous vibration). Ground vibration levels (in mm/s PPV) from other construction machinery items (e.g. excavator, crusher) are typically in the range of 0.1 to 1 mm/s at distances of 25 to 50 m. Truck traffic (over rough/irregular road surfaces) will typically generate ground vibration levels of 0.1 to 0.5 mm/s (or less) at distances of 25 to 50 m. Considering the nearest potential future commercial sensitive receptors are at far greater distances (>600m) away with nearest residential receptors over 1.5km away, predicted vibration levels would meet the human comfort criteria and are well below structural damage criteria for all nearby buildings.

8 Noise Mitigation and Management Measures

The noise modelling results indicate that noise levels from the Project are predicted to comply with the Project specific criteria during non-standard construction hours in worst case climatic conditions at all receptors except for NSR 2 – Cluden. Mitigation measures are proposed to address any potential impacts associated with construction to minimise the number of sensitive receptors impacted by the noise and to reduce the noise level.

8.1 Mitigation for Initial Construction Activities

In the first instance, construction is recommended to occur during standard hours (7am-7pm) wherever possible. If out of hours construction is required, it is recommended to avoid operating particularly noisy machinery before 7am and after 7pm. If activities can only occur during the non-standard hours, then mitigation measures shall be considered in accordance with the following are applicable:

- Provide an induction to construction personnel (including sub-contractors) addressing responsibilities regarding noise management outlined in the Construction Environmental Management Plan (CEMP).
- Ensure truck drivers are informed of designated vehicle routes, parking locations, delivery hours, and minimising engine braking and idling.
- Ensure all equipment is equipped with appropriate noise control (e.g. mufflers, silenced exhausts, acoustic enclosures, flashing lights as an alternative to reversing beepers), and equipment is shut down and not left idling when not in use.
- Ensure equipment is operated in the correct manner and adequately maintained - including replacement of engine covers, tightening of rattling components, repair of leakages in air lines and shutting down equipment not in use.
- Use alternatives to 'beeper' style reversing alarms, such as broadband style alarms (or quacker alarms).

8.2 Complaint Management

It is recommended the site operators develop a complaints procedure within its Standard Operating Procedures that will address issues raised by community members or stakeholders regarding noise during both construction and normal operation. Complaints will be further investigated, recorded and corrective actions will be implemented if required and where reasonable; actions taken will be communicated back to the complainant.

Where appropriate, noise monitoring will be undertaken at the affected location. Monitoring will be conducted to provide feedback into the success of mitigation measures, if any, to confirm modelling and determine if further corrective actions are required to protect sensitive receptors. Monitoring will be undertaken in accordance with the requirements of the EPA and AS1055:2018 – *Acoustics - Description and measurement of environmental noise*.

The complaints procedure will include:

- A site contact phone number will be established to allow a timely response to noise related complaints,
- Complaints register maintained,
- A written response will be made within seven days,
- Additional monitoring (if appropriate) following a complaint, provided it is not vexatious or frivolous. If additional noise monitoring is required, it will be conducted at the affected location,
- If the applicable criteria or the EA conditions are exceeded corrective actions will be implemented; and
- Corrective actions will be reported to the affected persons and recorded in the complaints register or as required in the EA conditions.

9 Impacts on Fauna

There are no current government policies or other accepted guidelines that provide recommended noise level thresholds or limits in relation to noise impact on terrestrial fauna. In Australia, there are no noise studies presently available that deal with noise impacts on native species for long-term exposure, therefore a general literature review has been carried out for potential fauna impacts.

There is limited knowledge or understanding of the effects of noise on fauna given that the research and studies on animals to date has been limited to small, disconnected, anecdotal or correlational studies as opposed to coherent programs of controlled experiments (Manci et al (1988), Larkin, (1996), Radle, (1998), Wyle (2003), Warren et al, (2006), Dooling and Popper (2007) and (Dooling, Fay, and Popper (2000)). Noise may adversely affect wildlife by interfering with communication, masking the sounds of predators and prey and causing stress or avoidance reactions, and in some cases may lead to changes in reproductive or nesting behaviour. At sufficiently high levels, noise could cause temporary or permanent hearing damage.

In general, Radle (2007) states the consensus that terrestrial animals will avoid any industrial or plant or construction area where noise or vibration presents an annoyance to them. Additionally, Radle (2007) observed many animals react to new noise initially as a potential threat (potentially followed by startle/fright and avoidance), but quickly 'learn' that the noise is not associated with a threat. Most wildlife is generally mobile and will act to avoid noise and vibration if it is perceived to be annoying.

The response to noise by animals can depend on a wide variety of factors including noise level, noise spectrum (frequency distribution), noise characteristics (such as impulsiveness, rate of onset, tonality, modulation etc.), duration, temporal variation, number and type of events, level of ambient noise, time of day/season/year, and the animal's age, sex, type of activity at the time, breeding situation and past experience, and the type of animal species/genera, hearing thresholds, individual differences etc.

Studies have shown the reaction to noise can vary from species to species, including those that are known to have adapted to human activity. Environment Australia (1998) suggests that unusual noise, in combination with close proximity visual stimulation, is enough to disturb any animal, including humans. In addition, any sudden and unexpected intrusion, whether acoustic or of another nature, may also produce a startle or panic reaction.

Studies of the impact of the sonic boom on domestic and wild animals show that these species are unaffected by repeated booms and farmers have reported birds actually perching on scare guns after only a couple of days operation (Environment Australia, 1998). From a literature review, it has been considered that noise levels up to 60 dB(A) do not result in negative or adverse response to impacted animals or livestock. Noise levels up to 80 dB(A) can generate startle responses in birds and animals, and noise levels in excess of 90 dB(A) may cause negative impact such as behavioural responses.

The predicted worst case noise levels from operation during worst climate conditions are approximately 50-66dB(A) at the site boundary and these noise levels are not expected to cause adverse response to animals or livestock. Typically, animals will avoid high noise areas and it is expected that animals will relocate away from such areas. Absolute worst case construction noise levels, albeit temporary and indicative at this stage, are marginally higher at approximately 57-80 dB(A) at the site boundary.

Predicted noise levels at the Stuart Creek Nature Refuge are 37-42dB(A) during neutral and adverse weather conditions throughout the construction phase, and 26-31dB(A) during neutral and adverse weather conditions throughout the operation phase. These noise levels are not expected to have any detrimental effect on animals or livestock.

To summarise, the impacts of noise on animals is generally inconclusive. In general, there is no or little evidence of cause and effect regarding behavioural or physiological effects on domestic animals, and possibly slight evidence of some effects on some types of wild animals (especially for high or impulsive levels of noise). Finally, it is noted that animals tend to habituate to disturbances over time, particularly when it is steady and associated with non-threatening activity.

10 Conclusions

Potential noise impacts from the construction and operation of the Project were assessed against applicable criteria.

Future potential noise levels at the nearest sensitive receptors were predicted using the SoundPlan noise model for both construction and operation of the project, where the potential noise impacts are expected to be the greatest.

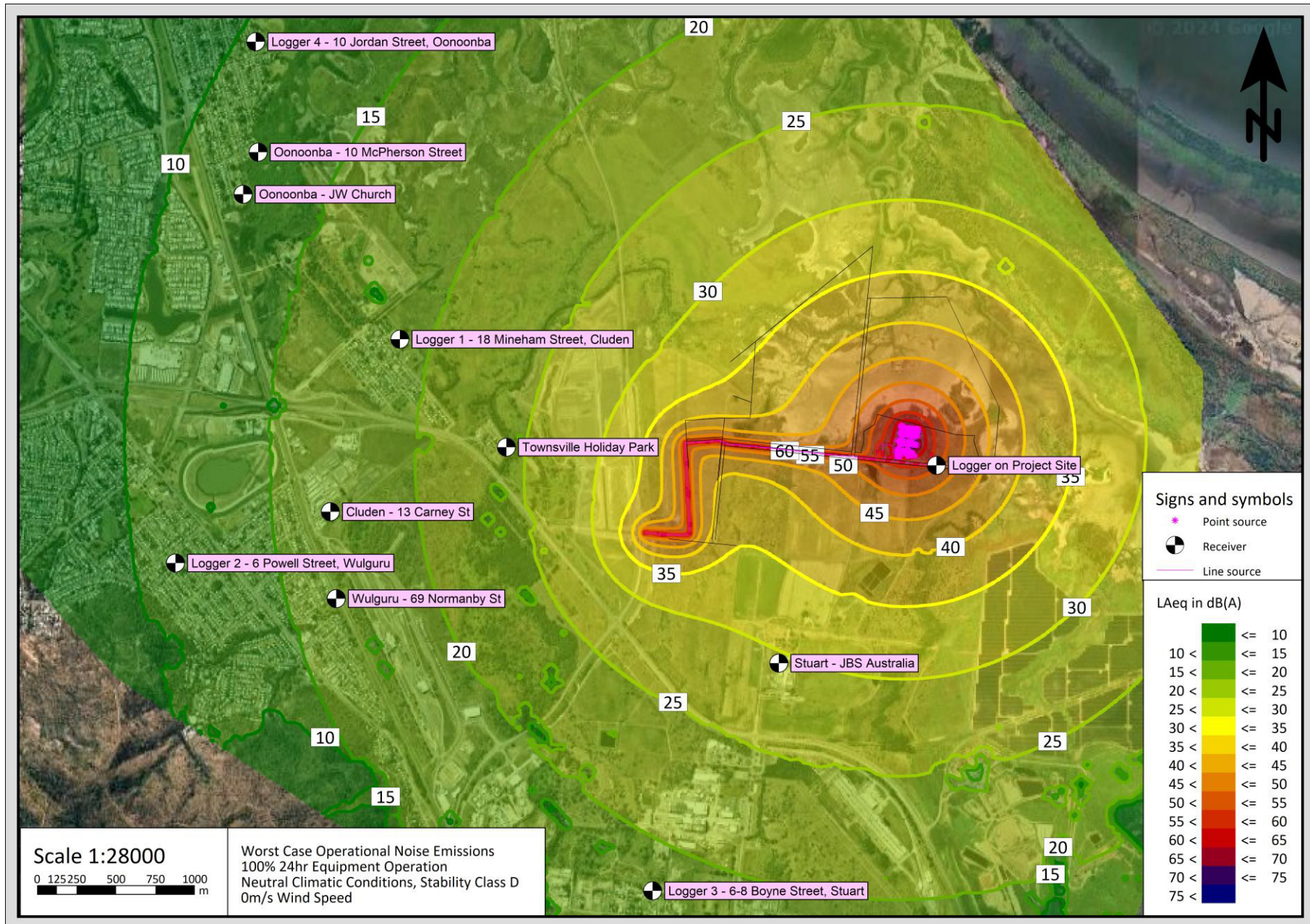
Operational noise levels from the proposed Project are predicted to comply during all time periods and weather scenarios without the need for noise mitigation.

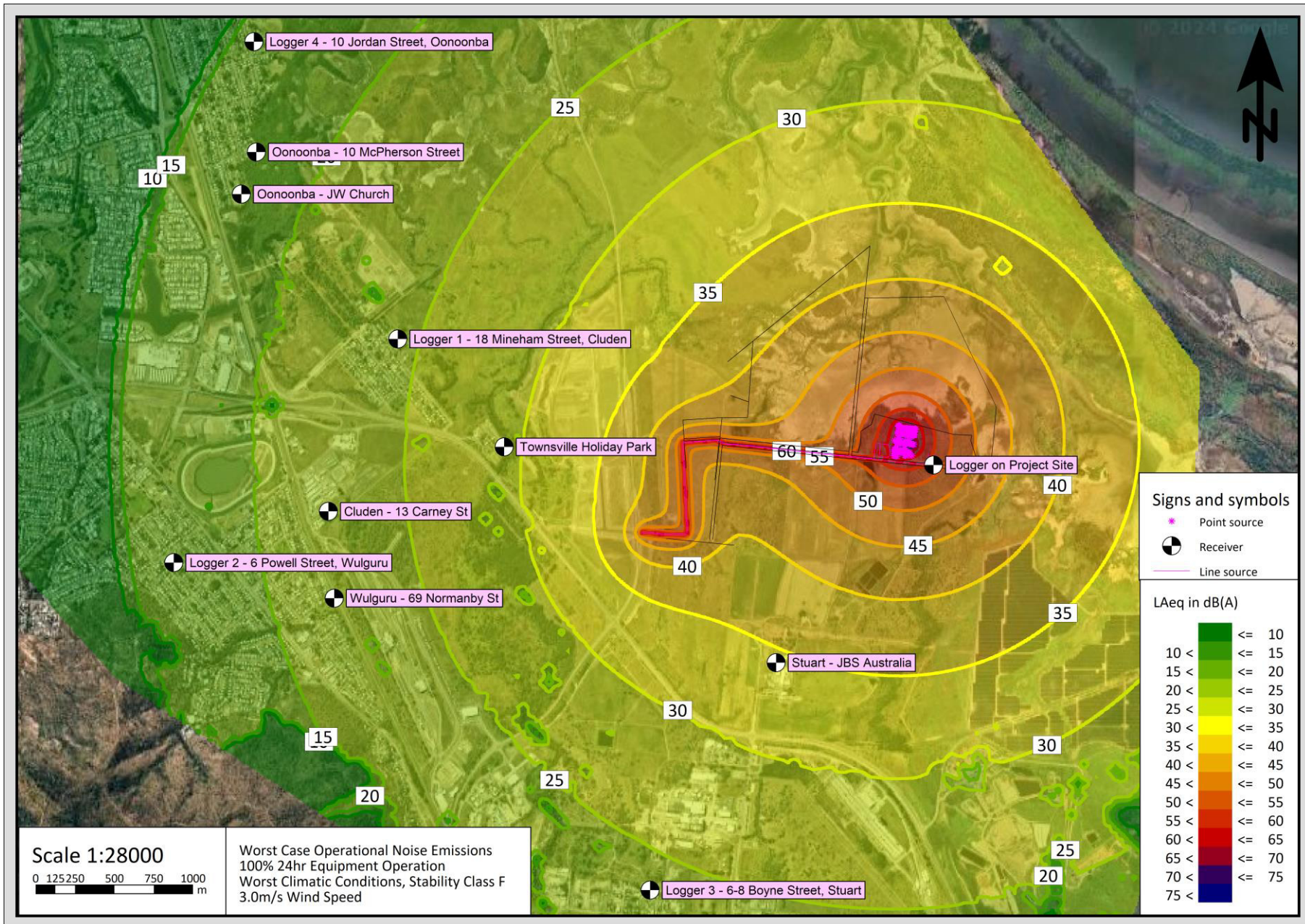
Cumulative noise levels from the proposed Project alongside existing background noise levels at all receptors are predicted to be maintained.

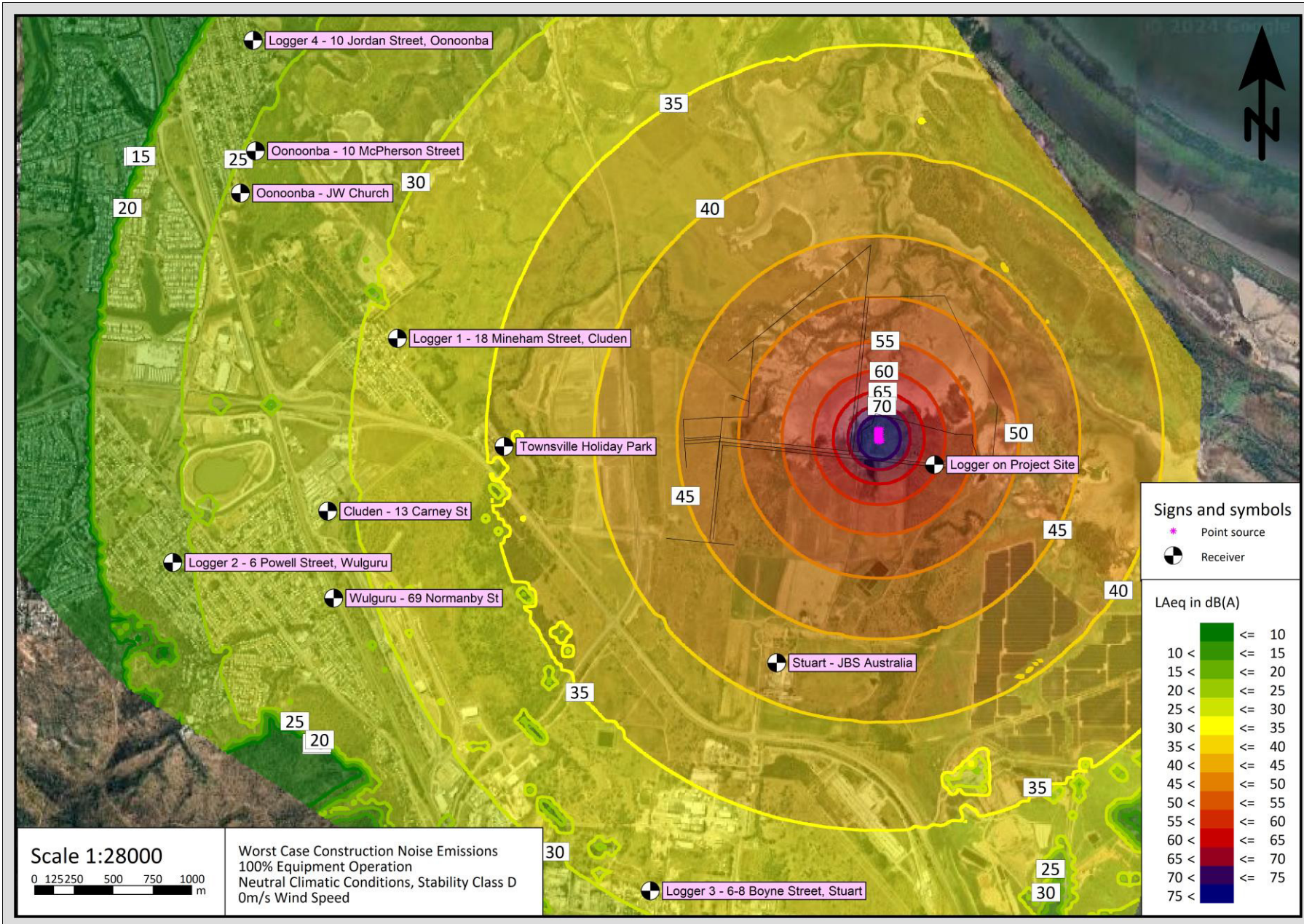
Noise levels are predicted to comply at the nearest receptors during construction of the Project except for NSR 2 - Cluden during non-standard hours in adverse weather conditions. Noise management measures have been provided in Section 8. It is recommended that construction noise mitigation measures are included in a CEMP developed in consultation and engagement with potentially affected receptors to achieve alternative arrangements if required.

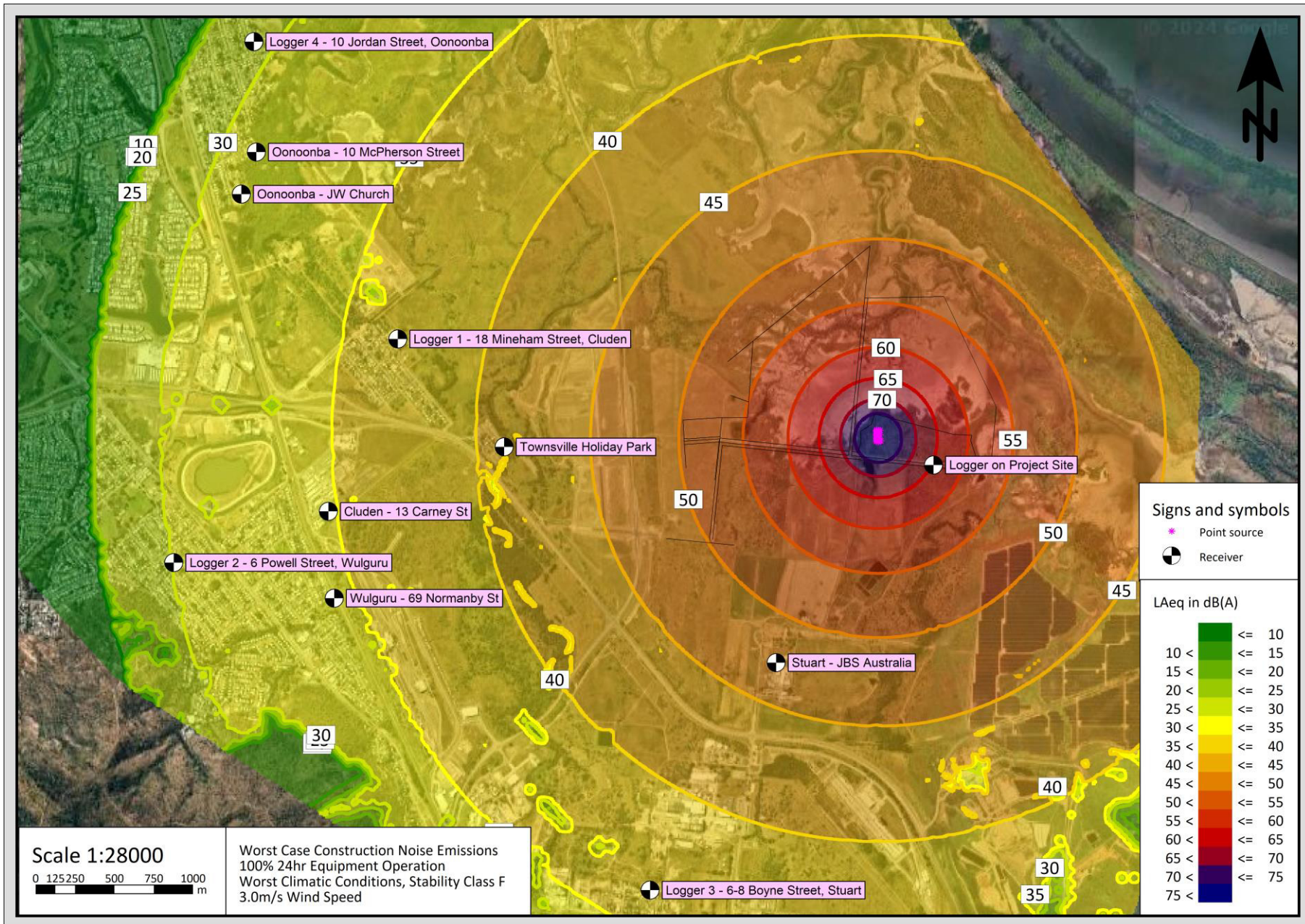


Appendix A Noise Contour Maps

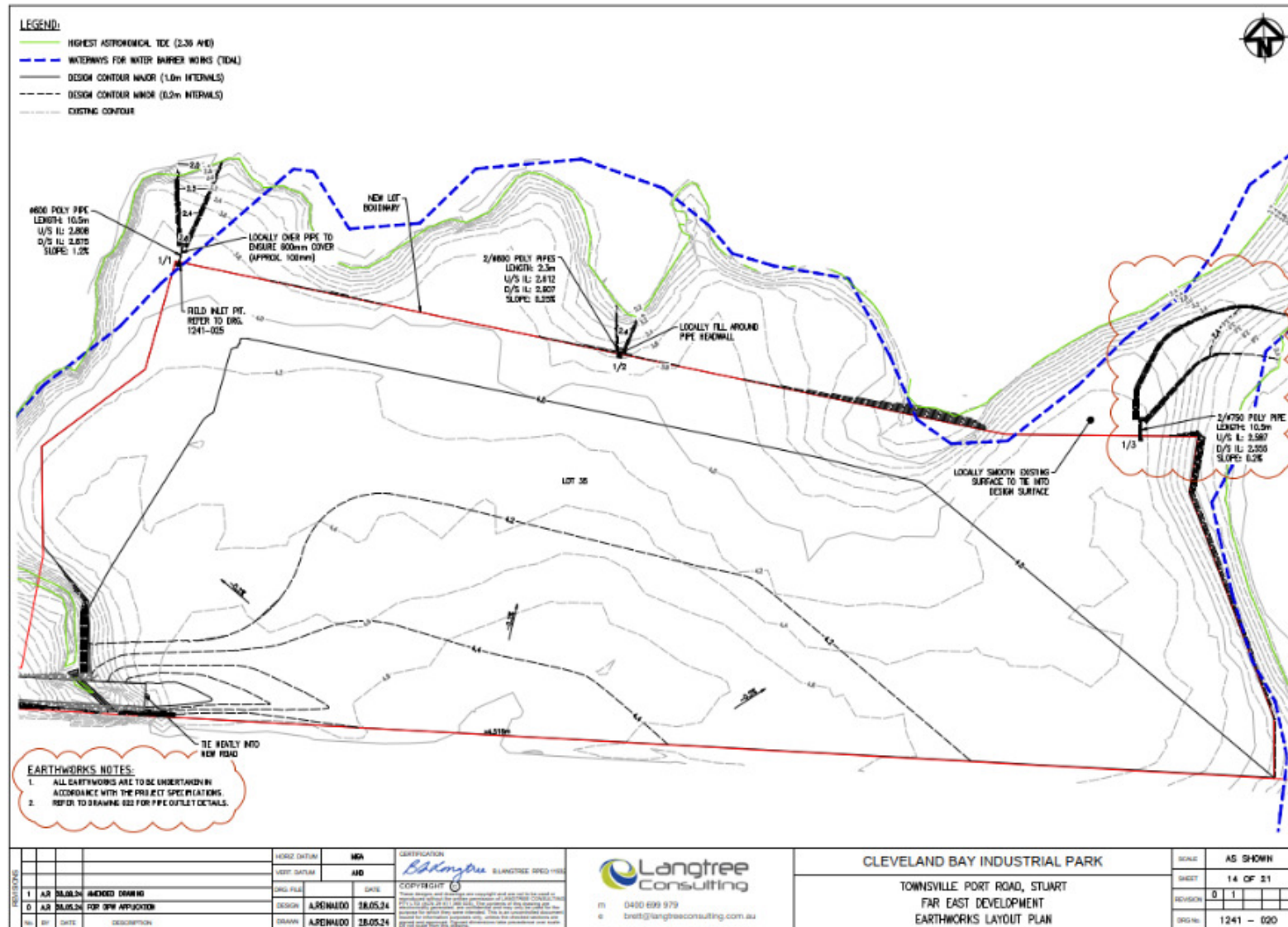






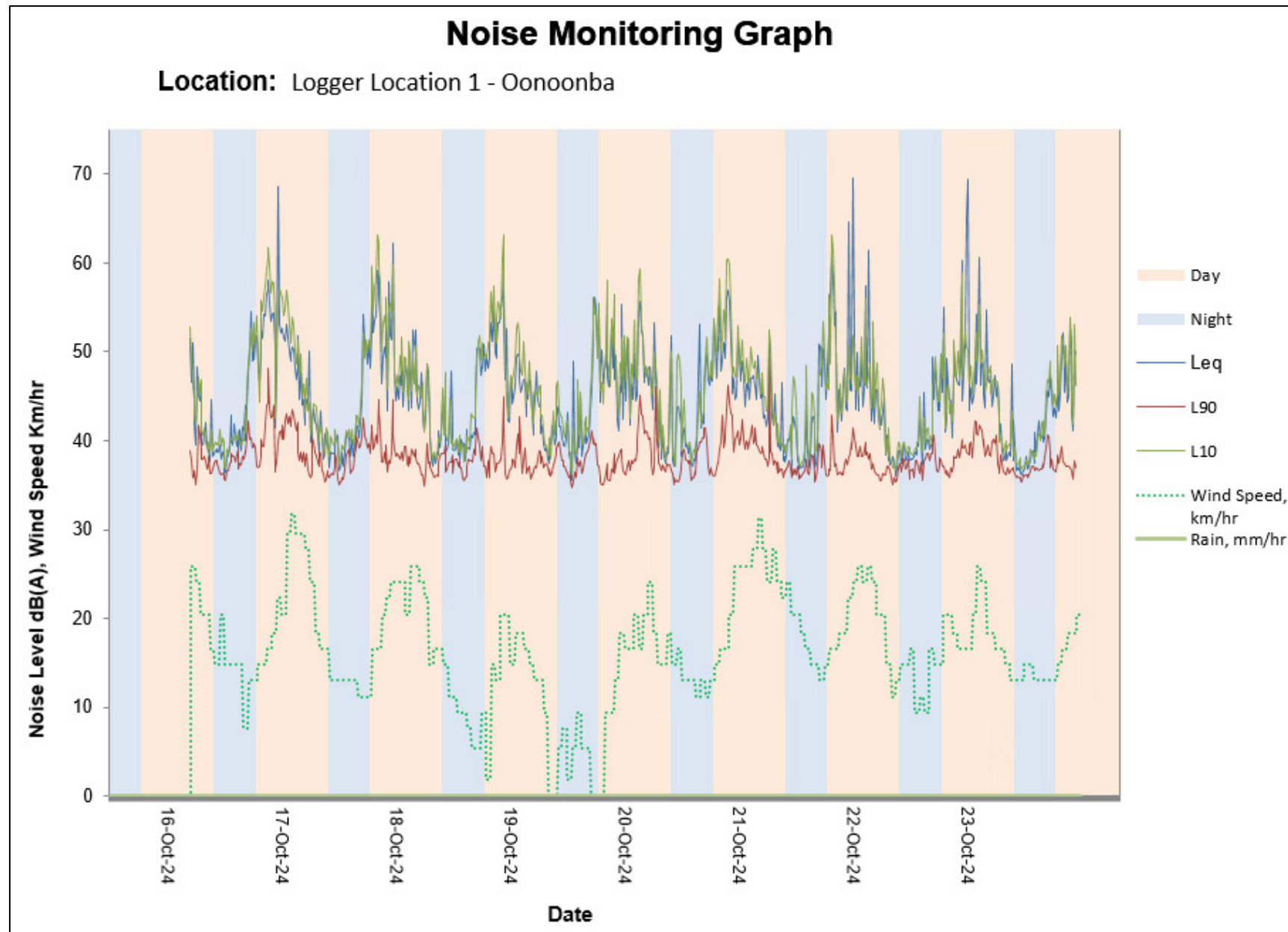


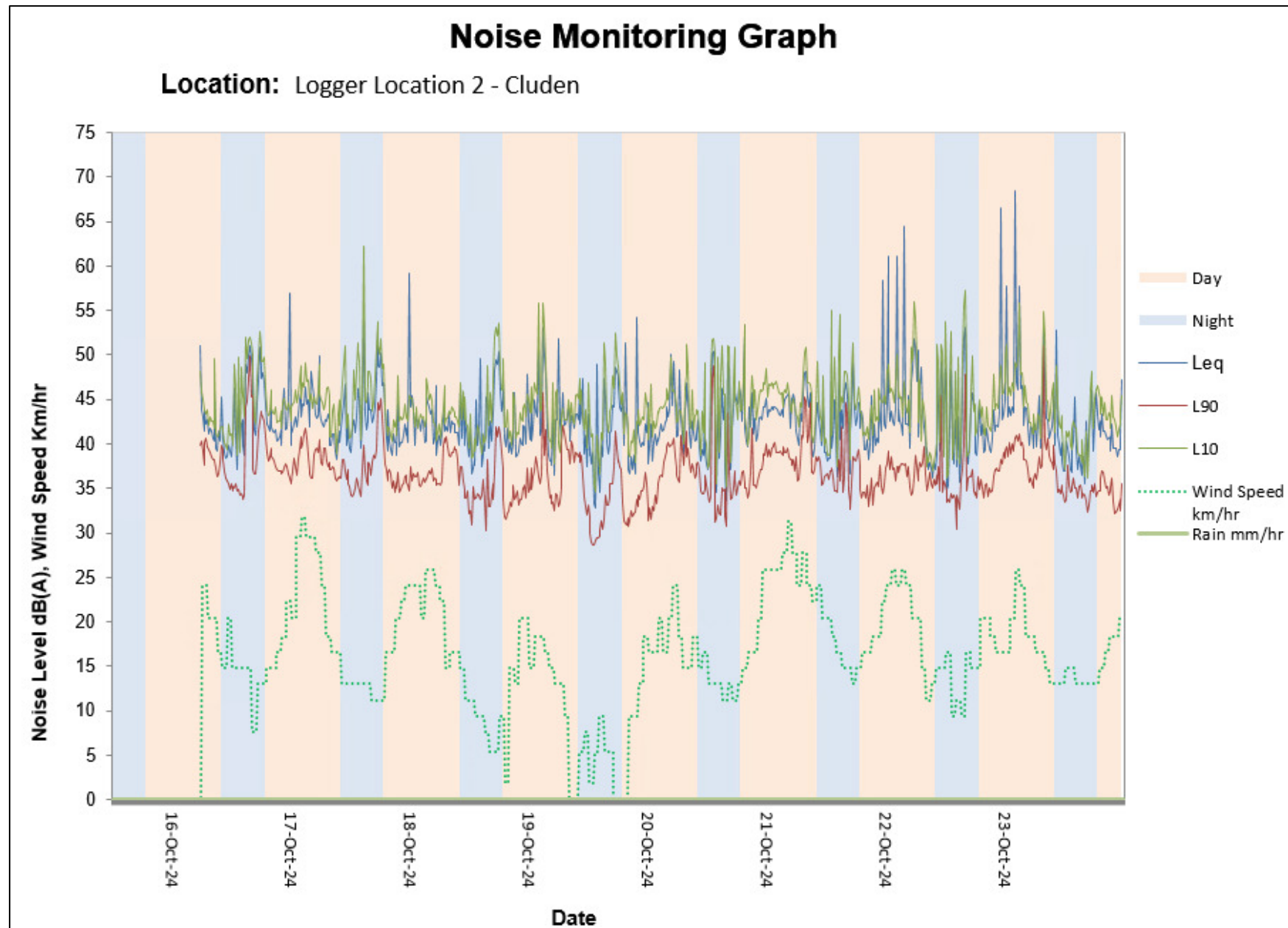
Appendix B Earthworks Layout Plan

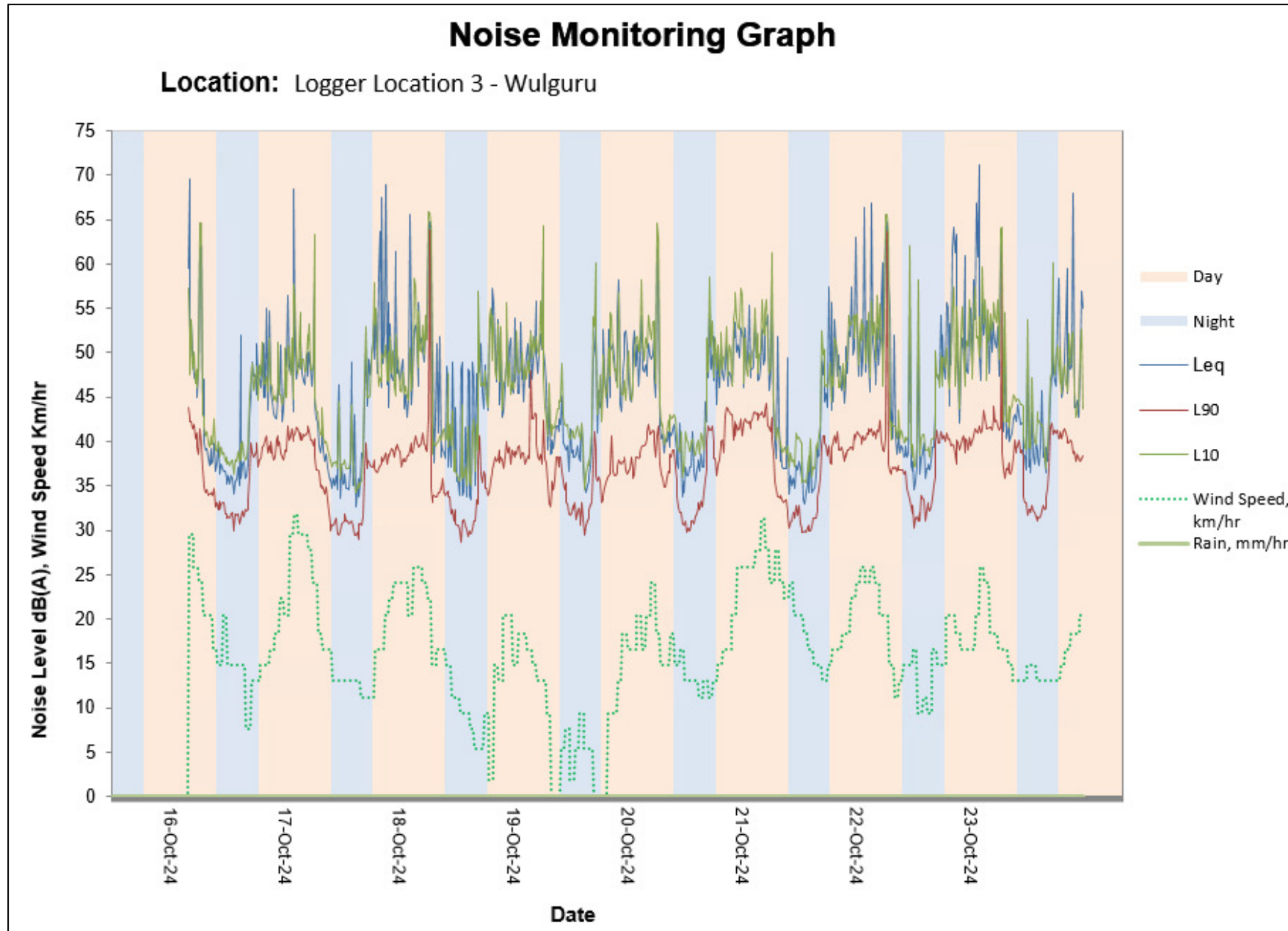


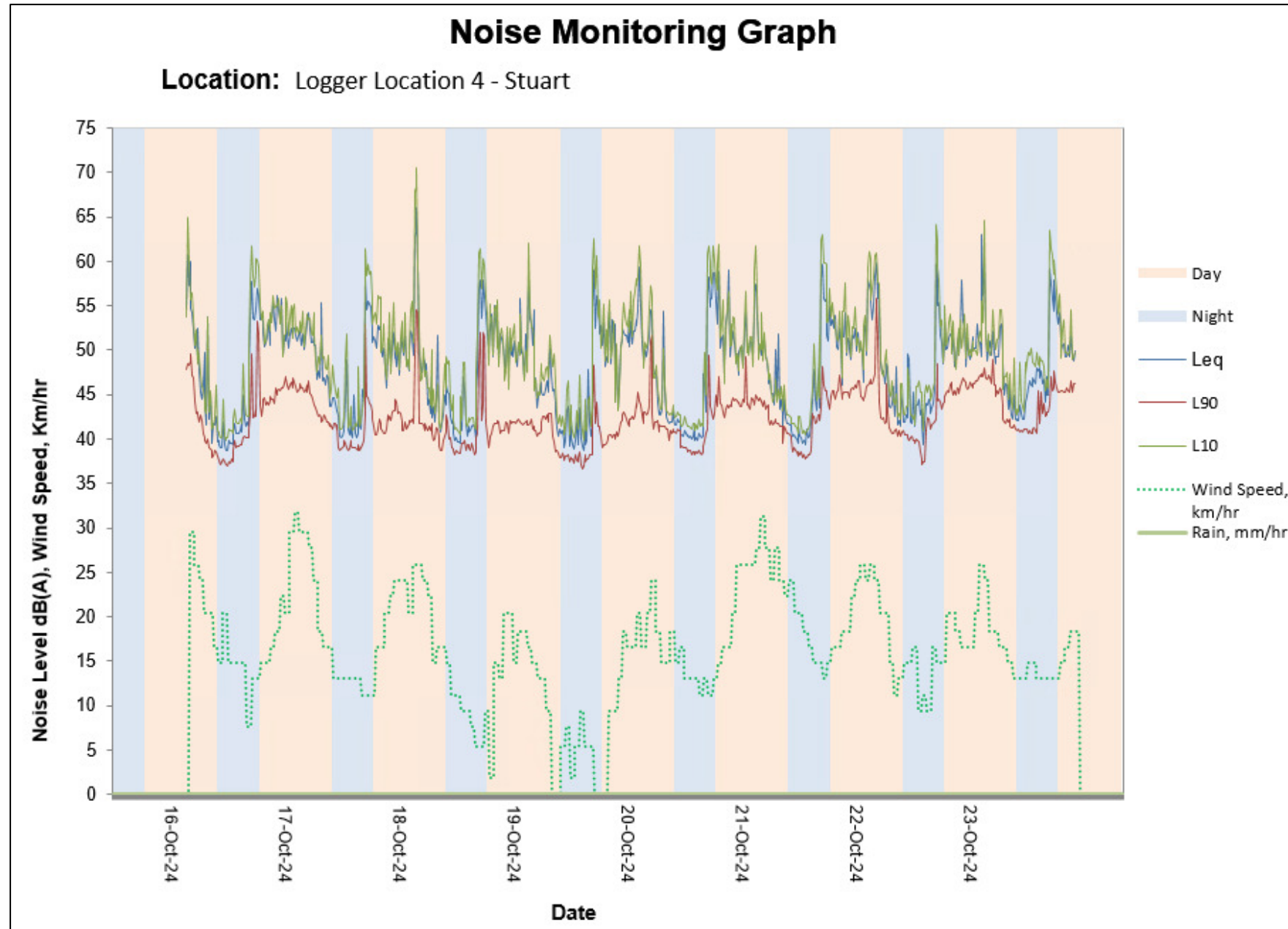


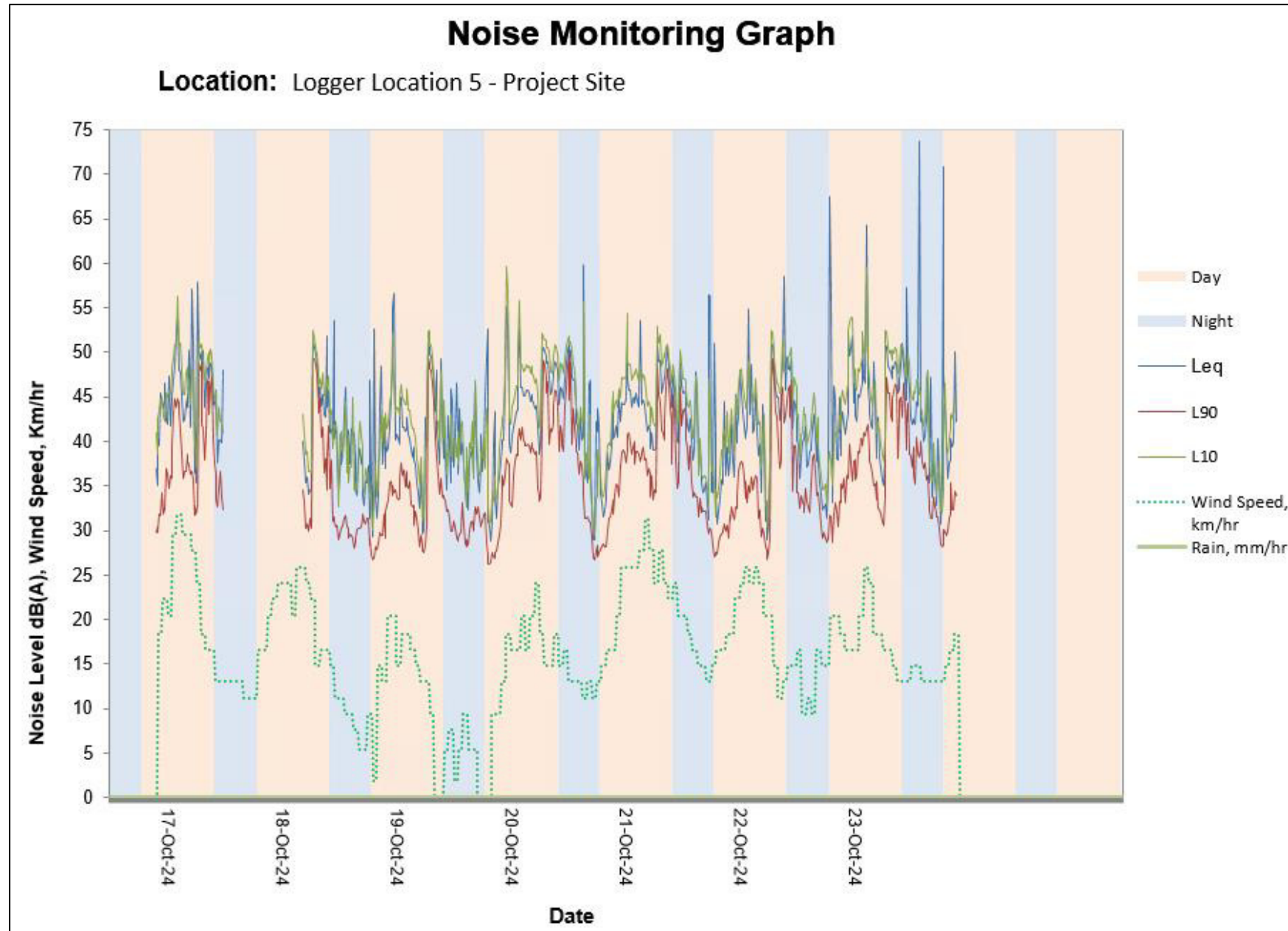
Appendix C Graphed Noise Monitoring Results











Appendix D Noise Monitors on Site (Photos)



Figure D 1 - Logger Location 1 – Ooononba



Figure D 2 - Logger Location 2 – Cluden



Figure D 3 - Logger Location 3 - Wulguru



Figure D 4 - Logger Location 4



Figure D 5 - Logger Location 5 - Project Site



Appendix E Supplied Noise Data

 TECHNIP ENERGIES NOISE SOURCE SCHEDULE & REPORT					Doc. No.:										Date:		
					Client No.: N/A												
					Job No.:												
					Client:												
					Project:												
					Site:												
Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data									Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
	PROCESS AREA TOWERS																
C-1100	ETHANOL PRE-TREATMENT COLUMN		-	SPL	-	-	-	-	-	-	-	-	-	0.5		Assumed Quiet	1
C-1350	PRIMARY SEPARATION COLUMN		-	SPL	-	-	-	-	-	-	-	-	-	9.5		Assumed Quiet	0
C-1450	ETHYLENE REFINEMENT COLUMN		-	SPL	-	-	-	-	-	-	-	-	-	7.25		Assumed Quiet	0
C-1510	WATER SEPARATION COLUMN		-	SPL	-	-	-	-	-	-	-	-	-	9		Assumed Quiet	0
C-1600	ETHYLENE SEPARATION COLUMN		-	SPL	-	-	-	-	-	-	-	-	-	10.5		Assumed Quiet	1
C-2400	STABILISER COLUMN		-	SPL	-	-	-	-	-	-	-	-	-	6.1		Assumed Quiet	0
C-2500	FRACTIONATOR		-	SPL	-	-	-	-	-	-	-	-	-	6.6		Assumed Quiet	0

 TECHNIP ENERGIES NOISE SOURCE SCHEDULE & REPORT					Doc. No.:										Date		
					Client No.: N/A												
					Job No.:												
					Client:												
					Project:												
					Site:												
Item Number	Service Description	Rated Power (KW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data									Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
	PROCESS AREA DRUMS																
V-1111	PRE-TREATMENT COLUMN REFLUX DRUM		-	SPL	-	-	-	-	-	-	-	-	-	30.55		Assumed Quiet	1
V-1131	ETHANOL PRE-TREATMENT SIDE DRAW DRUM		-	SPL	-	-	-	-	-	-	-	-	-	5.5		Assumed Quiet	0
V-1250	VAPORISER FEED DRUM		-	SPL	-	-	-	-	-	-	-	-	-	35		Assumed Quiet	0
V-1332	REACTOR PRODUCT SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
V-1361	PRIMARY SEPARATOR COLUMN REFLUX DRUM		-	SPL	-	-	-	-	-	-	-	-	-	21.5		Assumed Quiet	0
V-1461	ETHYLENE REFINEMENT COLUMN REFLUX DRUM		-	SPL	-	-	-	-	-	-	-	-	-	31		Assumed Quiet	0
V-1500	DEE & ETHANOL RECOVERY FLASH VESSEL		-	SPL	-	-	-	-	-	-	-	-	-	21.5		Assumed Quiet	0
V-1512	WATER SEPARATION COLUMN DECANTER		-	SPL	-	-	-	-	-	-	-	-	-	10.23		Assumed Quiet	0
V-1521	WATER SEPARATION COLUMN REFLUX DRUM		-	SPL	-	-	-	-	-	-	-	-	-	36.5		Assumed Quiet	0
V-1531	DEES ETHANOL RECOVERY KO DRUM		-	SPL	-	-	-	-	-	-	-	-	-	21.5		Assumed Quiet	0
V-1611	ETHYLENE SEPARATION COLUMN REFLUX DRUM		-	SPL	-	-	-	-	-	-	-	-	-	31.5		Assumed Quiet	0
V-1800	HP CONDENSATE FLASH DRUM		-	SPL	-	-	-	-	-	-	-	-	-	3		Assumed Quiet	0
V-1810	CLEAN CONDENSATE LP FLASH DRUM		-	SPL	-	-	-	-	-	-	-	-	-	5.6		Assumed Quiet	0
V-1830	MP SUSPECT CONDENSATE FLASH DRUM		-	SPL	-	-	-	-	-	-	-	-	-	5.6		Assumed Quiet	1

 TECHNIP ENERGIES NOISE SOURCE SCHEDULE & REPORT					Doc. No.:										Date									
					Client No.: N/A																			
					Job No.:																			
					Client:																			
					Project:																			
					Site:																			
Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV						
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID								
V-2110	OLIG 1 STEAM DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-	17.5		Assumed Quiet	0						
V-2150	REGEN KNOCK OUT POT		-	SPL	-	-	-	-	-	-	-	-	-	-	1		Assumed Quiet	0						
V-2151	DRAIN DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-	1		Assumed Quiet	0						
V-2160	INTERMITTENT BLOWDOWN DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-	1		Assumed Quiet	1						
V-2210	OLIG 1 HIGH PRESSURE SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	-	9.5		Assumed Quiet	0						
V-2212	OLIG 1 LOW PRESSURE SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	-	5		Assumed Quiet	0						
V-2301	OLIG 2 FEED SURGE DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-	5.7		Assumed Quiet	0						
V-2320	OLIG 2 FEED SURGE DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-	13		Assumed Quiet	0						
V-2330	OLIG 2 STEAM DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-	17.5		Assumed Quiet	0						
V-2420	STABILIZER OVERHEAD SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	-	9		Assumed Quiet	0						
V-2470	HYDROGENATION HIGH PRESSURE SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	-	8.5		Assumed Quiet	0						
V-2661	VACUUM PUMP INLET SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	-	8.5		Assumed Quiet	0						
V-2671	FRACTIONATOR OVERHEAD SEPARATOR		-	SPL	-	-	-	-	-	-	-	-	-	-	5		Assumed Quiet	1						

 TECHNIP ENERGIES NOISE SOURCE SCHEDULE & REPORT					Doc. No.:										Date:		
					Client No.:												
					Job No.:												
					Client:												
					Project:												
					Site:												
Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data									Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
	DRUMS - UTILITIES & STORAGE																
V-3510	PLANT AIR RECEIVER		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0
V-3530	IA RECIEVER		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0
V-4010	FUEL GAS KOD		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0
V-4750	CW DISENGAGEMENT DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0
V-6600	ORGANIC WASTE (ETHANOL RICH) DRAIN DRUM		-	SPL	-	-	-	-	-	-	-	-	-	Below Grade		Assumed Quiet	1
V-7000	HP FLARE KO DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
V-7150	LP FLARE KO DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
V-7300	COLD FLARE KO DRUM		-	SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
V-7950	PROCESS AREA LIQUID HYDROCARBON RECOVERY DRUM		-	SPL	-	-	-	-	-	-	-	-	-	Below Grade		Assumed Quiet	1



Doc. No.:

Client No: N/A

Job No.:

Client:

Project:

Site:

Date

NOISE SOURCE SCHEDULE & REPORT

Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
	REACTORS / ADSORBERS																	
R-1260	REACTOR 1		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-1270	REACTOR 2		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-1280	REACTOR 3		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-1290	REACTOR 4		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-1300	REACTOR 5		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-1310	REACTOR 6		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-1320	REACTOR 7		-	SPL	-	-	-	-	-	-	-	-	-	-	2.5		Assumed Quiet	0
R-2130A/B	OLIG 1 REACTORS		-	SPL	-	-	-	-	-	-	-	-	-	-	2		Assumed Quiet	1
R-2350A/B	OLIG 2 REACTORS		-	SPL	-	-	-	-	-	-	-	-	-	-	1.5		Assumed Quiet	0
R-2460	HYDROGENATION REACTOR		-	SPL	-	-	-	-	-	-	-	-	-	-	12.5		Assumed Quiet	0

NOISE SOURCE SCHEDULE & REPORT															Doc. No.: Client No.: N/A Job No.: Client: Project: Site:		Date
Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data									Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
	SHELL & TUBE HEAT EXCHANGERS																
HE-1101	ETHANOL FEED PRE- HEATER			SPL	-	-	-	-	-	-	-	-	-	13.4		Assumed Quiet	1
HE-1102	PRE-TREATMENT COLUMN REBOILER			SPL	-	-	-	-	-	-	-	-	80	10.25			1
HE-1112	PRE-TREATMENT COLUMN CONDENSER			SPL	-	-	-	-	-	-	-	-	-	31.945		Assumed Quiet	1
HE-1130	PRE-TREATMENT COLUMN SIDE DRAW CONDENSER			SPL	-	-	-	-	-	-	-	-	-	7.5		Assumed Quiet	1
HE-1251	FEED VAPORISER			SPL	-	-	-	-	-	-	-	-	70	31.765			1
HE-1251	REACTOR 1 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	13.5		Assumed Quiet	1
HE-1271	REACTOR 2 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	9.5		Assumed Quiet	1
HE-1281	REACTOR 3 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	9.5		Assumed Quiet	1
HE-1291	REACTOR 4 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	9.7		Assumed Quiet	1
HE-1301	REACTOR 5 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	9.7		Assumed Quiet	1
HE-1311	REACTOR 6 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	9.7		Assumed Quiet	1

 TECHNIP ENERGIES NOISE SOURCE SCHEDULE & REPORT					Doc. No.:										Date									
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					Job No.:																			
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					Project:																			
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Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV						
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID								
HE-1321	REACTOR 7 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	-	9.7		Assumed Quiet	1						
HE-1330	REACTOR FEED/ EFFLUENT EXCHANGER			SPL	-	-	-	-	-	-	-	-	-	-	32		Assumed Quiet	1						
HE-1331	VAPORISER PREHEAT/ REACTOR EFFLUENT EXCHANGER			SPL	-	-	-	-	-	-	-	-	-	70	9.5			1						
HE-1333	VAPORISER PREHEAT/ REA			SPL	-	-	-	-	-	-	-	-	-	70	13.5			1						
HE-1351	PRIMARY SEPARATION COLUMN REBOILER			SPL										80	9.5			1						
HE-1360	PRIMARY SEPARATION COLUMN CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	31.5		Assumed Quiet	1						
HE-1401	ETHYLENE COMPRESSOR OUTLET COOLER			SPL	-	-	-	-	-	-	-	-	-	-	36.5		Assumed Quiet	1						
HE-1451	ETHYLENE REFINEMENT COLUMN REBOILER			SPL										80	6.5			1						
HE-1460	ETHYLENE REFINEMENT COLUMN CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	36.5		Assumed Quiet	1						

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Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data									Elevation (m)	PFD	Remarks	REV	
					31,5	63	125	250	500	1000	2000	4000	8000		A-WT			P&ID
	SHELL & TUBE HEAT EXCHANGERS PROCESS AREA																	
HE-1463 A/B	ETHYLENE PRODUCT HEATER			SPL	-	-	-	-	-	-	-	-	-	-	41.5		Assumed Quiet	1
HE-1511	WATER SEPARATION COLUMN REBOILER			SPL										80	10.5			1
HE-1520	WATER SEPARATION COLUMN CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	41.5		Assumed Quiet	1
HE-1530	DEE & ETHANOL RECOVERY CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	21.5		Assumed Quiet	1
HE-1541	WATER SEPARATION COLUMN BOTTOMS COOLER			SPL	-	-	-	-	-	-	-	-	-	-	5		Assumed Quiet	1
HE-1610	ETHYLENE SEPARATION COLUMN CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	36.5		Assumed Quiet	1
HE-2100	OLIG 1 FEED/EFFLUENT EXCHANGER			SPL	-	-	-	-	-	-	-	-	-	-	5.75		Assumed Quiet	1
HE-2101	OLIG 1 FEED HEATER			SPL	-	-	-	-	-	-	-	-	-	-	9.5		Assumed Quiet	1
HE-2201	OLIG 1 REACTOR EFFLUENT CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	13.5		Assumed Quiet	1



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					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
HE-2321A/B	OLIG 2 FEED-PARAFFIN RECYCLE EXCHANGER			SPL	-	-	-	-	-	-	-	-	-	-	5.5		Assumed Quiet	1
HE-2322	OLIG 2 HP STEAM HEATER			SPL	-	-	-	-	-	-	-	-	-	-	5		Assumed Quiet	1
HE-2371	STABILISER PREHEATER			SPL	-	-	-	-	-	-	-	-	-	-	5		Assumed Quiet	1
HE-2401	STABILISER REBOILER	44	51.1	SPL										80	7.5			1
HE-2411	STABILISER OVERHEADS COOLER			SPL	-	-	-	-	-	-	-	-	-	-	17.6		Assumed Quiet	1
HE-2412	STABILISER OVERHEADS CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	14.5		Assumed Quiet	1
HE-2450	HYDROGENATION START-UP HEATER			SPL	-	-	-	-	-	-	-	-	-	-	14.5		Assumed Quiet	1
HE-2471	FRACTIONATOR PREHEATER			SPL	-	-	-	-	-	-	-	-	-	-	5.5		Assumed Quiet	1
HE-2480	HYDROGENATION RECYCLE COOLER			SPL	-	-	-	-	-	-	-	-	-	-	5.2		Assumed Quiet	1
HE-2601	FRACTIONATOR REBOILER	16		SPL										80	5.25			1
HE-2651	FRACTIONATOR OVERHEAD CONDENSER			SPL	-	-	-	-	-	-	-	-	-	-	13		Assumed Quiet	1
HE-2660	VACUUM PUMP PRECOOLER			SPL	-	-	-	-	-	-	-	-	-	-	12.875		Assumed Quiet	1



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Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
	SHELL & TUBE HEAT EXCHANGERS UTILITIES & STORAGE																	
HE-5451	SUSPECT CONDENSATE COOLER-1	-	-	SPL	-	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
HE-5452	SUSPECT CONDENSATE COOLER-2	-	-	SPL	-	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
HE-7301	COLD FLARE VAPORIZER	-	-	SPL	-	-	-	-	-	-	-	-	-	Grade			Quiet in normal operation. 80 dBA during peak flaring.	1
HE-7310	COLD FLARE SUPERHEATER	-	-	SPL	-	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
HE-7311	PROPANOL VAPORIZER	-	-	SPL	-	-	-	-	-	-	-	-	-	Grade			Quiet in normal operation. 80 dBA during peak flaring.	1
	PLATE & FRAME HEAT EXCHANGERS																	
HE-2701	DIESEL PRODUCT COOLER	-	-	SPL	-	-	-	-	-	-	-	-	-	Grade			Assumed Quiet	0
HE-2710	FRACTIONATOR SIDE DRAW COOLER	-	-	SPL	-	-	-	-	-	-	-	-	-	12			Assumed Quiet	1
	AIR COOLERS																	
HE-2200	OLIG 1 REACTOR EFFLUENT AIR COOLER	44	51.1	SPL										85	16	Vendor guarantee of noise spec (85 dBA at 1 meter) given. This is conservative and will be reviewed in Detailed Engineering.	1	
HE-2403	INTERMEDIATE PRODUCT COOLER	15		SPL										85	16	Vendor guarantee of noise spec (85 dBA at 1 meter) given. This is conservative and will be reviewed in Detailed Engineering.	1	
HE-2650	FRACTIONATOR OVERHEAD AIR COOLER	30	51.1	SPL										85	16	Vendor guarantee of noise spec (85 dBA at 1 meter) given. This is conservative and will be reviewed in Detailed Engineering.	1	
HE-1822	FLASH STEAM CONDENSER	6		SPL										85	18.5	Vendor guarantee of noise spec (85 dBA at 1 meter) given. This is conservative and will be reviewed in Detailed Engineering.	1	



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					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
	ELECTRIC HEATERS																	
HE-2750	REGEN GAS IMMERSION HEATER	-	-	SPL	-	-	-	-	-	-	-	-	-	-	6.5		Assumed Quiet	0
HE-2760	STEAM SUPERHEATERS	-	-	SPL	-	-	-	-	-	-	-	-	-	-	6.5		Assumed Quiet	0
	COMPRESSORS																	
J-1400 (INCLUDED IN Z-1400 PACKAGE)	ETHYLENE COMPRESSOR	1000	118.9	SPL										85	Grade		Package will be housed inside an enclosure. 85 dBA will be sound pressure level at 1 meter from compressor enclosure (size approximately 15m in length, 5m wide and 5m high). Reverberant sound inside building to be reviewed with vendor.	1
J-2250	OLIG 1 LP SEPARATOR GAS COMPRESSOR	410	115.3	SPL										85	Grade		Package will be housed inside an enclosure. 85 dBA will be sound pressure level at 1 meter from compressor enclosure (size approximately 15m in length, 5m wide and 5m high). Reverberant sound inside building to be reviewed with vendor.	1
J-2280	OLIG 1 HP SEPARATOR GAS COMPRESSOR	100	110.9	SPL										85	Grade		Package will be housed inside an enclosure. 85 dBA will be sound pressure level at 1 meter from compressor enclosure (size approximately 15m in length, 5m wide and 5m high). Reverberant sound inside building to be reviewed with vendor.	1



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Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
	PROCESS AREA PUMPS																	
P-1112A/B	PRE-TREATMENT COLUMN REFLUX PUMP	5.92		SPL										85	25		1	
P-1120A/B	PRE-TREATMENT COLUMN BASE BLEED PUMP	0.001		SPL										80	Grade		1	
P-1132A/B	PRE-TREATMENT COLUMN BASE PUMP	44.74	85.9	SPL										85	Grade		0	
P-1362A/B	PRIMARY SEPARATION COLUMN REFLUX PUMP	2.34		SPL										80	16		1	
P-1453A/B	ETHYLENE REFINEMENT COLUMN REBOILER CONDENSATE PUMP	0.01		SPL										85	Grade		1	
P-1462A/B	ETHYLENE REFINEMENT COLUMN REFLUX PUMP	2.79		SPL										80	12		0	
P-1522A/B	WATER SEPARATION COLUMN REFLUX PUMP	2.96		SPL										80	25		0	
P-1532A/B	DEE AND ETHANOL RECOVERY PUMP	29.61	84.1	SPL										85	12		0	
P-1540A/B	WATER SEPARATION COLUMN BOTTOMS PUMP	3.28		SPL										80	4		0	
P-1612A/B	ETHYLENE SEPARATION COLUMN REFLUX PUMP	1.49		SPL										80	25		0	
P-1652A/B	ANTI-HYDRATE ETHANOL BOOSTER PUMP	0.91		SPL										80	0.5		1	
P-1811A/B	CLEAN CONDENSATE PUMPS	2.57		SPL										80	0		1	



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					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
P-1821A/B	SUSPECT CONDENSATE PUMP	9.89		SPL										85	2.5			1
P-2120A/B	OLIG 1 BPW FEED PUMPS	18.49	90.7	SPL										85	Grade			1
P-2211A/B	OLIG 1 LP SEPARATOR TRANSFER PUMPS	10.12		SPL										85	Grade			1
P-2302A/B	OLIG 2 REACTOR CHARGE PUMP	39.86	85.9	SPL										85	Grade			1
P-2340A/B	OLIG 2 BPW FEED PUMPS	11.49		SPL										85	Grade			1
P-2402A/B	STABILISER BOTTOMS PUMP	2.78		SPL										85	2.5			1
P-2421A/B	STABILISER OVERHEAD REFLUX PUMP	9.83		SPL										80	4			1
P-2453A/B	HYDROGENATION CHARGE PUMP	33.81	84.9	SPL										85	Grade			1
P-2481A/B	HYDROGENATION RECYCLE PUMP	40.88	85.8	SPL										85	Grade			1
P-2490A/B	STABILISER SIDE DRAW PUMP	0.83		SPL										80	Grade			1
P-2602A/B	FRACTIONATOR BOTTOMS PUMP	69.87	83.9	SPL										85	Grade			1
P-2603	HEAVIES DRAIN PUMP	0.10		SPL										80	Grade			1
P-2662A/B	LIGHTS TRANSFER PUMP	0.01		SPL										80	4			1
P-2672A/B	FRACTIONATOR REFLUX PUMP	6.87		SPL										85	Grade			1
P-2711A/B	FRACTIONATOR SIDE DRAW PUMP	3.03		SPL										80	8			1

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Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV						
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID								
	UTILITIES & STORAGE PUMPS																							
P-4251A/B	LIQUID HYDROCARBON PUMPS	1.07		SPL										80	Grade		0							
P-4540A/B	UTILITY WATER DISTRIBUTION PUMPS	36.32		SPL										85	Grade		1							
P-4610A/B	FIREWATER JOCKEY PUMPS	15.00		SPL										85	Grade		1							
P-4710A/B/C/D/E	COOLING WATER PUMPS	155.74	85.9	SWL	107	111	110	99	88	81	79	77	74	96.5	Grade		1							
P-4740A/B	COOLING WATER BOOSTER PUMPS	75.83		SPL										85	Grade		1							
P-5011A/B	GEMIN WATER PUMPS	14.07		SPL										85	Grade		1							
P-5030A/B	HP BFW PUMPS	102.52		SPL										85	Grade		1							
P-5040A/B	MP BFW PUMPS	102.81		SPL										85	Grade		1							
P-5460A/B	SUSPECT CONDENSATE PUMPS	16.38		SPL										85	Grade		1							
P-5510A/B	FRESH CAUSTIC DISTRIBUTION PUMP	2.68		SPL										85	Grade		1							
P-5810A/B	SULPHURIC ACID DISTRIBUTION PUMP	3.44		SPL										80	Grade		1							
P-6020A/B	ETHANOL FEED PUMPS	8.97	86.1	SPL										85	Grade		1							
P-6110A/B	REPROCESSED OLEFINS PUMP	2.68		SPL										85	Grade		1							
P-6170A/B	PARAFFINS REPROCESSING PUMPS	4.81		SPL										80	Grade		1							
P-6420A/B	JET PRODUCT BARGE TRANSFER PUMPS	134.92		SPL										85	Grade		1							



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					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
P-6450A/B	DIESEL PRODUCT STORAGE PUMPS	10.97		SPL										85	Grade		1
P-6601	ORGANIC WASTE LIFTING PUMP	8.52		SPL										85	Grade		1
P-6911A/B	EFFLUENT WATER PUMPS	5.40		SPL										85	Grade		1
P-7001A/B	HP FLARE KO DRUM PUMP			SPL										85	Grade		1
P-7151A/B	LP FLARE KO DRUM PUMP			SPL										85	Grade		1
P-7951	PROCESS AREA LIQUID HYDROCARBON RECOVERY PUMP	9.39		SPL										85	Below Grade		1



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					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
	PROCESS AREA VENDOR PACKAGES																
Z-1150	CATION GUARD BED PACKAGE			SPL									85	Grade		Noise limit set for plant equipment is 85 dBA at 1 meter.	1
Z-1200	ANION GUARD BED PACKAGE			SPL									85	Grade		Noise limit set for plant equipment is 85 dBA at 1 meter.	1
Z-1470	ETHYLENE PRODUCT GUARD BED PACKAGE			SPL									85	Grade		Noise limit set for plant equipment is 85 dBA at 1 meter.	1
Z-1650	ANTI HYDRATE ETHANOL DRYER PACKAGE			SPL									85	Grade		Noise limit set for plant equipment is 85 dBA at 1 meter.	1
Z-2680	VACUUM PUMP PACKAGE		75	SPL									85	12		Noise limit set for plant equipment is 85 dBA at 1 meter.	1
Z-3000	PROPANE REFRIGERATION PACKAGE		90.4	SPL									85	Grade		Package will be housed inside an enclosure. 85 dBA will be sound pressure level at 1 meter from compressor enclosure (size approximately 15m in length, 5m wide and 5m high). Reverberant sound inside building to be reviewed with vendor.	1



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					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID		
	UTILITIES & STORAGE - VENDOR PACKAGES																	
Z-3500	AIR COMPRESSOR PACKAGE		85	SPL										85	4	Noise limit set for plant equipment is 85 dBA at 1 meter.	1	
Z-3520	IA DRYER PACKAGE			SPL										85	Grade	Nitrogen Generation Noise Emitter likely to be Atmospheric Vaporizer. This will be 2 trains. Dimension of vaporizer, 2m x 2m (w x l) and 8.5m height.	1	
Z-3750	LIQUID NITROGEN STORAGE & VAPORIZERS PACKAGE			SPL										85	Grade	Noise limit set for plant equipment is 85 dBA at 1 meter.	1	
Z-4300	HYDROGEN GENERATION PACKAGE			SPL										85	Grade	Hydrogen generation package will be containerized. Container dimensions = 12.5m long, 2.5m wide, 6m height. Anticipated 3 containers supplied on site. Refer site layout for configuration.	1	
Z-4500	RAW WATER METERING PACKAGE			SPL										85	Grade	Noise limit set for plant equipment is 85 dBA at 1 meter.	1	
Z-4510	RAW WATER TREATMENT PACKAGE			SPL										85	4	Noise limit set for plant equipment is 85 dBA at 1 meter.	1	
Z-4700	COOLING TOWER PACKAGE INLET		105.1	SWL		76.4	84.8	88.2	94.9	99.2	101.3	101.6	99.7	106.8	6.5		No Mitigation Considered. Based upon a 2 cell together configuration.	1
Z-4700	COOLING TOWER PACKAGE CASING		105.1	SWL		90.4	92.9	89.1	84.7	81.1	75.4	78.9	60.1	96.4	Grade		No Mitigation Considered. Based upon a 2 cell together configuration. Supply anticipated to be 1 tower with 3 cells. Dimensions 31.5 m x 9.5m (l x w). Height approx 10 meters.	1
Z-4700	COOLING TOWER PACKAGE OUTLET		105.1	SWL		86.4	94.4	95.6	96.3	97.9	96.8	95	91.8	104.3	10		No Mitigation Considered. Based upon a 2 cell together configuration.	1
Z-5660	SPENT CAUSTIC NEUTRALISATION PACKAGE			SPL										85	Grade	Noise limit set for plant equipment is 85 dBA at 1 meter.	1	

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					31,5	63	125	250	500	1000	2000	4000	8000		A-WT			P&ID												
Z-6900	AOC WATER COLLECTION BASIN			SPL										-	Grade		Assumed Quiet	1												
Z-7320	PROPANOL INJECTION PACKAGE			SPL										85	Grade		Noise limit set for plant equipment is 85 dBA at 1 meter.	1												
Z-7450	FLARE GAS RECOVERY PACKAGE			SPL										85	4		Noise limit set for plant equipment is 85 dBA at 1 meter.	1												
Z-7710	PRODUCT TANKER LOADING PACKAGE			SPL										85	Grade		Noise limit set for plant equipment is 85 dBA at 1 meter.	1												

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					31,5	63	125	250	500	1000	2000	4000	8000		A-WT		
	TANKS - UTILITIES & STORAGE																
T-4520	UTILITY WATER TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-4600	FIRE WATER TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-5010	DEMIN WATER STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-5450	SUSPECT CONDENSATE STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-5501	FRESH CAUSTIC STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-5801	SULPHURIC ACID STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-6000 A/B/C/D	ETHANOL STORAGE TANKS			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1
T-6160	PARAFFINS REPROCESSING STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0
T-6400 A/B/C/D	JET PRODUCT STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0
T-6431 A/B/C	DIESEL PRODUCT STORAGE TANK			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	0

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Item Number	Service Description	Rated Power (kW)	Pre-FEED Sound Power Level (dB)	Sound Power Level (SWL) vs Sound Pressure Level (SPL) (Note 2)	Noise Data										Elevation (m)	PFD	Remarks	REV														
					31,5	63	125	250	500	1000	2000	4000	8000	A-WT		P&ID																
	FILTERS - UTILITIES & STORAGE																															
F-4711A/B/C	COOLING WATER PUMP ~~SUCKION~~ DISCHARGE FILTERS			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1															
F-4712A/B/C	COOLING WATER FILTERS			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1															
	DE-SUPERHEATERS																															
DS-5210	MP DESUPERHEATER			SPL	-	-	-	-	-	-	-	-	-	0 - 85	Grade	Assumed at Grade. To be confirmed at EPC phase.	1															
DS-5300	LP DESUPERHEATER			SPL	-	-	-	-	-	-	-	-	-	0 - 85	Grade	Assumed at Grade. To be confirmed at EPC phase.	1															
	SUMP/PIT																															
S-6910	EQUALISATION SUMP			SPL	-	-	-	-	-	-	-	-	-	-		Assumed Quiet	1															

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Appendix F Glossary

Ambient noise – the totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.

Attenuation – a general term used to indicate the reduction of noise or vibration, by whatever method or for whatever reason, and the amount in decibels, by which it is reduced.

A-weighting – a frequency weighting devised to attempt to take into account the fact human response to sound is not equally sensitive to all frequencies.

Background noise level – The INP defines the background noise level as ‘*the underlying level of noise present in ambient noise when all unusual extraneous noise is removed*’. Additionally, the INP states that ‘*sound levels contributing to background levels can include sound from nearby traffic, birds, insects, animals, machinery and similar sources if these sounds are a normal feature of the location*’.

dB(A) – the A-weighted sound pressure level.

dB(Z) or dB(Lin) – the Z-weighted (linear) sound pressure level.

Decibel (dB) – the logarithmic-scaled unit used to report the level or magnitude of sound.

Hertz (Hz) – the unit of frequency.

L (Level) – the sound pressure level (SPL); it implies the use of decibels related to the ratio of powers or the power related quantities such as sound intensity or sound pressure.

Loudness – the measure of the subjective impression of the magnitude or strength of a sound.

Noise descriptors – A noise descriptor is a measure of noise used to define a specific characteristic of noise, e.g. average energy, variation (maximum and minimum) and annoyance. Noise descriptors are based on measurements of the sound pressure level. Common noise descriptors are provided below:

$L_{Aeq,T}$	Time-average A-weighted sound pressure level
$L_{A90,T}$	Background A-weighted sound pressure level. Corresponds to the level that is exceeded for 90% of the measured time interval
$L_{Amax,T}$	Maximum A-weighted sound pressure level, obtained by arithmetically averaging of the maximum levels of the noise under investigation
$L_{Amin,T}$	Minimum A-weighted sound pressure level, obtained by arithmetic averaging of the minimum levels of the noise under investigation
$L_{A10,T}$	Level that is exceeded for 10% of the measured time interval. The L_{10} is typically used to measure road traffic noise
$L_{A1,T}$	Level that is equal to or exceeded for 1% of the time interval considered in the absence of the noise under investigation

Noise criteria – a maximum or minimum value imposed on a noise index e.g. a legal purpose.

PPV – Peak Particle Velocity measured in mm/s

RBL – Rating Background Level: Statistical noise descriptor used to describe the lowest noise levels (background) on site.

Sound power – the sound energy radiated per unit time by a sound source, measured in watts.

Sound propagation – the transfer of sound from one point to another.

Velocity – a vector quantity that specifies the time derivative of displacement.

Appendix G Bibliography

- Dooling, R. J., & Popper, A. N. (2007). *The Effects of Highway Noise on Birds*. California: nvironmental BioAcoustics LLC, for the California Department of Transportation, Division of Environmental Analysis.
- Dooling, R. J., Fay, R. R., & Popper, A. N. (2000). *Comparative Hearing: Birds and Reptiles*. Springer-Verslag.
- Larkin, R. P. (1996). *Effects of Military Noise on Wildlife: A Literature Review*. US: CWE/CERL.
- Manci et al. (1988). *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*. U.S. Fish and Wildlife Service National Ecology Research Centre.
- Radle, A. L. (2007). *The Effect of Noise on Wildlife: A Literature Review*.
- Warren, P. S., Katti, M., Ermann, M., & Brazel, A. (2006). Urban Bioacoustics: It's Not Just Noise. *Animal Behaviour*, 71, pp. 491-502.
- Wyle. (2003). *Noise Basics and the Effect of Aviation Noise on the Environment*. USA: Wyle.

Appendix H Calibration Certificates



THE CALIBRE TECHNOLOGY
ACOUSTIC & VIBRATION CALIBRATION CENTRE

CERTIFICATE OF CALIBRATION

Certificate Number: 7309

NATA Accreditation No: 20688

Customer: Vipac Engineers
Unit 2, 146 Leichhardt Street
Spring Hill, QLD 4000

Test Object: Calibrator
Manufacturer: ONO SOKKI
Model: SC-2120
Serial No: 35100926
Class: 2
Adapter Make: None
Adapter Model: N/A

Environmental Conditions:	Pressure	Temperature	Relative Humidity
Reference Conditions:	101.325 kPa	23.0 °C	50.0 % RH
Measurement Conditions:	100.737 kPa	24.3 °C	51.8 % RH

Measurement Results:	Level	Frequency	THD + Noise
1:	93.96 dB	1000.61 Hz	1.18 %
2:	93.95 dB	1000.63 Hz	1.20 %
3:	93.99 dB	1000.62 Hz	1.23 %
Result (Average):	93.97 dB	1000.62 Hz	1.20 %
Expanded Uncertainty:	0.11 dB	1.00062 Hz	0.3 %
Degree of Freedom:	>100	>100	>100
Coverage Factor:	2.00	2.00	2.00

The stated level is relative to 20µPa and is valid at measurement conditions.
Tested when received - no adjustments required to comply with tolerances in IEC 60942.

Accredited for Compliance with ISO/IEC 17025 - Calibration

The results of the tests, calibrations and/or measurements included in this document are traceable to the International System of Units (SI) via International and Australian/national standards. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

Date of Calibration: 15/11/2023
Date of Issue: 16/11/2023
Authorised Signatory:



Claire Richardson

Calibration Location:
Unit 3, 4 Tombo Street, Capalaba, QLD 4157
07 3245 1730
enquiries@calibretechnology.com.au
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THE CALIBRE TECHNOLOGY

ACOUSTIC & VIBRATION CALIBRATION CENTRE

CERTIFICATE OF CALIBRATION

Certificate Number: 8569

NATA Accreditation No: 20688

Customer: Vipac Engineers
Unit 2, 146 Leichhardt Street, Spring Hill, QLD 4000

Test Object:	Manufacturer:	Model:	Serial No:	ID:
Sound Level Meter	Norsonic	Nor139	1393022	8569
Microphone	Norsonic	1228	03539	8569
Preamplifier	Norsonic	1207	21606	8569
Calibrator	None	-	-	-
Connecting Cable	Unknown	N/A	N/A	N/A

Information:

Test Configuration: Microphone on preamp with connecting cable.
Instrument Manual: Nor139 User Manual
Firmware Version: 4.0.1430
Class of Instrument: Class 1
Source of Correction Data: Norsonic
Reference Level: 114 dB
Reference Level Range: 55 - 130 dB

Environmental Conditions:	Pressure	Temperature	Relative Humidity
Reference Conditions:	101.325 kPa	23.0 °C	50.0 % RH
Conditions Before Measurement:	102.51 kPa	23.9 °C	47.2 % RH
Conditions After Measurement:	102.51 kPa	23.9 °C	47.2 % RH

The laboratory environmental conditions remained within the acceptable limits as defined in IEC 61672.3 and IEC 61260 throughout the calibration test.

The measurements are performed according to the IEC 61672 Sound level meters - Part 3: Periodic tests (2013), and DIN 45657 Sound Level Meters - Requirements for Special Applications (2015). Where applicable testing has also been completed in accordance with IEC 61260 Electroacoustics - Octave-band and fractional-octave-band filters (2016).

This certificate only relates to the test object calibrated. This certificate shall only be reproduced in full with the permission of Calibre Technology.

Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to the International System of Units (SI) via international or Australian/national standards. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

Date of Calibration: 05/09/2024
Date of Issue: 06/09/2024
Authorised Signatory:



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Calibration Location:
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THE CALIBRE TECHNOLOGY

ACOUSTIC & VIBRATION CALIBRATION CENTRE

CERTIFICATE OF CALIBRATION

Certificate Number: 7093

NATA Accreditation No: 20688

Customer: Vipac Engineers
Unit 2, 146 Leichhardt Street
Spring Hill, QLD 4000

Test Object:	Manufacturer:	Model:	Serial No:	ID:
Sound Level Meter	Brüel & Kjær	2270-4189	3028505	7093
Microphone	Brüel & Kjær	4189	3099668	7093
Preamplifier	Brüel & Kjær	ZC0032	25847	7093
Calibrator	None	-	-	-
Connecting Cable	None	-	-	-

Information:

Test Configuration:	Microphone on Preamp
Instrument Manual:	Instruction Manual-Hand-Held Analyzer Types 2250, 2250-L and 2270 BE1712
Firmware Version:	V4.7.6.244
Class of Instrument:	Class 1
Source of Correction Data:	Brüel & Kjær
Reference Level:	114 dB
Reference Level Range:	55 - 130 dB

Environmental Conditions:	Pressure	Temperature	Relative Humidity
Reference Conditions:	101.325 kPa	23.0 °C	50.0 % RH
Conditions Before Measurement:	101.96 kPa	25.3 °C	49.0 % RH
Conditions After Measurement:	101.96 kPa	25.3 °C	49.0 % RH

The laboratory environmental conditions remained within the acceptable limits as defined in IEC 61672.3 and IEC 61260 throughout the calibration test.

The measurements are performed according to the IEC 61672 Sound level meters – Part 3: Periodic tests (2013), and DIN 45657 Sound Level Meters – Requirements for Special Applications (2015). Where applicable testing has also been completed in accordance with IEC 61260 Electroacoustics – Octave-band and fractional-octave-band filters (2016).

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Accredited for compliance with ISO/IEC 17025 - Calibration.

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Date of Calibration: 22/09/2023
Date of Issue: 27/09/2023
Authorised Signatory:



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Calibration Location:
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THE CALIBRE TECHNOLOGY
ACOUSTIC & VIBRATION CALIBRATION CENTRE

CERTIFICATE OF CALIBRATION

Certificate Number: 7776

NATA Accreditation No: 20688

Customer: **Belcur**
5 Lang Street
Pelican Waters, QLD, Australia 4551

Test Object:	Manufacturer:	Model:	Serial No:	ID:
Sound Level Meter	Norsonic	Nor140	1404703	7776
Microphone	Norsonic	122B	02586	7776
Preamplifier	Norsonic	1209	15161	7776
Calibrator	None	-	-	-
Connecting Cable	None	-	-	-

Information:
Test Configuration: Microphone on preamp
Instrument Manual: Nor-140 Instruction Manual
Firmware Version: 2.1.670
Class of Instrument: Class 1
Source of Correction Data: Norsonic
Reference Level: 114 dB
Reference Level Range: 55 - 130 dB

Environmental Conditions:	Pressure	Temperature	Relative Humidity
Reference Conditions:	101.325 kPa	23.0 °C	50.0 % RH
Conditions Before Measurement:	101.83 kPa	23.7 °C	59.1 % RH
Conditions After Measurement:	101.83 kPa	23.7 °C	59.1 % RH

The laboratory environmental conditions remained within the acceptable limits as defined in IEC 61672.3 and IEC 61260 throughout the calibration test.

The measurements are performed according to the IEC 61672 Sound level meters - Part 3: Periodic tests (2013), and DIN 45657 Sound Level Meters - Requirements for Special Applications (2015). Where applicable testing has also been completed in accordance with IEC 61260 Electroacoustics - Octave-band and fractional-octave-band filters (2016).

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Date of Calibration: 08/03/2024
Date of Issue: 10/03/2024
Authorised Signatory:



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THE CALIBRE TECHNOLOGY

ACOUSTIC & VIBRATION CALIBRATION CENTRE

CERTIFICATE OF CALIBRATION

Certificate Number: 7945

NATA Accreditation No: 20688

Customer: Belcur PTY LTD
5 Lang Street
Pelican Waters, QLD, Australia 4551

Test Object:	Manufacturer:	Model:	Serial No:	ID:
Sound Level Meter	Norsonic	Nor139	1392780	7945
Microphone	Norsonic	1228	02565	7945
Preamplifier	Norsonic	1207	20310	7945
Calibrator	None	-	-	-
Connecting Cable	None	-	-	-

Information:
Test Configuration: Microphone on Preamp
Instrument Manual: Nor 139 User Manual
Firmware Version: V4.0.1312
Class of Instrument: Class 1
Source of Correction Data:
Reference Level: 114 dB
Reference Level Range: 55 - 130 dB

Environmental Conditions:	Pressure	Temperature	Relative Humidity
Reference Conditions:	101.325 kPa	23.0 °C	50.0 % RH
Conditions Before Measurement:	101.37 kPa	23.6 °C	59.1 % RH
Conditions After Measurement:	101.37 kPa	23.6 °C	59.1 % RH

The laboratory environmental conditions remained within the acceptable limits as defined in IEC 61672.3 and IEC 61260 throughout the calibration test.

The measurements are performed according to the IEC 61672 Sound level meters - Part 3: Periodic tests (2013), and DIN 45657 Sound Level Meters - Requirements for Special Applications (2015). Where applicable testing has also been completed in accordance with IEC 61260 Electroacoustics - Octave-band and fractional-octave-band filters (2016).

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Accredited for compliance with ISO/IEC 17025 - Calibration.

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Date of Calibration: 26/04/2024
Date of Issue: 30/04/2024
Authorised Signatory:



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THE CALIBRE TECHNOLOGY

ACOUSTIC & VIBRATION CALIBRATION CENTRE

CERTIFICATE OF CALIBRATION

Certificate Number: 7965

NATA Accreditation No: 20688

Customer: Vipac
Unit 2, 146 Leichhardt Street
Spring Hill, QLD 4000

Test Object:	Manufacturer:	Model:	Serial No:	ID:
Sound Level Meter	Norsonic	Nor139	1392998	7965
Microphone	Norsonic	1228	03704	7965
Preamplifier	Norsonic	1207	21573	7965
Calibrator	None	-	-	-
Connecting Cable	None	-	-	-

Information:

Test Configuration: Microphone on Preamp
Instrument Manual: Norsonic Nor139
Firmware Version: V4.0.1430
Class of Instrument: Class 1
Source of Correction Data: Norsonic
Reference Level: 114 dB
Reference Level Range: 55 - 130 dB

Environmental Conditions:	Pressure	Temperature	Relative Humidity
Reference Conditions:	101.325 kPa	23.0 °C	50.0 % RH
Conditions Before Measurement:	102.16 kPa	23.4 °C	54.0 % RH
Conditions After Measurement:	102.35 kPa	23.9 °C	65.3 % RH

The laboratory environmental conditions remained within the acceptable limits as defined in IEC 61672.3 and IEC 61260 throughout the calibration test.

The measurements are performed according to the IEC 61672 Sound level meters - Part 3: Periodic tests (2013), and DIN 45657 Sound Level Meters - Requirements for Special Applications (2015). Where applicable testing has also been completed in accordance with IEC 61260 Electroacoustics - Octave-band and fractional-octave-band filters (2016).

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Accredited for compliance with ISO/IEC 17025 - Calibration.

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Date of Calibration: 15/05/2024
Date of Issue: 21/05/2024
Authorised Signatory:



Claire Richardson

Calibration Location:
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Certificate of Calibration

Certificate No.: 477978688

Object: Sound Analyser Nor139

Supplier: Norsonic AS

Type: Nor139

Serial number: 1393030

Client: Belcur Pty Ltd.

This instrument is tested and calibrated in accordance to the Norsonic production standard set for Nor139, ensuring that the instrument conforms to the following standards;

IEC 61672-1:2002 class 1
IEC 61260-1 class 1 Ed 1.0 2014-02
ANSI S1.4-1983 (R2001) with amd. S1.4A-1985 class 1
ANSI S1.43-1997 (R2002) class 1
ANSI S1.11-2004 class 1
DIN 45 657, Applicable parts
IEC 61094 part 4

Instrumentation used for calibration traceable to:

Electrical Parameters: MT, Norway
Acoustical Parameters: PTB, Germany
Environmental Parameters: Justervesenet, Norway

Adjustments: None

Comments: None

Date of calibration:

2023-01-27

Calibration interval recommended

2 years

The environmental parameters applicable to this calibration are kept well within limits ensuring negligible deviation on obtained measurement results.

Calibrated by:

Sign.



Norsonic AS, P.B 24, 3421 Lierskogen. Visitor address: Gunnersbråtan 2, Tranby, Norway.
Phone +47 32858900 Fax: +47 32852208, email: info@norsonic.com