GOOD EARTH GREEN HYDROGEN & AMMONIA PROJECT

NOISE AND VIBRATION IMPACT ASSESSMENT

REPORT NO. 17230-N
VERSION 1.0

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PREPARED FOR

HIRINGA SUNDOWN PROJECT TRUST
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1. MAAS = Member, Australia Acoustical Society.

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. The most common of these noise descriptors are defined below.

L_{Amax} The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time.

L_{A90} The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This descriptor is a common measure of environmental noise.

ABL The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day.

RBL The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

1 INTRODUCTION

1.1 Project Overview

The Good Earth Green Hydrogen and Ammonia ('GEGHA') Project is an integrated solar energy to hydrogen and ammonia plant that will be constructed at the Wathagar cotton gin in northern NSW, approximately 33km southwest of Moree. The locality of the project is shown in **Figure 1-1**.

The GEGHA Project's primary objective is to safely construct and operate a green hydrogen and ammonia plant that is capable of delivering an annual production of up to 2,200 tonnes of hydrogen and up to 4,500 tonnes of Ammonia to local and regional offtakers.

The project will involve the construction and operation of a new 27MW (DC) solar farm that will provide the power source for the electrolysis plant, ammonia plant, hydrogen storage, ammonia storage and ancillary infrastructure and connections.

The majority of hydrogen will be used on site to produce low-carbon fertiliser (anhydrous ammonia). There will also be a quantity of hydrogen available for use in on-farm fuel conversion and displacement of high-carbon fuels and feedstock in industrial manufacturing and heavy vehicle transport refuelling.

1.2 Project Components

The GEGHA Project's key components consist of the construction and operation of:

- 15 MW of hydrogen electrolysis utilising high pressure alkaline electrolysers:
    - Maximum 6 tonnes per day
    - Maximum 2,200 tonnes per year
- 16 tonne per day ammonia (NH3) plant, to convert green hydrogen and atmospheric nitrogen feedstock into green ammonia.
- Production limited to maximum 4,500 Tonnes per year (based on energy availability).
- Up to 3 tonnes of Hydrogen storage to balance production and demand.
- Up to 600 tonnes of ambient temperature ammonia storage capacity to buffer against seasonal ammonia demand and renewable energy variability.
- Approximately 51 ML of water per year.
- Evaporation pond with a capacity of 16,200 KL.
- Ancillary power and water pump/ connections, water treatment, telemetry, security camera system, switch room and control room.
- Protective perimeter fencing.

- Custody transfer metering for both hydrogen and ammonia.
- Ammonia and Hydrogen Load out facilities adjacent to storage vessels.
- Car park and site office.

It is proposed that the ammonia and hydrogen production will be powered by:

- A new 27 MW (DC) solar farm adjacent to the site.
- 30 MWh of Battery Energy Storage System (BESS) adjacent to site.
- Utilising redundant energy from the existing 8.65 MW (DC) Wathagar Stage 1 solar farm in close proximity to the development.
- Low capacity grid connection for firming and stability with renewable energy Power Purchase Agreement (PPA).

The Plant will have a maximum water requirement of 51ML per annum which will be sourced from:

- Drainage water from the Wathagar gin yard which will be drawn from an existing 198ML capacity dam; and
- Supplementary supply of Groundwater from the established Wathagar bore (on site adjacent to the Wathagar gin). This would be subject to further licencing and approvals.

The existing Wathagar gin access will be subject to an upgrade to enable heavy goods vehicles to safely pass each other on entry/ exit. The upgrade forms part of the Wathagar Solar Farm Stage 2 Scope.

The locations of the GEGHA Plant and the project's disturbance footprint relative to the Wathagar gin site are shown in **Figure 1-2**.

1.3 Aspects outside of the State Significant Development Scope

Aspects considered outside of GEGHA's SSD Scope include:

- Power generation (including the Wathagar solar farm Phase 1 and Phase 2)
- Transport of hydrogen and ammonia off site
- Hydrogen and Ammonia end use
- Operation of the Wathagar gin
- Existing use of the Keytah water bore
- Upgrade of the Wathagar gin entry

It is considered that each of these aspects are subject to their own regulatory consenting and operational regime and would operate independently of the GEGHA project.

1.4 Project Location

The GEGHA Project is located just off the Gwydir Highway adjacent to the existing Wathagar gin. Site selection for the GEGHA Project focused on proximity existing power and water sources required for the plant's operation.

The area where the main plant and equipment will be constructed is flat, largely cleared and has previously been used for 'waste cotton trash' storage. The closest residence is the gin manager's residence, approximately 1.4km away. The nearest off-farm residence is approximately 3.9km away from the plant boundary.

All above ground buildings, plant and equipment will be fully contained within the Wathagar gin flood protection levee which, in addition to providing an important flood defence, creates a visual screening barrier from the adjacent Gwydir highway.

Access to site is provided via the existing access to Wathagar gin off the Gwydir Highway. A secondary access option is available should the upgrade to the primary access not be completed by construction commencement.

Figure 1-1 Project Locality

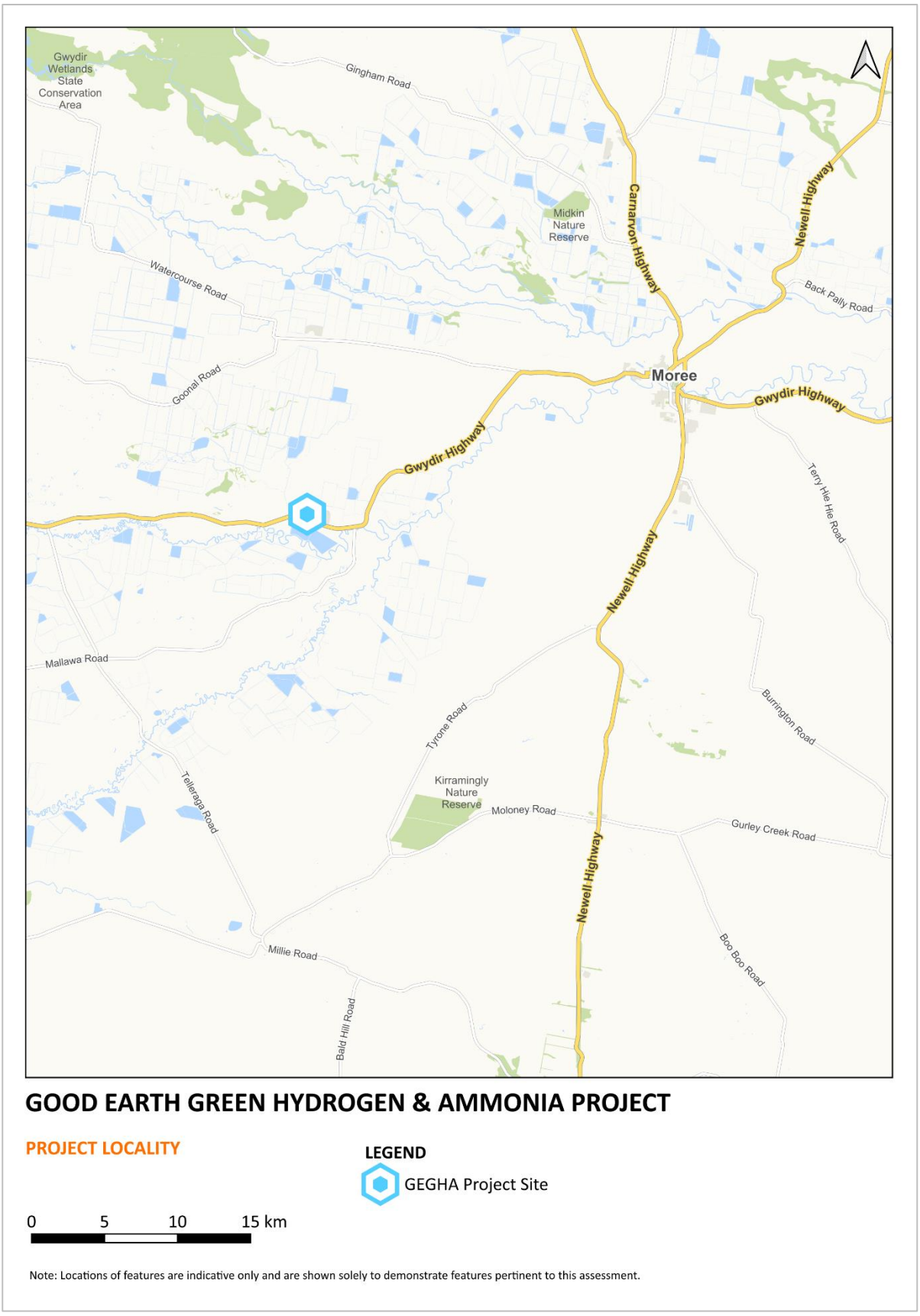


Figure 1-2 Project Extents

1.5 Purpose of this Assessment

SoundIN Pty Ltd (SoundIN) has been engaged by HSPT, to prepare a Noise and Vibration Impact Assessment (NVIA) for the Project. This report presents an assessment of potential noise and vibration impacts associated with the construction and operation of the GEGHA Project at nearby sensitive receivers. The assessment has been conducted in general accordance with the following NSW Government guidelines and policies:

- *Interim Construction Noise Guideline* (DECC, 2009)
- *Noise Policy for Industry* (EPA, 2017)
- *NSW Road Noise Policy* (DECCW, 2011)

No significant sources of vibration are likely to be associated with the construction or operation of the proposal. Accordingly, a detailed assessment of vibration impacts has not been conducted.

2 EXISTING ENVIRONMENT

2.1 Sensitive Receivers

The nearest and most potentially affected sensitive receivers, not associated with Sundown Pastoral, comprise several isolated rural dwellings located more than 3 kilometres from the site.

It is noted that a manager's residence is located on the Wathagar gin site and several dwellings are located on the "Keytah" property to the west of the GEGHA Project site. These dwellings are owned in full or in part by Sundown Pastoral Company, a JV partner of the GEGHA Project.

Receivers considered in this assessment are identified in **Table 2-1** and shown in **Figure 2-1**.

Table 2-1 Sensitive Receivers

Receiver ID	Distance (km)	
	GEGHA Plant boundary	Disturbance footprint
R1	4.1	3.2
R2	4.3	2.9
R3	4.6	3.1
Gin Manager	1.4	0.4
Keytah 1 (K1)	0.9	0.9
Keytah 2 (K2)	1.0	1.0
Keytah 3 (K3)	1.1	1.1
Keytah 4 (K4)	1.1	1.1
Keytah 5 (K5)	1.1	1.1

2.2 Existing Noise Environment

Unattended noise monitoring was conducted between Tuesday 8 and Thursday 17 August 2023 to establish the existing ambient noise levels at the most potentially affected nearby receivers.

The noise monitoring location is shown in **Figure 2-1**. The monitoring location (L1) was selected for the following reasons:

- L1 was considered to have an ambient noise environment (i.e. quiet rural setting) representative of the nearest and most potentially affected sensitive receivers near the GEHGA Project.
- Ease of gaining landowner consent to access private property.

The noise monitoring equipment used for these measurements consisted of environmental noise loggers set to A-weighted, fast response. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

From the background noise levels (L_{A90}) the Rating Background Levels (RBLs) were determined using the methodology recommended in the *Noise Policy for Industry* (NPfI) and are presented in **Table 2-2**.

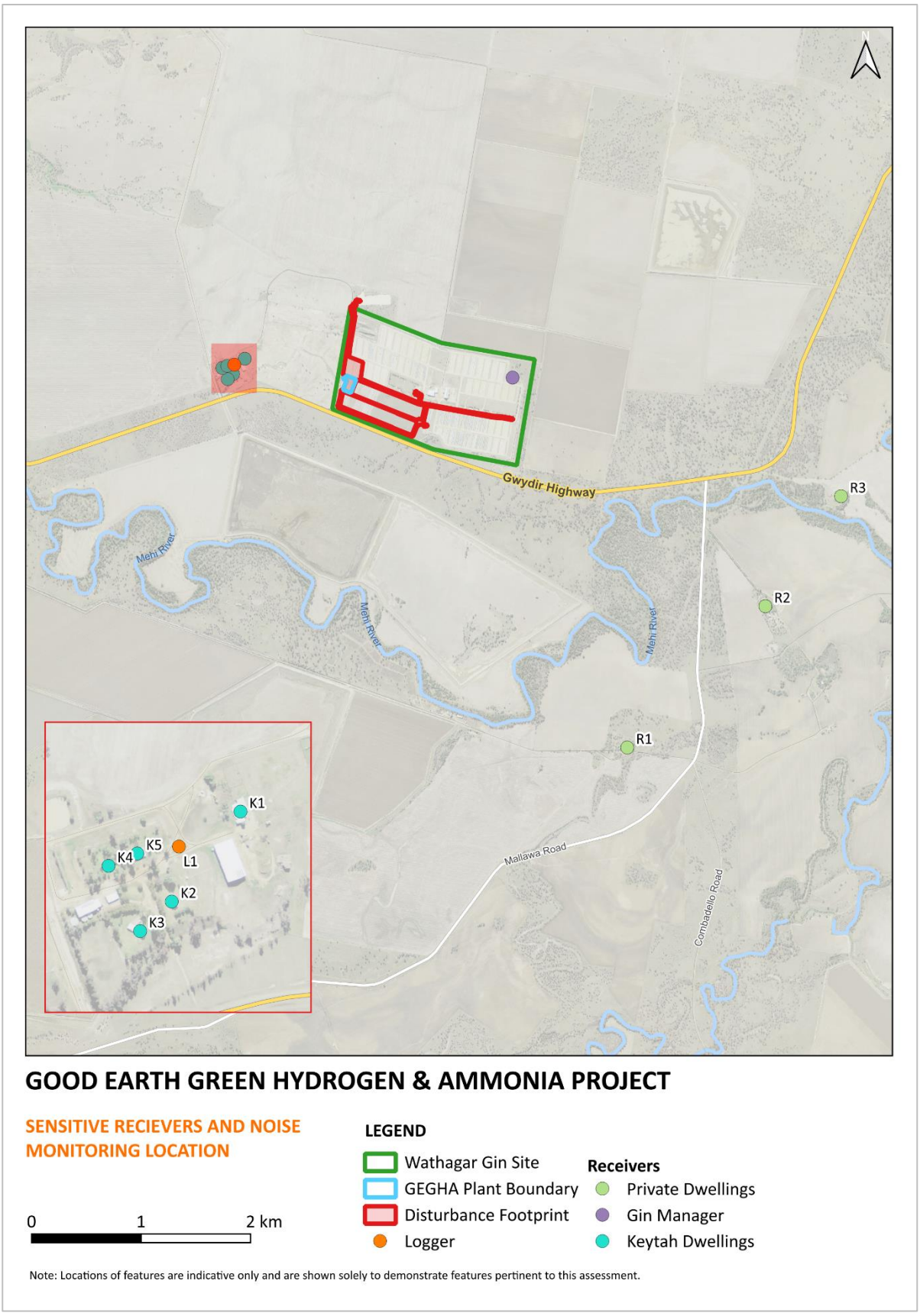
The NPfI recommends a minimum RBL of 35 dBA for the daytime assessment period and 30 dBA for the evening and night time assessment periods. The daytime and night time RBL values calculated from the noise monitoring data were below the minimum recommended values and have been adjusted accordingly. The unadjusted values are presented (in brackets) in **Table 2-2.**

Table 2-2 Rating Background Levels (RBL)

Monitoring Location	Rating background level (dBA)		
	Day (7am – 6pm)	Evening (6pm – 10pm)	Night (10pm – 7am)
L1	35 (29)	30 (23)	30 (26)

It is noted that, since the measured RBL at L1 are below the minimum recommended values, the choice of monitoring location does not materially affect the noise assessment.

Figure 2-1 Sensitive Receivers and Noise Monitoring Location



3 CONSTRUCTION NOISE ASSESSMENT

3.1 Construction Noise Management Levels

The *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) recommends noise management levels (NML) to reduce the likelihood of noise impacts arising from construction activities. The ICNG NML for residential receivers are presented in **Table 3-1**.

Table 3-1 Construction NML – Residential Receivers

Time of day	Management level – $L_{Aeq,15min}$ (dBA)	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected. RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected. 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected. RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see *ICNG* section 7.2.2.

Construction activities associated with the GEGHA Project would be conducted during recommended standard hours. In accordance with the ICNG, works that may be undertaken outside of standard hours would include:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads.
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm.
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours.

The Gin Manager's residence is located on the Wathagar Gin site and would rarely be inhabited during standard construction hours. Accordingly, the Gin Manager's residence is not considered to be a sensitive receiver for the purposes of assessing construction noise impacts.

Project-specific construction NML for the most potentially affected receivers near the Site are presented in **Table 3-2**.

Table 3-2 Project-specific Construction NML

Receiver	Acceptable $L_{Aeq,15min}$ noise level (standard daytime hours) (dBA)	Highly affected noise level (dBA)
R1 – R3 & K1 – K5	45	75

3.2 Noise Modelling Methodology and Assumptions

Construction noise emissions from the GEGHA Project have been modelled using SoundPLAN v8.2. The selected noise calculation method is International Standard ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation* (ISO 9613-2).

Factors accounted for by ISO 9613-2 are:

- Noise source sound power and locations
- Shielding from ground topography and structures
- Noise attenuation due to geometric spreading
- Ground absorption
- Atmospheric absorption.

ISO 9613-2 is a "downwind" model, which conservatively assumes that each receiver is downwind from all noise sources.

3.3 Construction Plant, Activities and Sound Power Levels

Sound levels of typical construction equipment are listed in **Table 3-3**. Equipment sound levels have been determined from Transport for NSW's *Construction Noise Estimator* and the UK Department of Environment, Food and Rural Affairs' (DEFRA) *Noise Database for Prediction of Noise on Construction and Open Sites*.

The table gives both Sound Power Level (SWL) and Sound Pressure Level (SPL) at seven metres from the equipment. SWL is independent of measurement position. Verification of plant noise is often done by measuring the SPL at seven metres.

Based on the information in **Table 3-3**, activity sound power levels for several key construction phases have been calculated and are presented in **Table 3-4**.

Table 3-4 presents typical worst-case construction source noise levels across a 15-minute period, considering the likely usage of plant during that time, termed the "activity sound power level". The activity sound power is considered to represent the typical worst-case level in a given 15-minute period. It is important to note that this sound power level is unlikely to be sustained at such a level for the duration of the activity. As a result, many 15-minute periods will be at lower levels.

Table 3-3 Typical Construction Plant Sound Levels

Equipment	Sound Power Level, L_{Aeq} (dBA)	Sound Pressure Level at 7m, L_{Aeq} (dBA)
Bulldozer (D9)	116	91
Grader	113	88
Dump truck	108	83
Excavator, Large (~30t)	109	84
Concrete truck	107	82
Concrete pump	112	87
Concrete saw	113	88
Forklift	106	81
Mobile Crane	110	85
Hand-held power tools	109	84
Generator	104	79
Welder	105	80

Table 3-4 Construction Phase Activities and Associated Sound Power Levels

Code	Activity	Typical Equipment Used	Activity Sound Power Level (dBA)
S01	Earthworks, including internal road upgrades, services and drainage works	Dozer Grader Dump truck Excavator	119
S02	Concrete works	Concrete truck Concrete pump Concrete saw	116
S03	Plant installation and commissioning	Hand-held power tools Mobile crane Telehandler Generator Welder Truck	114

3.4 Predicted Construction Noise Levels

The predicted $L_{Aeq,15min}$ noise levels at sensitive receivers during the identified activities are presented in **Table 3-5**.

The results indicate that construction noise levels are predicted to comply with the NML at all nearby sensitive receivers across the duration of the works.

It is noted that the predicted construction noise levels are below 20 dBA at some receivers during scenarios S02 and S03. Predicted noise levels below 20 dBA are not explicitly stated as it is not reasonably practicable to validate such low noise levels via measurement.

Noting the very low predicted construction noise levels at nearby sensitive receivers, no specific measures to mitigate construction noise emissions are recommended.

Table 3-5 Predicted Construction Noise Levels at Sensitive Receivers

Receiver	Predicted Construction $L_{Aeq,15min}$ Noise Levels (dBA)			NML	Exceedance (dBA)
	S01	S02	S03		
R1	22	<20	<20	45	-
R2	23	<20	<20	45	-
R3	22	<20	<20	45	-
Gin Manager	51	33	31	-	-
K1	39	37	35	45	-
K2	37	36	34	45	-
K3	37	36	34	45	-
K4	36	35	33	45	-
K5	36	35	33	45	-

4 OPERATIONAL NOISE ASSESSMENT

This section presents an assessment of potential noise impacts on sensitive off-site receivers due to the operation of the GEGHA Project.

4.1 Operational Noise Trigger Levels

The *Noise Policy for Industry* (NPfI) (EPA, 2017) provides a framework for assessing environmental noise impacts from industrial premises and industrial development proposals in New South Wales.

The NPfI recommends the development of project noise trigger levels, which provide a benchmark for assessing a proposal or site. The project noise trigger levels should not be interpreted as mandatory noise criteria but, rather, as noise levels that, if exceeded, would indicate a potential noise impact on the community.

The project noise trigger level is the lower value of the project intrusiveness noise level and the project amenity noise level. The project intrusiveness noise level assesses the likelihood of noise being intrusive above the ambient noise level and is applied to residential receivers only. The project amenity noise level ensures the total industrial noise from all sources in the area does not rise above a maximum acceptable level.

The NPfI stipulates that project noise trigger levels are determined for the daytime (7am – 6pm), evening (6pm – 10pm) and night time (10pm – 7am) periods, as relevant. The determined trigger levels typically apply at the most affected point on or within the receiver property boundary within 30 metres of a dwelling.

4.1.1 Project Intrusiveness Noise Level

The intrusiveness noise level is the noise level 5 dBA above the rating background noise level (RBL) for each time period (daytime, evening or night time) of interest at a residential receiver. The RBL is derived from the measured L_{A90} noise levels.

The NPfI stipulates that project intrusiveness noise levels should not be set below 40 dBA during the daytime and 35 dBA in the evening and night time. Additionally, the NPfI recommends that the project intrusiveness noise level for evening is set at no greater than that for the daytime, and that the project intrusiveness level for night time is set at no greater than that for the evening and daytime.

Project intrusiveness noise levels, based on the RBL presented in Section **2.2**, are summarised in **Table 4-1**.

Table 4-1 Project Intrusiveness Noise Levels

Receiver	Time of day [1]	RBL (dBA)	Project Intrusiveness noise level – $L_{Aeq,15min}$ (dBA)
R1 – R3 & K1 – K5	Day	35	40
	Evening	30	35
	Night	30	35

1. Day – 7am – 6pm; Evening = 6pm – 10pm; Night = 10pm – 7am.

4.1.2 Project Amenity Noise Levels

Project amenity noise levels aim to set a limit on continuing increases in noise levels from all industrial noise sources affecting a variety of receiver types; that is, the ambient noise level in an area from all industrial noise sources remains below recommended amenity noise levels.

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include transportation noise (when on public transport corridors), noise from motor sport, construction noise, community noise, blasting, shooting ranges, occupational workplace noise, wind farms, amplified music/patron noise.

The amenity noise level aims to limit continuing increases in noise levels which may occur if the intrusiveness level alone is applied to successive development within an area.

The recommended amenity noise level represents the objective for total industrial noise at a receiver location. The project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

To prevent increases in industrial noise due to the cumulative effect of several developments, the project amenity noise level for each new source of industrial noise is set at 5dBA below the recommended amenity noise level.

The following exceptions apply to determining the project amenity noise level:

- For high-traffic areas the amenity criterion for industrial noise becomes the $L_{Aeq,period(traffic)}$ minus 15dBA.
- In proposed developments in major industrial clusters.
- If the resulting project amenity noise level is at least 10 dB lower than the existing industrial noise level, the project amenity noise level can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
- Where cumulative industrial noise is not a consideration because no other industries are present in, or likely to be introduced into the area, the relevant amenity noise level is assigned as the project amenity noise level for the development.

Amenity noise levels are not used directly as regulatory limits. They are used in combination with the project intrusiveness noise level to assess the potential impact of noise, assess mitigation options and determine achievable noise requirements.

The project amenity noise levels are calculated from the recommended amenity noise levels presented in **Table 4-2**.

Table 4-2 Recommended Amenity Noise Levels

Receiver	Noise amenity area	Time of day [1]	Recommended amenity noise level – $L_{Aeq,period}$ (dBA)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretaker's quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dBA above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day.
School classroom (internal)	All	Noisiest 1-hour period when in use	35
Hospital ward:			
Internal	All	Noisiest 1-hour	35
External	All	Noisiest 1-hour	50
Place of worship (internal)	All	When in use	40
Area specifically reserved for passive recreation (e.g., national park)	All	When in use	50

Receiver	Noise amenity area	Time of day [1]	Recommended amenity noise level – $L_{Aeq,period}$ (dBA)
Active recreation area (e.g., school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dBA to recommended noise amenity area

1. Day – 7am – 6pm; Evening = 6pm – 10pm; Night = 10pm – 7am.

Recommended amenity noise levels presented in **Table 4-2** represent the objective for total industrial noise at a receiver location. In the case of a single new noise source being proposed, the project amenity noise level represents the objective for noise from a single industrial development at the receiver location. This is typically calculated as the recommended amenity noise level minus 5 dBA.

Due to different averaging periods for the $L_{Aeq,15min}$ and $L_{Aeq,period}$ noise descriptors, the values of project intrusiveness and amenity noise levels cannot be compared directly when identifying noise trigger levels i.e. the most stringent values of each category. To make a comparison between descriptors, the NPfI assumes that the $L_{Aeq,15min}$ equivalent of an $L_{Aeq,period}$ noise level is equal to the $L_{Aeq,15min}$ level plus 3dB.

Private dwellings (R1 – R3) and dwellings on the Keytah Property (K1 – K5) are classified as being in a "rural" noise amenity area. The Gin Manager's residence is classified as a caretaker's quarters.

The project amenity noise levels for the GEGHA Project are presented in **Table 4-3**.

Table 4-3 Project Amenity Noise Levels

Receiver	Time of day [1]	Recommended amenity noise level – $L_{Aeq,period}$ (dBA)	Project amenity noise level – $L_{Aeq,15min}$ (dBA)
R1 – R3 & K1 – K5	Day	50	48
	Evening	45	43
	Night	40	38
Gin Manager	Day	55	53
	Evening	50	48
	Night	45	43

1. Day – 7am – 6pm; Evening = 6pm – 10pm; Night = 10pm – 7am.

4.1.3 Project Noise Trigger Levels

The project intrusiveness noise levels and project amenity noise levels for sensitive receivers are summarised in **Table 4-4**. The project noise trigger levels (PNTL) – which are the lower values of the project intrusiveness noise levels and the project amenity noise levels – are highlighted in bold.

Table 4-4 Project Noise Trigger Levels

Receiver	Time of day [1]	Project intrusiveness noise level – $L_{Aeq,15min}$ (dBA)	Project amenity noise level – $L_{Aeq,15min}$ (dBA)
R1 – R3 & K1 – K5	Day	**40**	48
	Evening	**35**	43
	Night	**35**	38
Gin Manager	Day	-	**53**
	Evening	-	**48**
	Night	-	**43**

1. Day – 7am – 6pm; Evening = 6pm – 10pm; Night = 10pm – 7am.

4.1.4 Maximum Noise Trigger Levels

Noise sources at night occurring over a short duration have the potential to cause sleep disturbance despite complying with project noise trigger levels. The GEGHA Project would operate on a 24-hour

basis. Therefore, maximum noise level events need to be considered for potential sleep disturbance.

The NPfI recommends that, where the night time L_{Amax} receiver noise levels from a development exceeds 52 dBA or the RBL plus 15 dBA, whichever is the greater, then a more detailed assessment of potential sleep disturbance impacts is warranted. **Table 4-5** presents the maximum noise trigger levels for the receivers identified in this assessment.

Table 4-5 Maximum Noise Trigger Levels

Receiver	RBL (dBA)	RBL + 15 (dBA)	Maximum Noise Trigger Level (dBA)
R1 – R3 & K1 – K5	30	45	52

In accordance with the NPfI, in instances where night time $L_{Aeq,15min}$ noise levels exceed 40 dBA or the prevailing RBL plus 5 dBA, whichever is the greater, then a detailed assessment of potential sleep disturbance impacts is warranted. Since the night time project noise trigger level is less than 40 dBA for all nearby residential receivers, compliance with these noise trigger levels will ensure that no further assessment of night time $L_{Aeq,15min}$ noise levels, with regard to sleep disturbance, would be required.

4.2 Noise Modelling Methodology and Assumptions

Operational noise emissions from the Proposal have been modelled using SoundPLAN v8.2, using the CONCAWE prediction algorithm. The CONCAWE noise propagation model is used around the world and is widely accepted as an appropriate model for predicting noise over significant distances. Factors addressed in the noise modelling are:

- Equipment noise level emissions and locations
- Shielding from structures
- Noise attenuation due to geometric spreading
- Meteorological conditions
- Ground absorption
- Atmospheric absorption.

4.2.1 Meteorological Effects

At relatively large distances from a source, the resultant noise levels at receivers can be influenced by meteorological conditions, particularly temperature inversions and gradient winds. Where these factors are a feature of an area, their effect on resultant noise levels should be taken into account.

In accordance with the NPfI, the following default conditions have been modelled to account for potential noise-enhancing meteorology:

- Stability category D with 3.0 m/s source-to-receiver winds during the daytime and evening.
- Stability category F with 2. 0 m/s source-to-receiver winds during the night time.

The SoundPLAN noise modelling software includes a feature that allows the model to be run with the "worst-case wind direction". This option produces the highest noise level for each receiver due to noise-enhancing winds and has been used in the modelling.

Predicted noise levels associated with both standard meteorological conditions ("calm") and noise enhancing ("NE") meteorological conditions are presented in this assessment.

4.3 Operational Noise Sources and Assessment Scenarios

4.3.1 Continuous Noise Sources

Significant continuous noise sources associated with the operation of the GEGHA Project are as follows:

- Fixed mechanical plant associated with hydrogen and ammonia production
- Trucks transporting product (ammonia and hydrogen) offsite.

Table 4-6 presents an inventory of the fixed mechanical plant items, with individual sound power levels (SWL) for these plant items provided by the client. The locations of these plant items are shown in **Figure 4-1**.

In addition to the plant items in **Table 4-6**, trucks would be used to transport products offsite. Based on measurements previously conducted by SoundIN, the SWL of a large truck (e.g. semi-trailer or tanker) travelling through an industrial site is 103 dBA.

Table 4-6 Operational Noise Sources and Sound Power Levels

Item	Quantity	Continuous SWL (dBA) per item
Ammonia plant	1	90
Compressor	9	85
Cooling tower	6	98
Electrolyser (Hydrogen)	3	94

The ammonia plant will typically run on a 24/7 basis whereas the hydrogen electrolysers will operate during the day, following solar energy production. For assessment purposes, it is assumed that all fixed mechanical plant will operate on a 24/7 basis.

Up to two ISO tank loadouts of ammonia would occur per day, between the hours of 7am and 6pm. For assessment purposes, it is assumed that a single truck is operating continuously along the internal access road (see **Figure 4-1**).

The assessment scenarios outlined above, which conservatively represent typical worst-case noise emissions associated with the operation of the GEHGA Project, are summarised in **Table 4-7**.

Table 4-7 Noise Assessment Scenarios

Period [a]	Source	Comments
Day	Fixed plant	Continuous operation
	Trucks	1 truck continuously travelling along internal road
Evening & Night	Fixed plant	Continuous operation
	Trucks	Nil

Figure 4-1 Operational Noise Source Locations

4.4 Predicted Operational Noise Levels

The predicted $L_{Aeq,15min}$ noise levels at nearby residential receivers associated with the scenarios outlined above are presented in **Table 4-8**.

Table 4-8 Predicted $L_{Aeq,15min}$ Noise Levels at Sensitive Receivers

Receiver	Predicted Noise Level (dBA)				PNTL (dBA)			Complies?
	Day		Evening/Night		Day	Evening	Night	
	Calm	NE	Calm	NE				
R1	<20	<20	<20	<20	40	35	35	Yes
R2	<20	<20	<20	<20	40	35	35	Yes
R3	<20	<20	<20	<20	40	35	35	Yes
Gin Manager	31	36	22	28	53	48	43	Yes
K1	28	33	27	33	40	35	35	Yes
K2	27	32	26	32	40	35	35	Yes
K3	26	32	26	31	40	35	35	Yes
K4	26	31	25	31	40	35	35	Yes
K5	26	32	26	31	40	35	35	Yes

The results in **Table 4-8** indicate that $L_{Aeq,15min}$ noise levels are predicted to comply with the PNTL at all nearby sensitive receivers.

It is noted that the predicted operational noise levels are below 20 dBA at some nearby sensitive receivers. Predicted noise levels below 20 dBA are not explicitly stated as it is not reasonably practicable to validate such low noise levels via measurement.

Contour plots of the predicted operational noise levels are presented in **Figure 4-2**, **Figure 4-3**, **Figure 4-4** and **Figure 4-5**.

Noting the very low predicted operational noise levels at nearby sensitive receivers, no specific measures to mitigate operational noise emissions are recommended.

Figure 4-2 Noise Contours – Daytime, Calm Meteorology

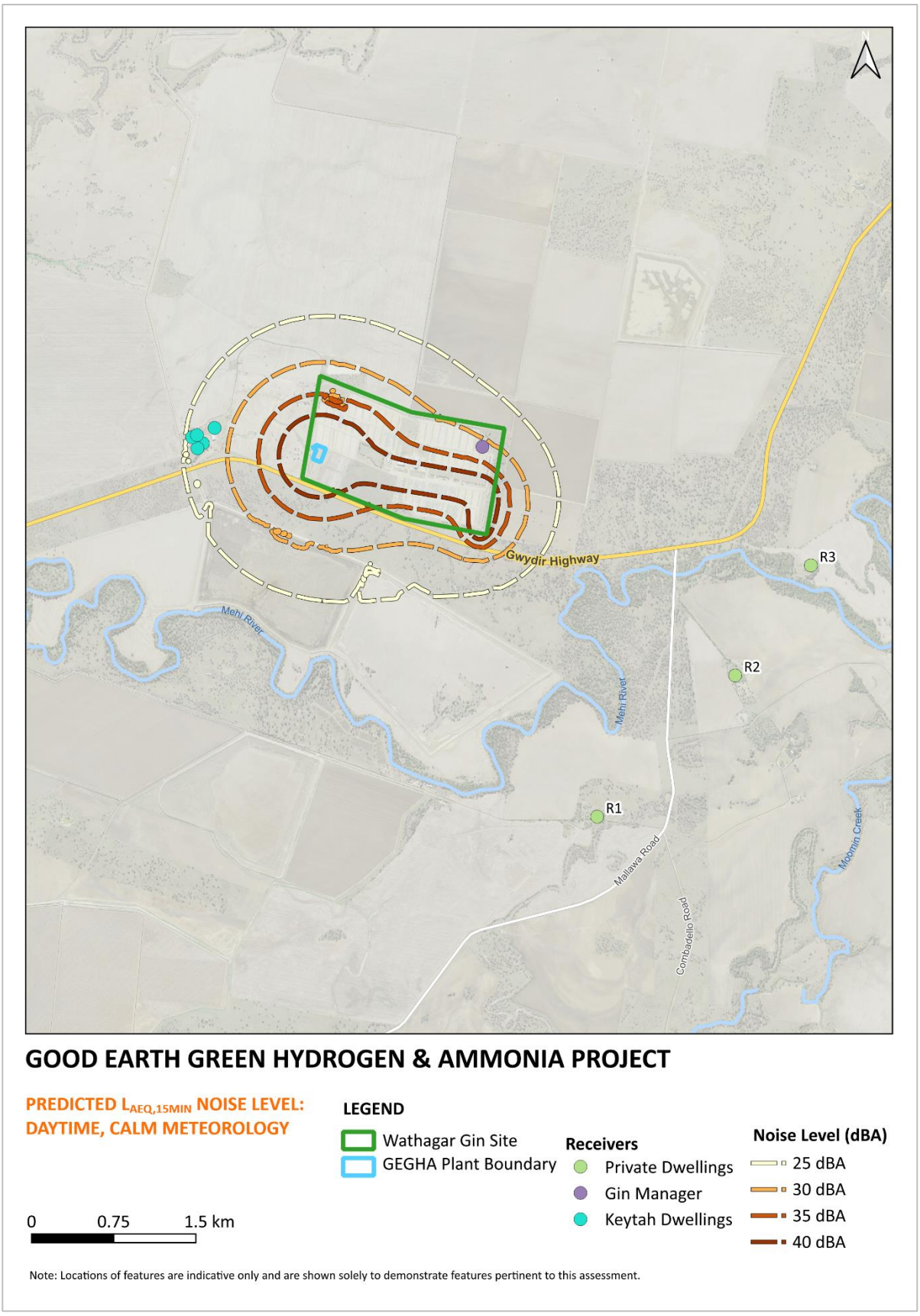


Figure 4-3 Noise Contours – Daytime, Noise-enhancing Meteorology

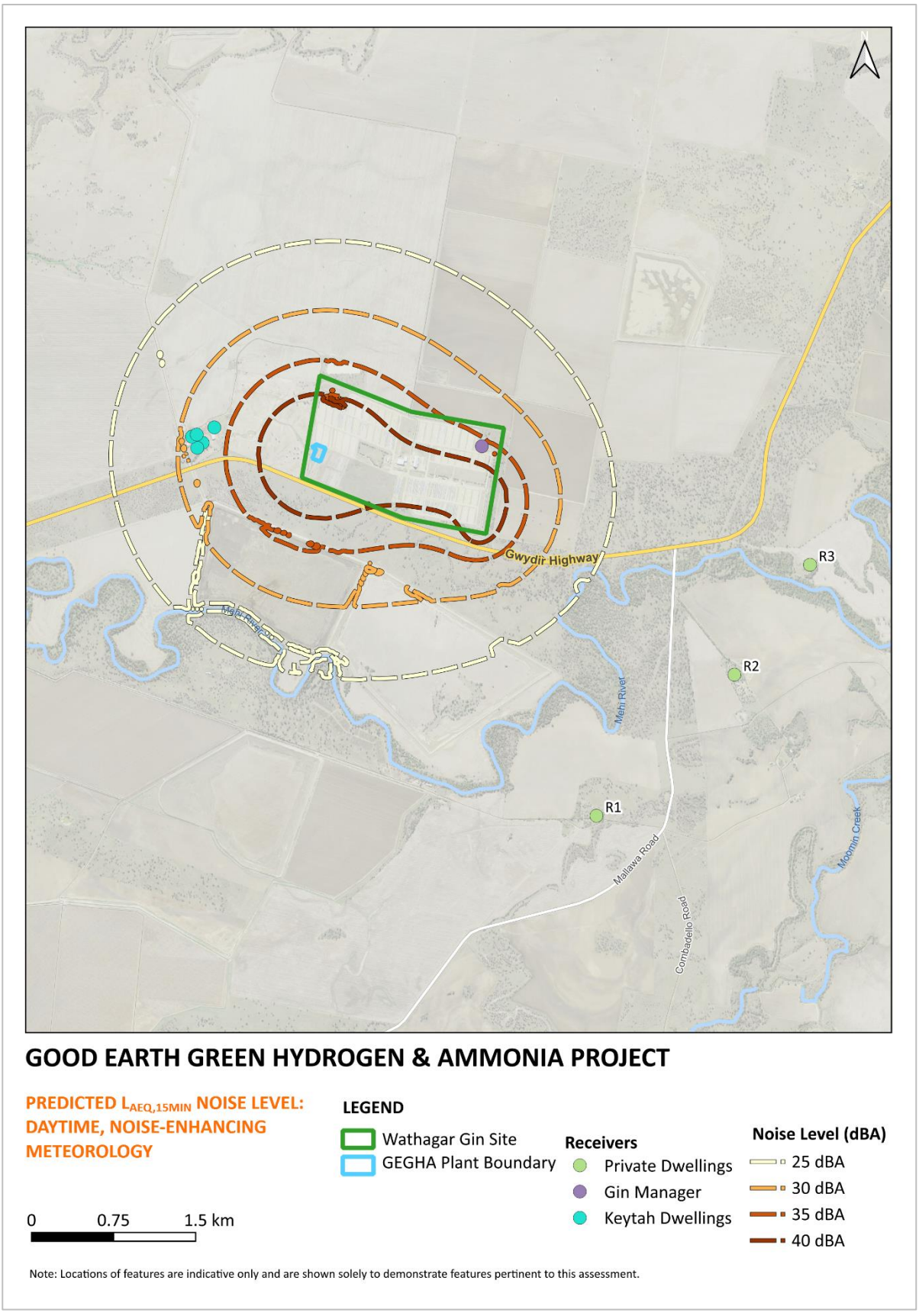


Figure 4-4 Noise Contours – Evening/Night, Calm Meteorology

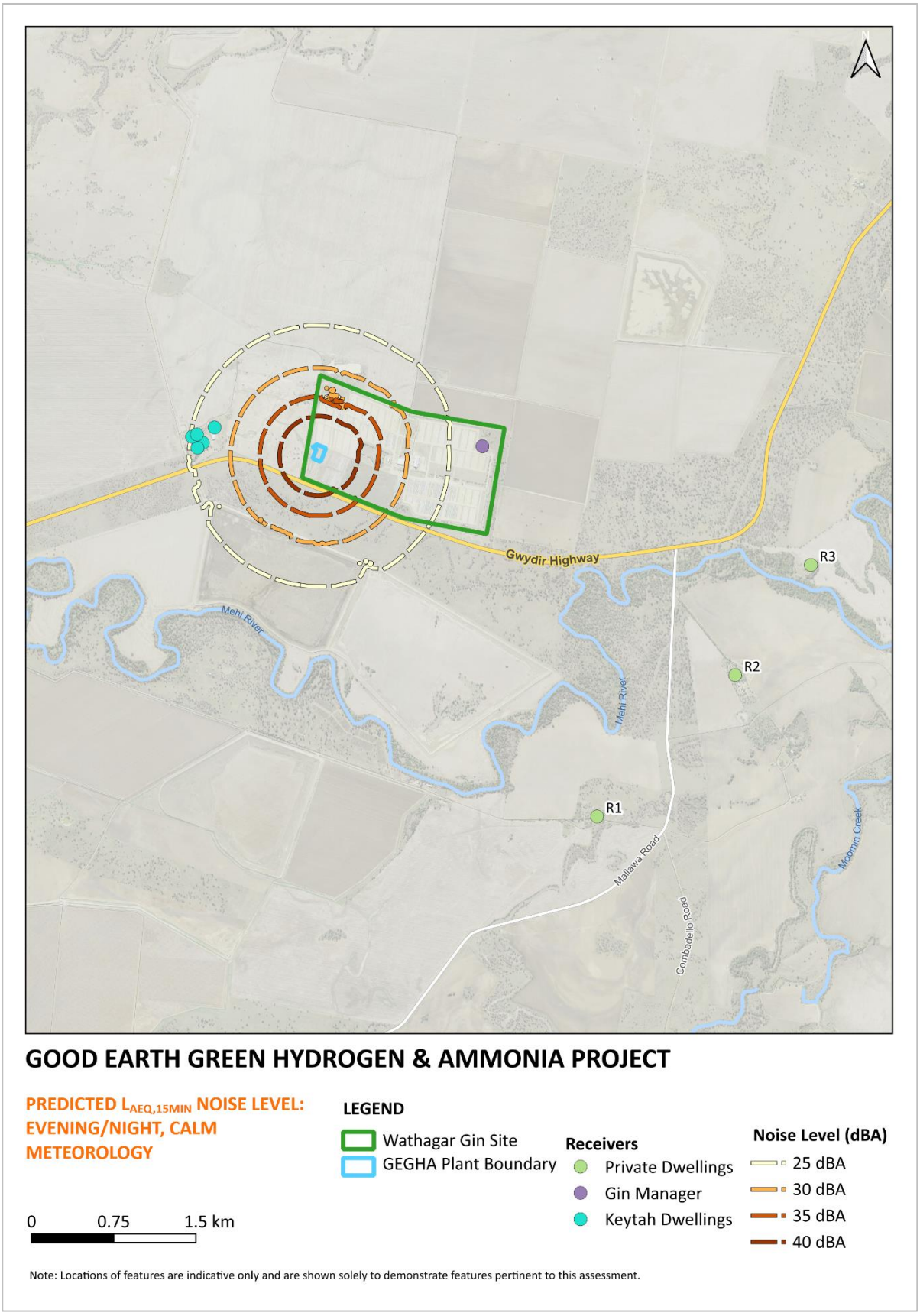
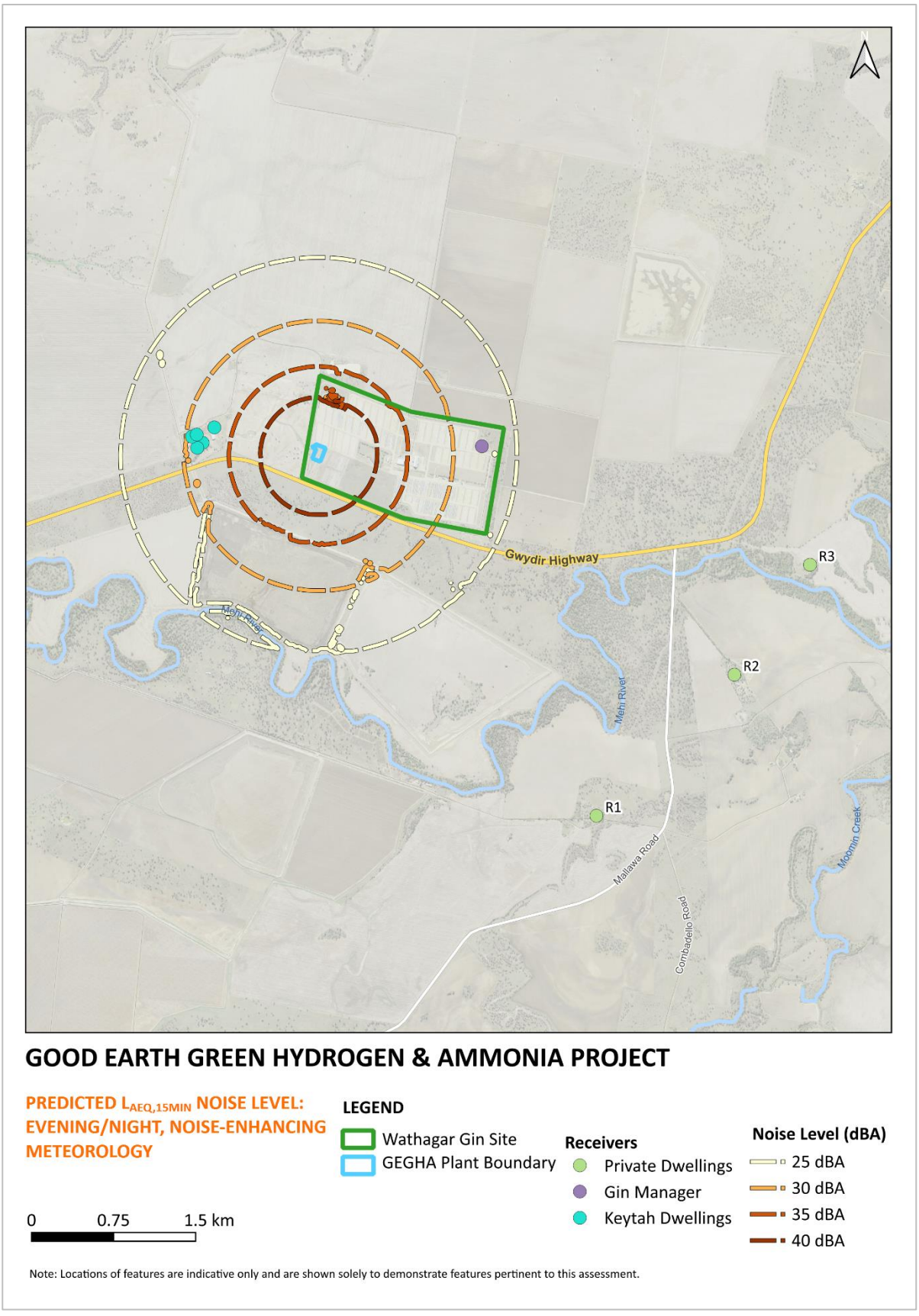


Figure 4-5 Noise Contours – Evening/Night, Noise-enhancing Meteorology



5 ROAD NOISE ASSESSMENT

The following Section assesses potential road noise impacts on sensitive receivers due to traffic generated by the GEHGA Project. Sensitive receivers most potentially affected by noise from traffic generated by the Proposal are residences along Gwydir Highway, east of the Site.

5.1 Road Noise Criteria

The *NSW Road Noise Policy* (RNP) (DECCW, 2011) sets out criteria for assessment of noise from traffic on public roads. The RNP sets out noise assessment criteria for "freeways", "arterial", "sub-arterial" and "local roads".

In accordance with the RNP, Gwydir Highway is considered an arterial road. The RNP impact assessment criteria for residential land uses affected by additional traffic on arterial roads are presented in **Table 5-1**.

Table 5-1 RNP Impact Assessment Criteria

Road	Category	Assessment criteria (dBA)	
		Day	Night
Gwydir Highway	Arterial	$L_{Aeq,15\ hour}$ 60 (external)	$L_{Aeq,9\ hour}$ 55 (external)

Note: Day = 7am – 10pm; Night = 10pm – 7am

With regard to the permissible increase in road traffic noise from a land use development the RNP states:

> *"For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'."*

5.2 Road Noise Modelling

Road noise levels at the most potentially affected receivers along have been predicted using the Calculation of Road Traffic Noise (CoRTN) algorithm, and are based upon the following assumptions:

- Vehicle speeds are 110 km/h along Gwydir Highway.
- The facades of the nearest receivers to Gwydir Highway are set back approximately 160 metres from the road.
- The surface of the majority of Gwydir Highway is understood to be chip seal. Accordingly, a +4 dBA surface correction has been applied.

5.3 Existing Traffic Flows

According to the traffic impact assessment (TIA) prepared for the GEGHA Project (Appendix xxx of the EIS) the existing two-way daily traffic volume along Gwydir Highway, in the vicinity of the site, is 650 vehicles per day with a heavy vehicle percentage of 30%. The TIA indicates that approximately 80% of the daily traffic occurs during the daytime (7am – 10pm) assessment period.

5.4 Traffic Generated by the Proposal

During operations, the GEGHA Project would generate approximately 10 light vehicle and 24 heavy vehicle movements per day. For assessment purposes, it is conservatively assumed that all traffic movements generate by the GEGHA Project travel to/from the east of the site. It is also assumed that the generated movements would occur in the daytime period.

Table 5-2 summarises the existing ("no build") and future ("build") traffic volumes and percent heavy vehicles ("mix") along The Gwydir Highway near the Site.

Table 5-2 Traffic Volumes – No-Build and Build

Road	Time [a]	Existing (no-build)		Future (build)	
		Volume	% Heavy	Volume	% Heavy
Gwydir Highway	Day	520	30%	554	32%

a. Day = 7am – 10pm

5.5 Predicted Road Noise Levels

Using the traffic data in **Table 5-2**, road noise levels at the most potentially affected sensitive receivers along Gwydir Highway have been predicted for the no-build and build scenarios and are shown in **Table 5-3**.

Table 5-3 Predicted $L_{Aeq,period}$ Road Noise Levels (dBA)

Road	No-build	Build	RNP Criterion	Difference	Complies?
Gwydir Highway	49.0	49.5	60	0.5	Yes

Review of **Table 5-3** indicates that the predicted road noise levels at the facades of the most potentially affected receivers along Gwydir Highway comply with the RNP assessment criteria. Accordingly, no specific measures to mitigate noise from additional traffic on nearby public roads are recommended.

6 CONCLUSION

SoundIN has been engaged by HSPT to prepare a Noise and Vibration Impact Assessment for the GEGHA Project.

Unattended noise monitoring was conducted in August 2023 to establish the existing background noise levels in the area near the site.

Potential noise impacts associated with the construction of the GEGHA Project have been assessed in general accordance with the ICNG. Construction noise levels are predicted to comply with the NML at all nearby sensitive receivers throughout the duration of the works.

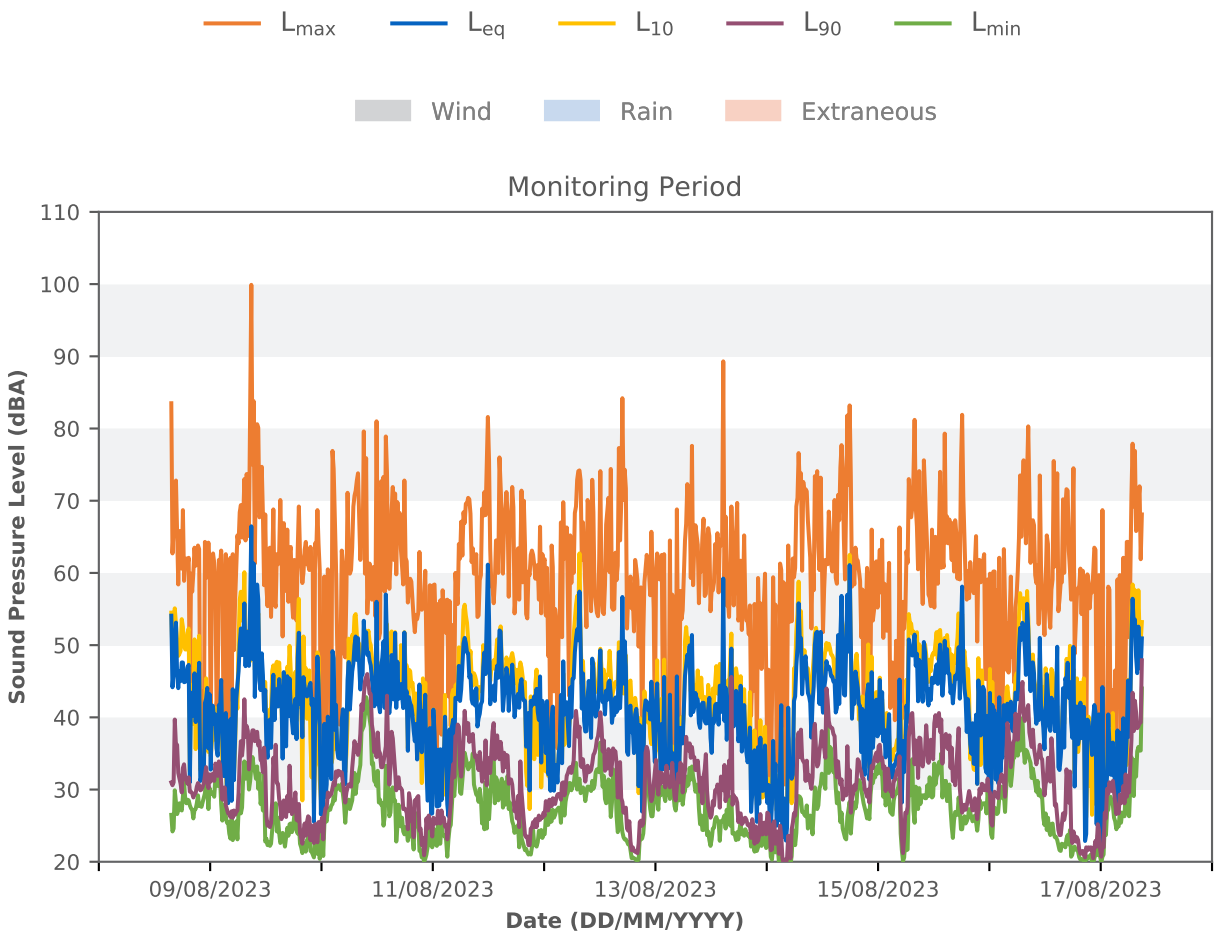
Potential noise impacts associated with the operation of the GEHGA Project have been assessed in general accordance with the NPfI. Noise modelling indicates that operational noise levels comply with the established PNTL at all sensitive receivers.

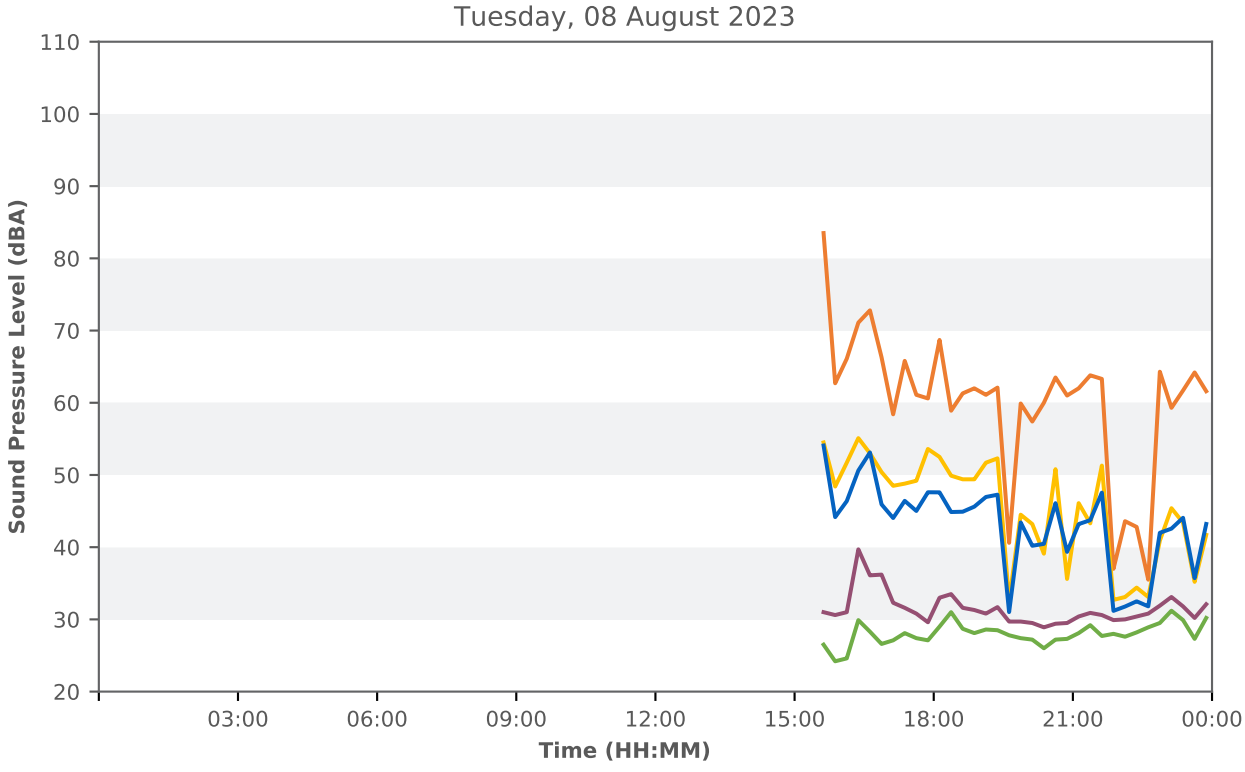
Road noise impacts associated with the operation of the GEGHA Project have been assessed in accordance with the RNP. Predicted road noise levels associated with traffic generated by the GEGHA Project comply with the RNP impact assessment criteria.

APPENDIX A

NOISE MONITORING RESULTS

Location A - Keytah Homestead





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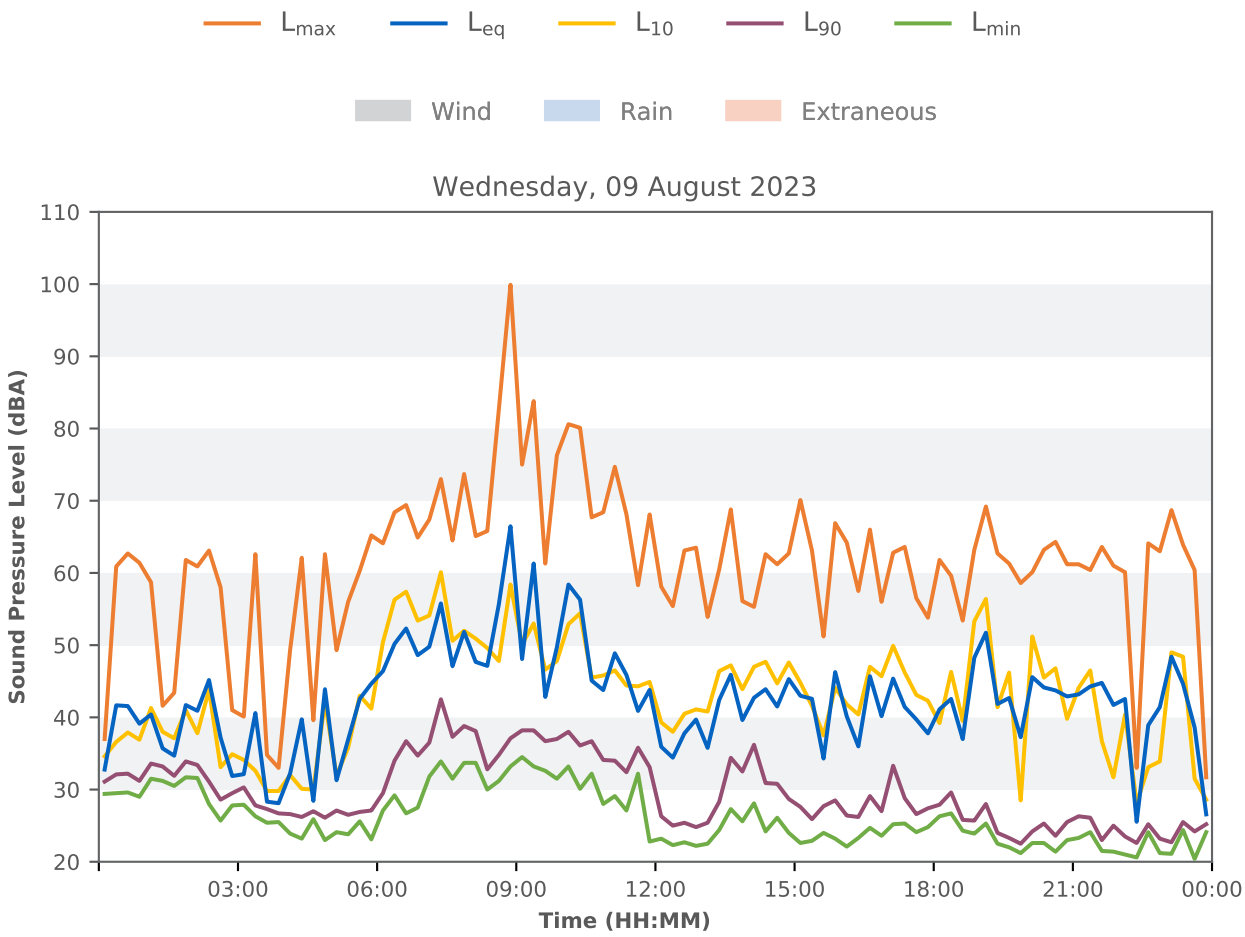
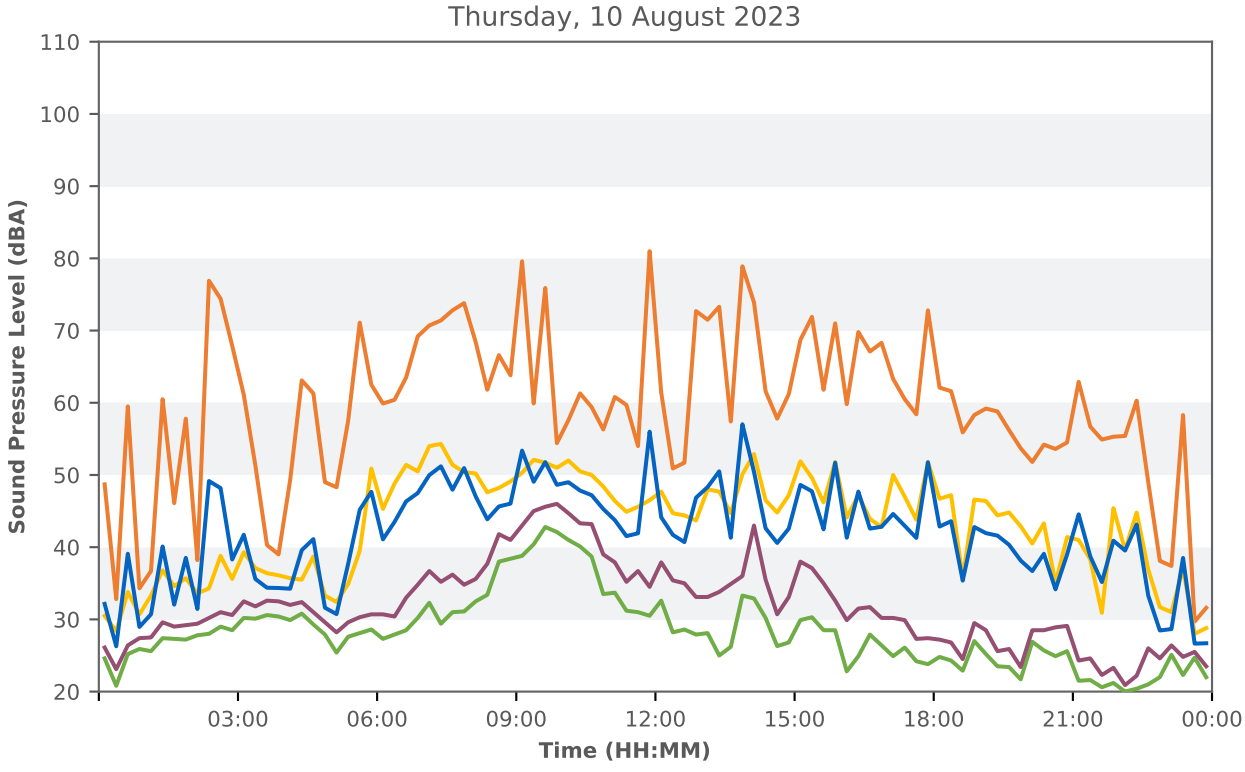
Location A - Keytah Homestead





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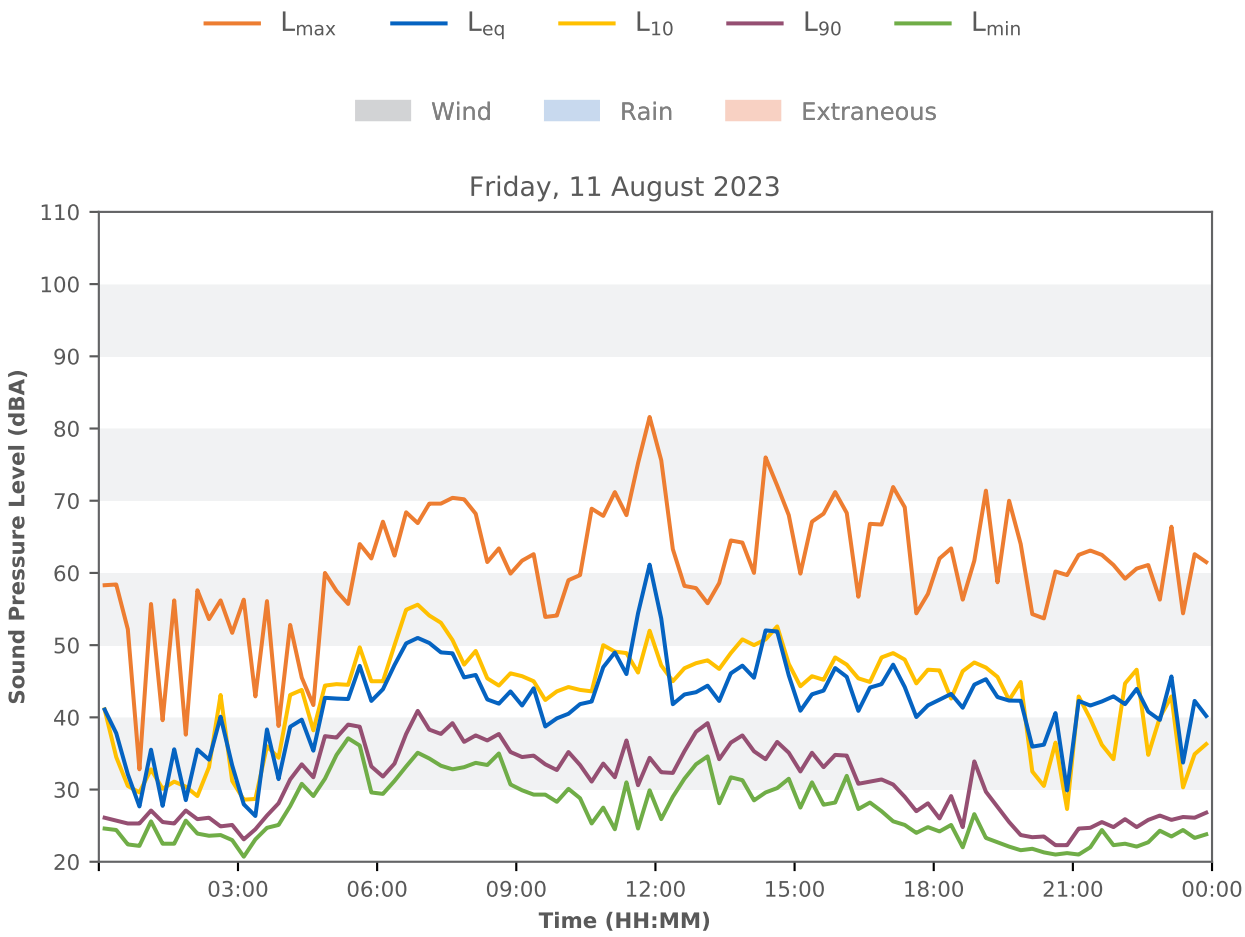
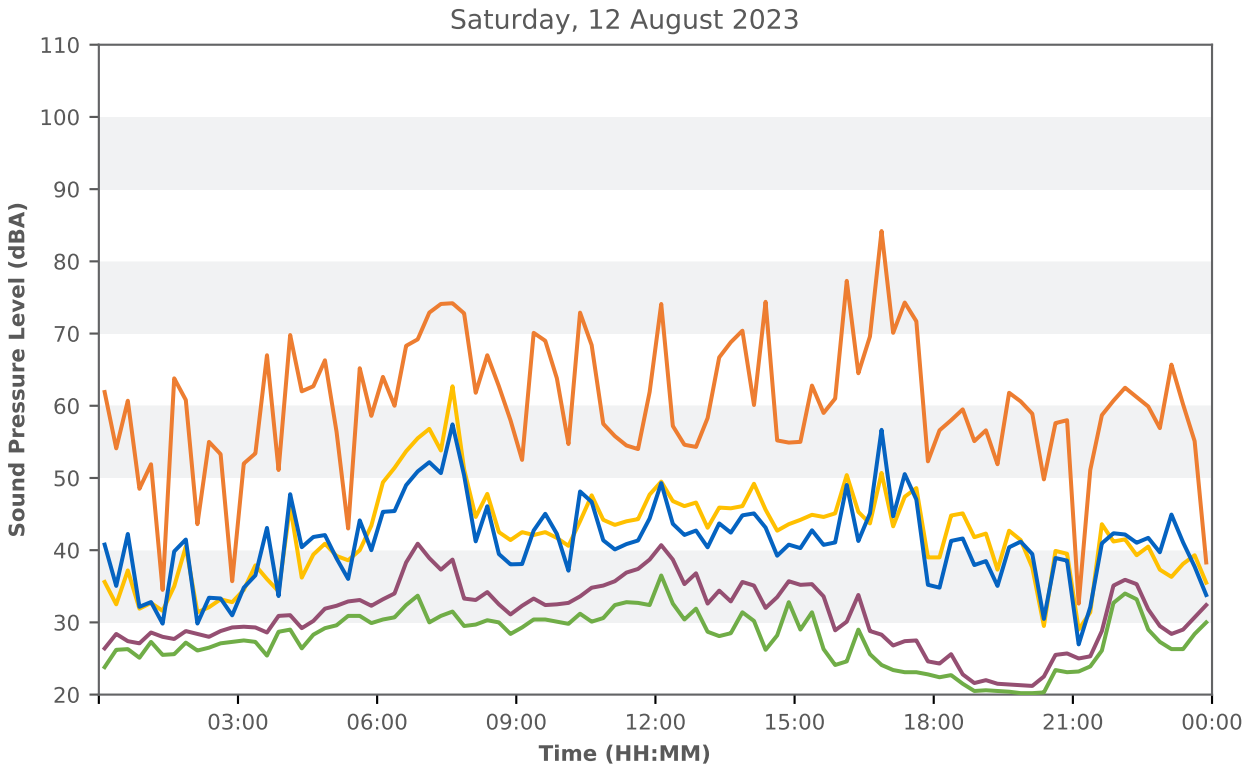
Location A - Keytah Homestead





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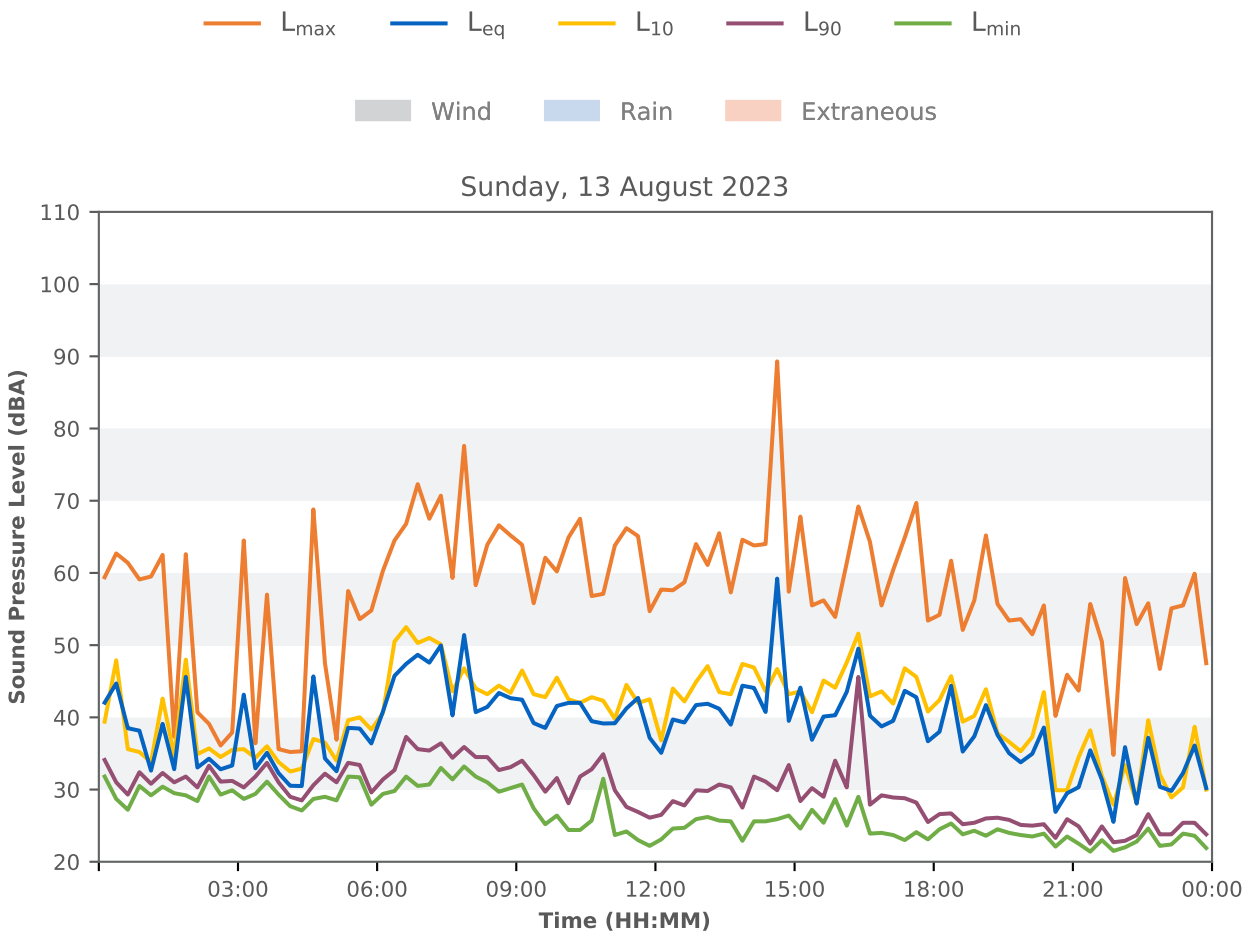
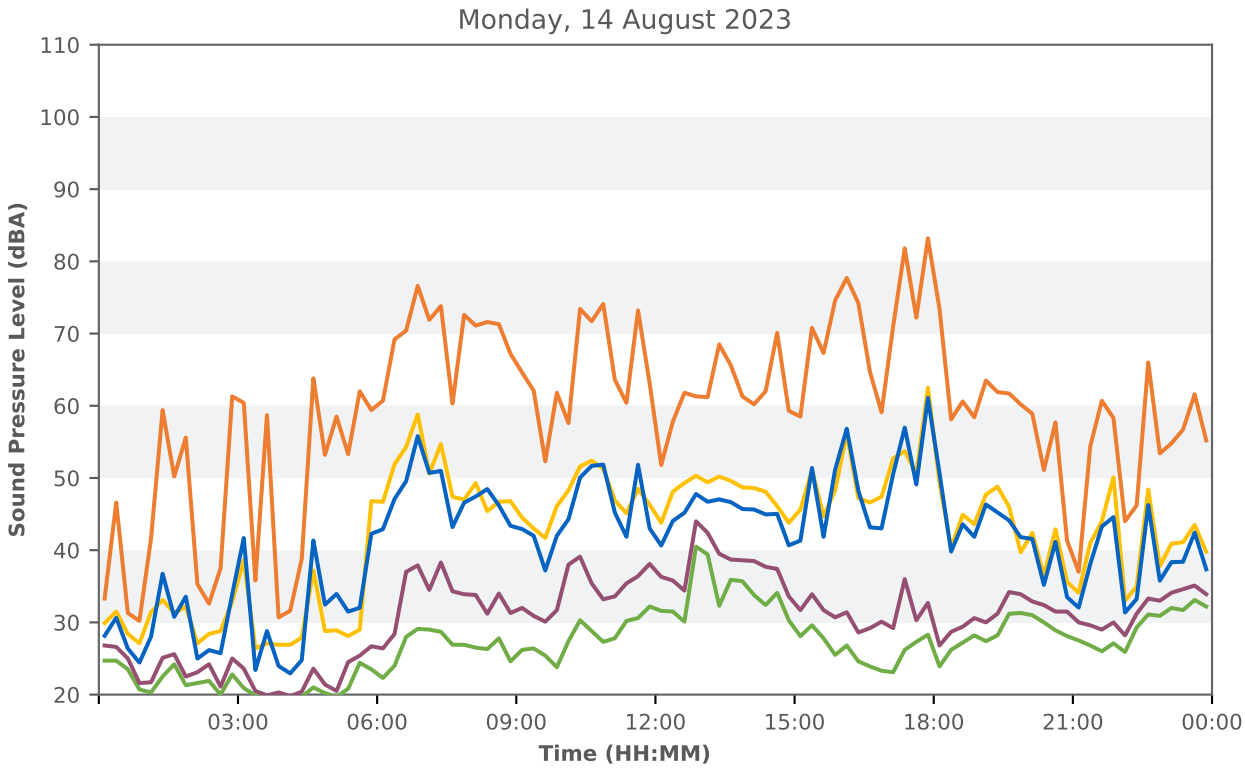
Location A - Keytah Homestead





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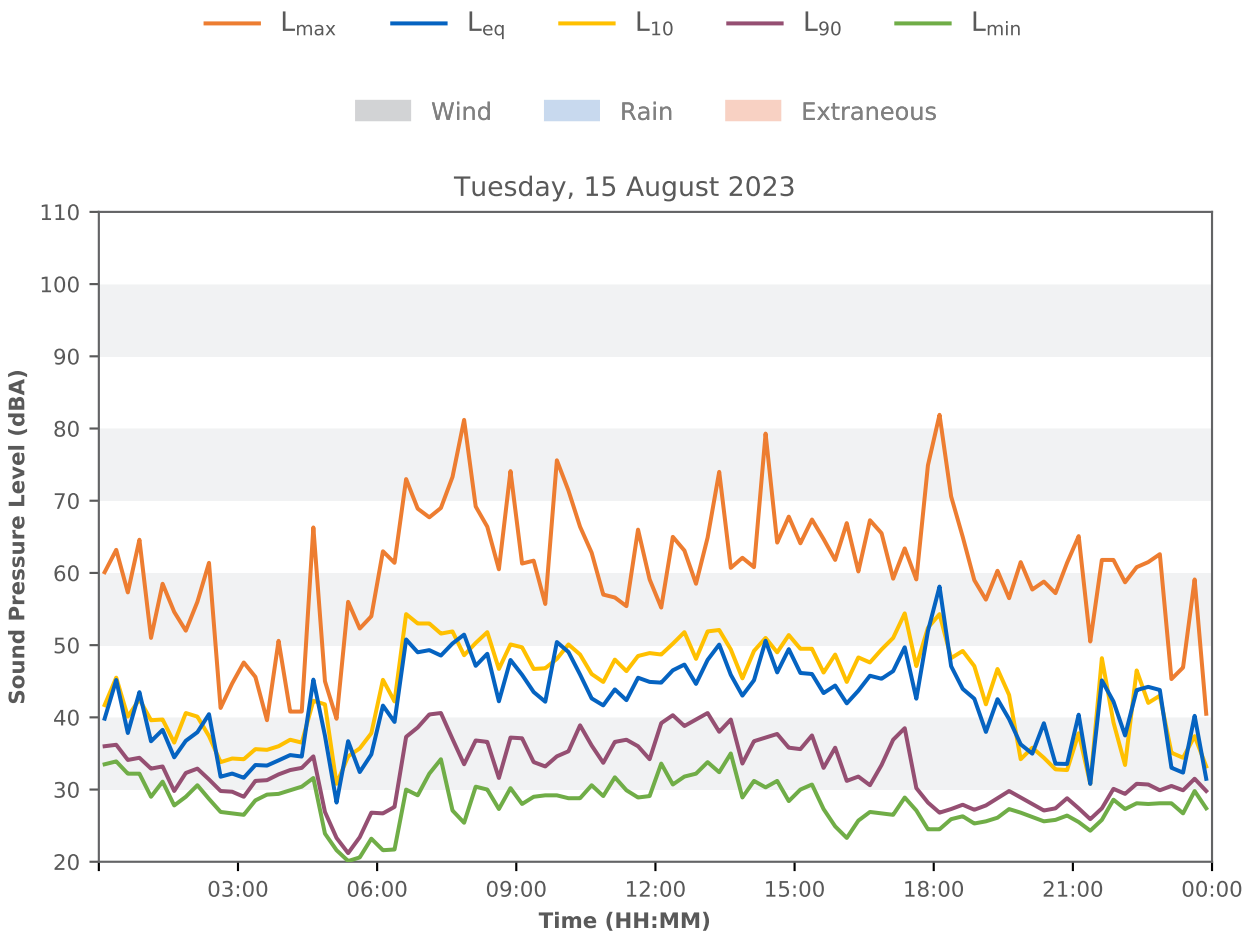

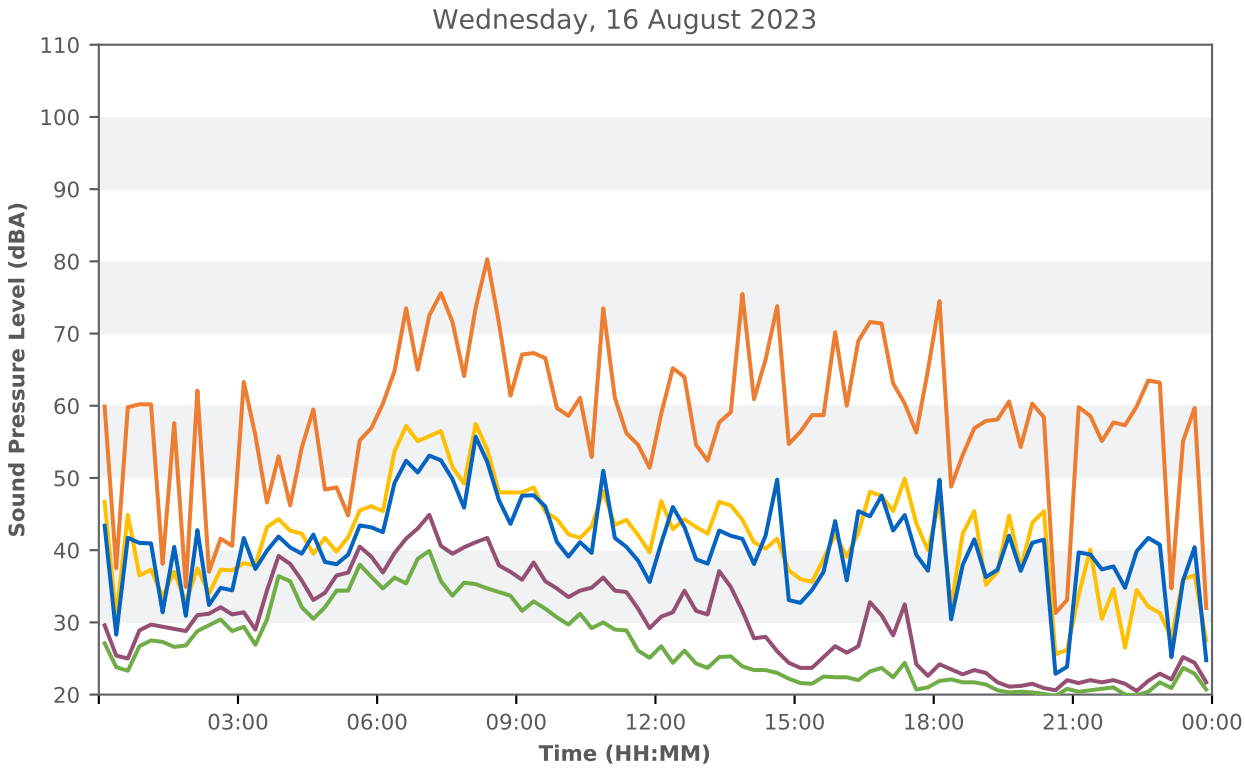

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Location A - Keytah Homestead