Noise Impact Assessment

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Yarra Valley Water

Lilydale Waste to Energy Facility

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Executive Summary

Yarra Valley Water (YVW) proposes to develop a Waste to Energy (WtE) Plant on the site of the existing Lilydale STP facility. The proposed WtE installation is located in Lilydale 36 km north-east of Melbourne CBD, on land owned by YVW at 83-85 Nelson Road. The plant generates energy via an anaerobic digester producing biogas for the generation of electricity and process heat. The purpose of this report is to determine the compliance of the proposed WtE plant with Victorian Environment Protection legislation and prescribe noise mitigations if required.

The existing site is located in the northern pocket of a large PUZ1 zone with a mosaic of zones (SUZ, GWZ, NRZ, IN1Z, PPRZ) surrounding the site. The facility is located in an Urban Area while Major Urban areas are designated to the south and north-east of the facility.

EPA Victoria's Noise Protocol in Part I-A sets out assessment criteria based on the receivers' location(s) within rural or urban Victoria. This project is located within a major urban area with the receivers considered in the Urban (north) and Rural (western) setting. Details of the criteria development do not include *"noise character adjustment"* but incorporate background recordings where applicable and are summarised in Section 3 and detailed in Appendix B.

Although the facility operates continuously (24 hrs), activities will vary during the day, evening and night periods. Emergency equipment (flares) form part of standard operations and a separate testing and maintenance of the emergency equipment (valves) is not carried out. Two types of waste removal are considered under Option 1 and Option 2 using 20 kL and 40 kL Tankers respectively.

Selected receivers for Option 1 are detailed in Table ES-1 below. The use of different Tanker options is only of marginal impact (<1dB) on the nearest affected receivers R5 and R8.

Table ES-1: Predicted Effective Noise Levels – Option 1 General operations $L_{Aeq(30\ minutes)}$ (dBA) (outdoor, free-field)

Receiver	Day			Eve			Night		
	Crit	SPL	dBC-dBA	Crit	SPL	dBC-dBA	Crit	SPL	dBC-dBA
R1_Prop_4 Saintly Place	42	27.5	8.5	46	27.5	8.5	35	27	8.2
R2_60 Trafalgar Crescent	42	27.4	10.0	42	27.4	10.0	35	26.4	10.1
R3_75 Como Road	45	21.1	11.3	37	21.1	11.3	32	17.4	12.4
R4_517-519 Maroondah Hwy	45	20.9	12.6	37	20.9	12.6	32	8.3	12.0
R5_564-566 Maroondah Hwy	45	21.6	10.8	37	21.6	10.8	32	8	12.0
R6_572 Maroondah Hwy	45	32.3	5.5	37	32.3	5.5	32	16.6	12.1
R7_5 Ingram Road	42	28	11.1	44	28	11.1	38	19.3	11.4
R8_584 Maroondah Hwy	42	36.3	7.0	44	36.3	7.0	38	21.9	11.2
R9_74 Station Street	42	24.9	9.7	44	24.9	9.7	38	21	11.2
R10_11 Coldstream West Road	45	26	9.9	37	26	9.9	32	23.4	11.0
R11_19-21 Coldstream West Road	45	24.8	10.3	37	24.8	10.3	32	23.3	10.6
R12_23-27 Coldstream West Road	45	25.3	11.9	37	25.3	11.9	32	23.3	9.6
R13_138 Victoria Road	45	23.4	9.1	37	23.4	9.1	32	22.9	8.6
R14_134 Victoria Road	45	20.5	9.4	37	20.5	9.4	32	19.9	8.6

The results indicate that the facility contribution is expected to meet the noise limit criteria at all receivers, during the day, evening and night under worst-case meteorological conditions. Comparison of the predicted effective noise levels against the noise limits, without adjusting for noise character, indicates that no additional controls are required to comply with the Noise Protocol noise criteria.

A detailed study utilising 1/3 octave band data should be carried out during the Detailed Design stage. The purpose of the detailed study is to validate the equipment suppliers' sound power data and explore the noise character according to The Noise Protocol.

Where manufacturer's noise emission data was not available, Jacobs has used estimated sound power level data. Jacobs has built conservativeness into the assessment but cannot assure the accuracy of this data. It is recommended that all plant should be assessed at Detailed Design stage, before installation, to ensure that the source noise levels used in this assessment are consistent with the installed values.

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Acronyms & Abbreviations

Term	Description
Ambient Noise Level	The prevailing noise level at a location due to all noise sources but excluding the noise from the specific noise source under consideration. Generally measured as a dB(A) noise level.
Acoustic Spectrum	The sound pressure level (or sound power level) as a function of frequency (eg octave band, ⅓ octave or narrow band). Generally used to identify noise sources or items contributing disproportionately to an overall noise level.
Barriers	Generally a wall or an earth mound that obstructs or restricts the passage of sounds waves from a noise source. Barriers usually require a surface density of not less than 15 kg/m^2 and an overall weighted Sound Reduction Index (R_w) of no less than 30 dB to be considered effective. The barriers are also assumed to be installed without holes or gaps (eg underneath the barrier), to prevent noise transmission.
Background Noise Level	The lower ambient noise level, usually defined as the value of the time varying ambient noise level exceeded for 90% of the measurement time. Usually defined in the dB(A) scale - L_{A90}.
Day Period	The time between 0700 and 1800 hours on Monday to Saturday (except public holidays)
dB	Sound pressure levels are expressed in decibels as a ratio between the measured sound pressure level and the reference pressure. The reference pressure is 20×10^{-6} Pascal (Newtons per square metre). Some typical noise levels are presented below: Sound Pressure Level, dB(A) / Example 130 Threshold of pain 120 Jet aircraft take-off at 100 m 110 Power tool at 1 m 100 Nightclub 90 Heavy trucks at 5 m 80 Kerbside of busy street 70 Loud radio (in typical domestic room) 60 Office 50 Domestic fan heater at 1 m 40 Living room 30 Theatre 20 Rural environment on still night 10 Sound insulated test chamber 0 Threshold of hearing
dB(A)	The A-weighted sound pressure level in decibels, denoted dB(A) is the unit generally used for the measurement of environmental, transportation or industrial noise. The A-weighting scale approximates the sensitivity of the human ear when it is exposed to normal levels and correlates well with subjective perception over a number of different types of sounds. An increase or decrease in sound level of approximately 10 dB corresponds to a subjective doubling or halving in loudness. A change in environmental noise level of 2 dB is considered to be just noticeable.
dB(C)	The unit used for measuring occupational health and safety maximum industrial noise levels in Australia is the C-weighted sound pressure level in decibels, denoted dB(C). C-weighting has a relatively flat response when compared to an A-weighting network.
dB(Z)	Z-Weighted Decibel or Linear Decibel
DIL	Dynamic Insertion Loss
Evening Period	The time between 1800 and 2200 hours on Monday to Saturday; and between 0700 and 2200 hours on Sundays and public holidays
Frequency	The rate of repetition of a sound wave. The unit of frequency is the Hertz (Hz), defined as one cycle per second.

Term	Description
	Human hearing ranges approximately from 20 Hz to 20,000 Hz. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. The most commonly used frequency bands are octave bands. For more detailed analysis each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.
ISO	International Organization for Standardization
L_1	The L_1 statistical level is sometimes used to represent the maximum level of a sound that varies with time. Mathematically, the L_1 level is the level exceeded for 1% of the measurement period.
$L_{AF1(1\ minute)}$	The A-weighted sound pressure level measured using the 'Fast' response time setting, exceeded for 1% of the time interval, where the time interval is 1 minute.
L_{A10}	The A weighted sound pressure level that is exceeded for 10% of the measurement period. It is often referred to as the average of the maximum values.
L_{A90}	The A weighted sound pressure level that is exceeded for 90% of the measurement period. Usually used to represent the background noise level.
L_{eq}	The equivalent continuous sound level. The steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.
L_{Aeq}	The A weighted equivalent continuous sound level is denoted L_{Aeq}.
L_{Max}, L_{FMax}, L_{Smax} L_{AMax}, L_{AFMax}, L_{ASMax}	The maximum measured linear (un-weighted or Z) sound pressure level. The L_{Max} variations, L_{FMax}, L_{SMax} are the L_{Max} levels using the "Fast" and "Slow" networks respectively. The A-weighted variations, L_{AMax}, L_{AFMax} and L_{ASMax}.are also used in various guidelines and standards
L_W	The Sound Power Level of a source is a measure of the total acoustic power radiated by a source. It is a characteristic of the sound source which is not affected by the environment within which the source is located.
NATA	National Association of Testing Authorities
NC	Noise Control
Night Period	The time between 2200 and 0700 hours
Noise Sensitive Area	That part of the land within the apparent boundaries of any piece of land which is within a distance of 10 m outside the external walls of any of the following buildings, dwelling and residential building That part of the land within the apparent boundaries of any piece of land on which is situated any of the following buildings which is within a distance of 10 m outside the external walls of any dormitory, ward or bedroom of such buildings: Caretaker's house, Hospital, Hotel, Institutional Home, Motel, Reformative Institution, Tourist Establishment, Work Release Hostel
Noise Emission	Received noise at a receiver (either internally within a building or external at an outdoor receiver)
NR	Noise Reduction
Noise Protocol / the Protocol	Environment Protection Authority Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*
Sound Level Meter	An instrument consisting of a microphone, amplifier and data analysis package for measuring and quantifying noise.
SPL	Sound Pressure level (dB)
Suitably qualified acoustic consultant	An acoustic consultant who is a full member of the Australian Acoustical Society (or equivalent)
TL	Transmission Loss, a measure of change in sound pressure level, incidence vs. transmitted
UTM	Universal Transverse Mercator

1. Introduction

Yarra Valley Water proposes to develop a Waste to Energy Plant at the existing Lilydale facility. The proposed WtE installation is located on land owned by YVW at 83-85 Nelson Road in Lilydale, 36 km north-east of Melbourne CBD. The plant generates energy via an anaerobic digestion of organic waste producing biogas for the generation of electricity and process heat.

The facility will consist of a waste receival building, two digester vessels, an inlet and outlet storage tank, two cogeneration units, an emergency flare and liquid digestate treatment train. The cogeneration units will produce electricity for the WtE facility and the STP and excess electricity will be exported to the local grid. The heat generated by the cogeneration units will be used to maintain the temperature within the anaerobic digesters and to assist with the pasteurisation of the digestate.

The existing site is located in the northern pocket of a large PUZ1 zone with a mosaic of zones (SUZ, GWZ, NRZ, IN1Z, PPRZ) surrounding the site. The facility is located in an Urban Area while Major Urban areas are designated to the south and north-east of the facility.

The purpose of this report is to determine the compliance of the proposed WtE plant with Victorian Environment Protection legislation and recommend indicative noise mitigations if required.

The functional design layout of the proposed facility is shown in Figure 1-2.

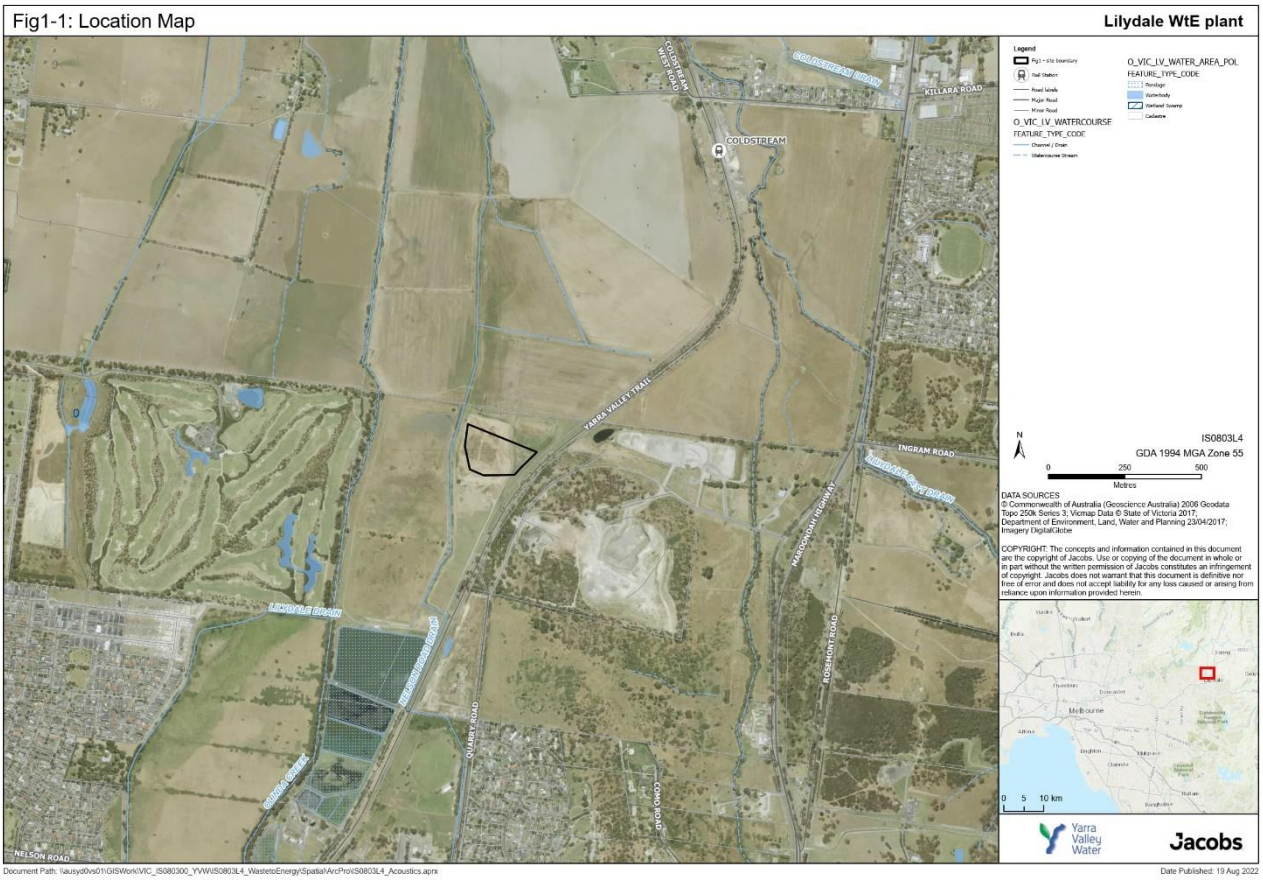

Figure 1-1 – Location Map

Figure 1-2 – Functional Design Site Plan

2. Site Location and Noise Sensitive Areas

The facility is located in an Urban Area[1] classified by the Victorian Government (VIC.GOV.AU, 2022) as identified in Figure 2-1.

The facility is located in a Public Use Zone (PUZ1) - Service and Utility. Adjacent sensitive zones surrounding the facility consist of Green Wedge Zones to the north and west (GWZ4, GWZ2) as well as Neighbourhood zones in east, south and west, as shown in Figure 2-2.

There are potentially sensitive receivers in every direction from the site, in both Rural and Major Urban area. The receivers are defined as the 10 m envelope around residential buildings. The noise impact assessment considers the nearest sensitive receiver in each direction.

The receivers have been selected to be representative of all sensitive receivers in the area, based on their exposure to noise from the facility and their expected prevalent background noise. Receiver R1 is located in close proximity to the site and though no building exists yet on this site, published data indicates a future residence, indicating there is an approved receiver at this location. The receivers are summarised in Table 2-1 and shown in Figure 2-3.

Table 2-1 – Receiver Locations and distance to Facility centre

Receiver	Distance & Direction from Centre of Plant [344150.19, 5787662.97 UTM]		Zoning	Method
R1_Prop_4 Saintly Place Lilydale	1,040 m	WSW	NRZ1	Urban
R2_60 Trafalgar Crescent	870 m	S	NRZ1	Urban
R3_75 Como Road	1,160 m	SSE	GWAZ2	Rural
R4_517-519 Maroondah Highway	1,370 m	SSE	GWAZ2	Rural
R5_564-566 Maroondah Highway	1,460 m	SE	GWZ2	Rural
R6_572 Maroondah Highway	1,500 m	ESE	GWZ2	Rural
R7_5 Ingram Road Coldstream	1,810 m	ENE	NRZ3	Urban
R8_584 Maroondah Highway	1,350 m	ENE	NRZ3	Urban
R9_74 Station Street Coldstream	1,400 m	NE	NRZ3	Urban
R10_11 Coldstream West Road Coldstream	1,240 m	NNE	GWZ4	Rural
R11_19-21 Coldstream West Road Coldstream	1,440 m	N	GWZ4	Rural
R12_23-27 Coldstream West Road Coldstream	1,340 m	NNW	GWZ4	Rural
R13_138 Victoria Road	1,710 m	WNW	GWZ4	Rural
R14_134 Victoria Road	1,740 m	WNW	GWZ4	Rural

[1] Victorian Government – Major Urban Area – locations polygons and table, Feb 2022, Major Urban Area - location polygons and table - Dataset - Victorian Government Data Directory

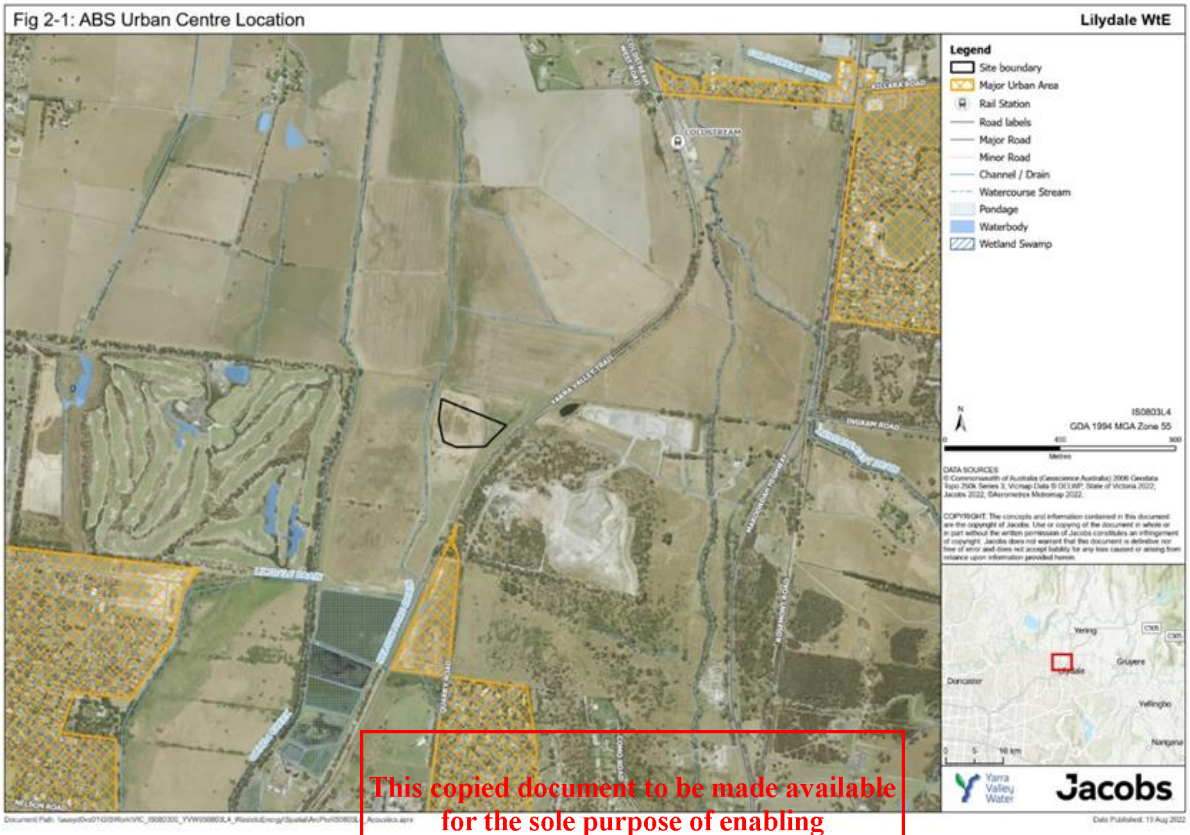

Figure 2-1. ABS Urban Centre Location

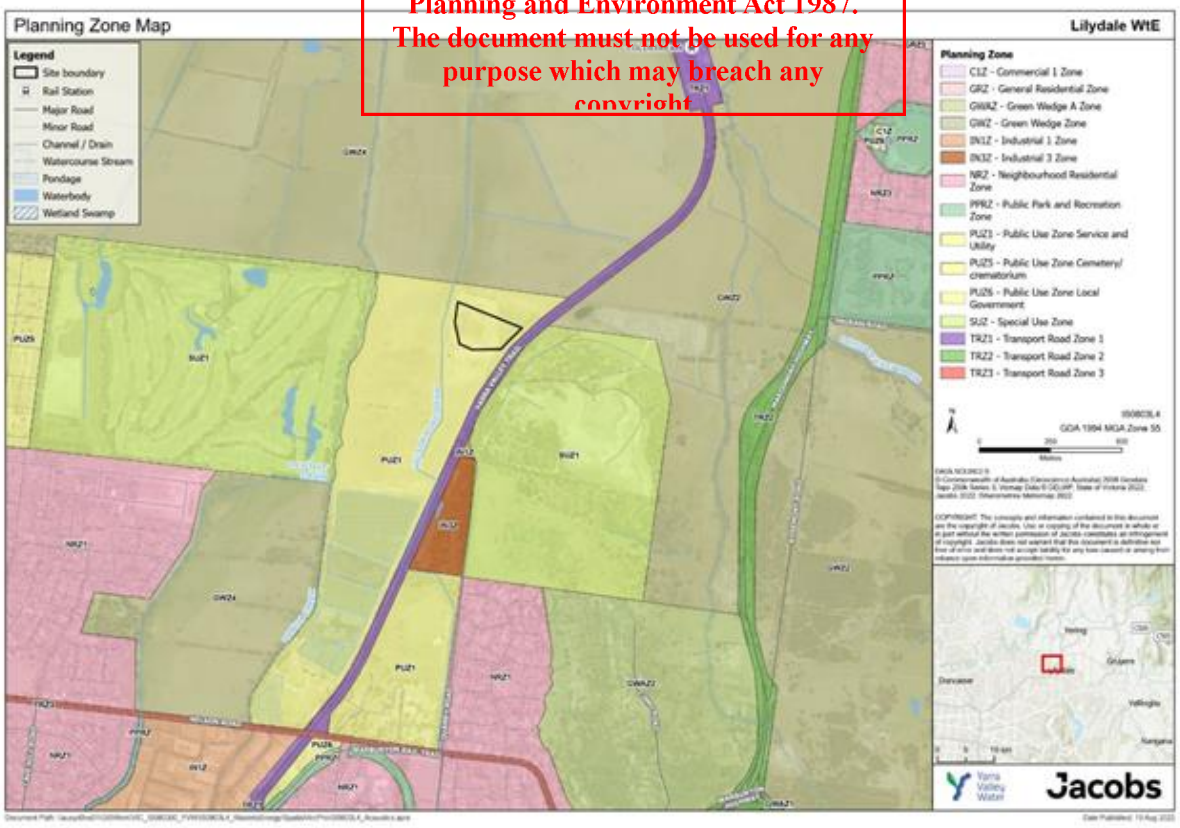

Figure 2-2. Planning Zones

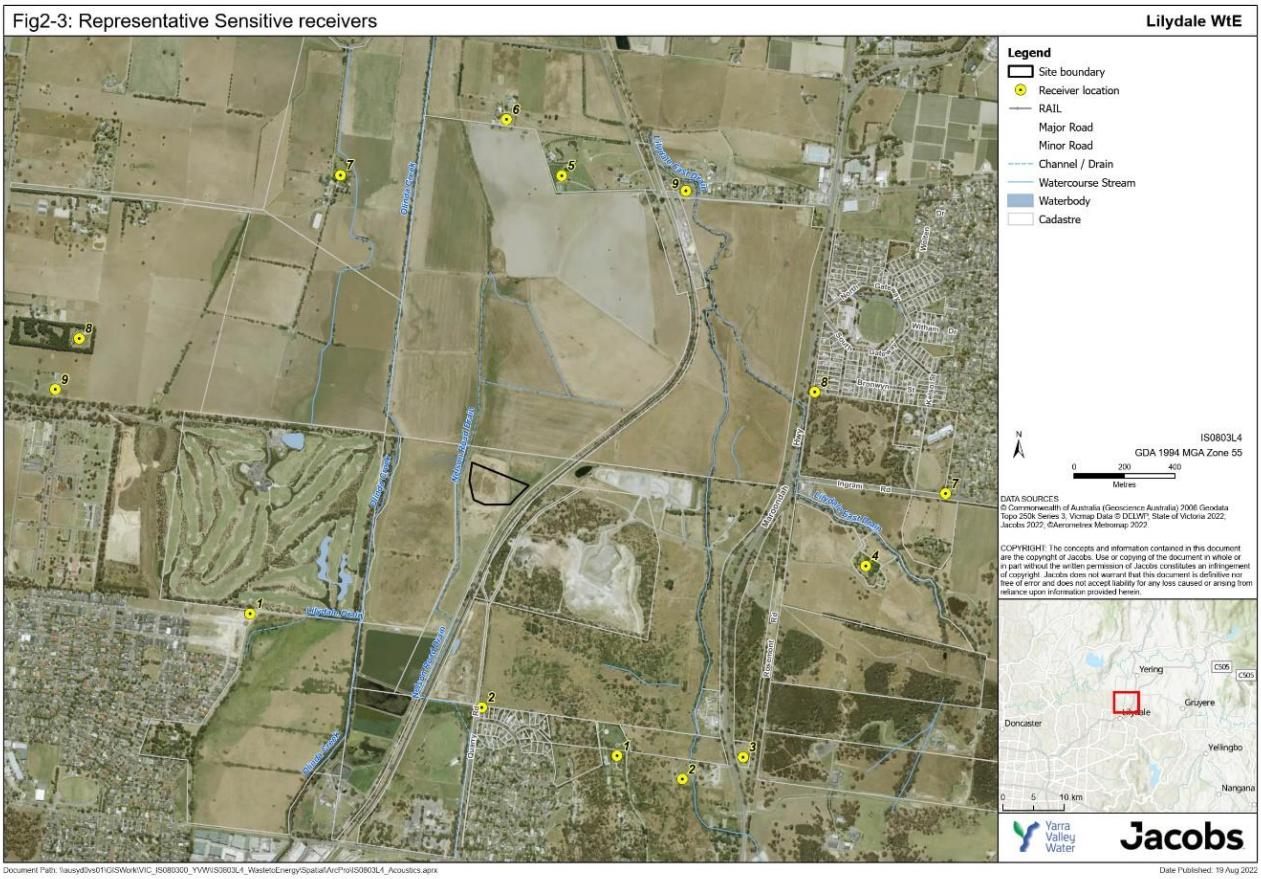

Figure 2-3. Representative Noise Sensitive Areas

3. Noise Legislation

3.1 Environment Protection Act 2017

On 1 July 2021 the *Environment Protection Act 1970* and its subordinate instruments was replaced by the *Environment Protection Act 2017* (EP Act 2017) through the *Environment Protection Amendment Act 2018*. The new subordinate instruments, the *Environment Protection Regulations 2021* (EP Regulations) and the *Environment Reference Standard* (ERS) commenced on 1 July 2021.

The cornerstone of the EP Act 2017 is the general environmental duty (GED). The GED requires anyone conducting an activity that poses risks to human health and the environment to understand and minimise those risks so far as reasonably practicable. This includes eliminating risks so far as reasonably practicable. This includes the risk of detrimental impacts associated with noise.

3.2 Environment Protection Regulations 2021

The Regulations replace the following subordinate legislation in relation to noise:

- *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade), SEPP N-1*
- *State Environment Protection Policy (Control of Music Noise from Public Premises), SEPP N-2*
- *Environment Protection (Residential noise) Regulations 2018*
- *Environment Protection (Vehicle emissions) Regulations 2013.*

In relation to noise assessments, regulation 113 sets out that prediction, measurement, assessment and analysis of noise must be in accordance with the EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (the Noise Protocol). The noise protocol specifies how to set noise limits, background levels, alternative assessment criterion at an alternative assessment location and also effective noise levels.

Regulation 4 defines the noise sensitive areas that must be protected from unreasonable noise. The regulations maintain the noise sensitive areas that were defined in the SEPPs, these include areas such as residential premises, retirement villages and hospitals. However, the regulations also include 2 new noise sensitive areas:

- The first area covers: childcare centres, kindergartens, primary schools and secondary schools
- The second area includes rural areas that are: tourist establishments, camping grounds, and caravan parks.

The EP Act 2017 defines unreasonable noise as follows:

> *unreasonable noise means noise that—*
>
> *(a) is unreasonable having regard to the following—*
>
> *(i) its volume, intensity or duration;*
>
> *(ii) its character;*
>
> *(iii) the time, place and other circumstances in which it is emitted;*
>
> *(iv) how often it is emitted;*
>
> *(v) any prescribed factors; or*
>
> *(b) is prescribed to be unreasonable noise;*

Regulation 118 sets out the following restrictions in regard to noise limits:

> *(1) For the purposes of paragraph (b) of the definition of unreasonable noise in section 3(1) of the Act, noise emitted from commercial, industrial and trade premises is prescribed to be unreasonable noise if the effective noise level of the noise exceeds—*
>
> *(a) the noise limit that applies at the time the noise is emitted; or*
>
> *(b) the alternative assessment criterion that applies at the time the noise is emitted if the assessment of an effective noise level is conducted at an alternative assessment location in accordance with the Noise Protocol.*

(2) For the purposes of subregulation (1)(a), the lowest decibel value that may be set as the noise limit (the base noise limit) is—

(a) in the case of noise emitted in a major urban area—

(i) during the day period, 45 dB(A); or

(ii) during the evening period, 40 dB(A); or

(iii) during the night period, 35 dB(A); and

(b) in the case of noise emitted in a rural area—

(i) during the day period, 4 5dB(A); or

(ii) during the evening period, 37 dB(A); or

(iii) during the night period, 32 dB(A).

(3) The noise limit for commercial, industrial and trade premises for the night period must not exceed 55 dB(A).

Noise limit is defined in the EP Regulations as follows:

noise limit means—

(a) in Part 5.3 (other than Division 5), the maximum effective noise level allowed in a noise sensitive area, as determined in accordance with the Noise Protocol; and

(b) in Division 5 of Part 5.3, the limits determined in accordance with the relevant noise standard or regulation 131B(2);

Finally, the periods are defined in the EP Regulations as follows:

- Day Period: means Monday to Saturday (except public holidays), from 7 a.m. to 6 p.m.
- Evening Period: means Monday to Saturday, from 6 p.m. to 10 p.m.; and Sunday and public holidays, from 7 a.m. to 10 p.m.
- Night Period: means 10 p.m. to 7 a.m. the following day.

3.3 Environment Reference Standard

The ERS is not a compliance standard but it sets out environmental values, indicators and objectives that describe the environmental and human health outcomes to be achieved or maintained in Victoria. It must be considered by EPA in permission decisions.

3.3.1 Applicable Environmental Values

The primary assessment of noise occurs in accordance with the Regulations to determine that the activity will meet the necessary noise limits. As such the environmental values in the ERS are not as relevant to the permission application. For the purposes of this assessment, it has been considered that if the limits of the regulations have been met then the environmental values will be adequately protected. The ambient sound environmental values specified in the ERS are:

- sleep during the night
- domestic and recreational activities
- normal conversation
- childhood learning and development
- human tranquillity and enjoyment outdoors in natural areas
- musical entertainment.

3.4 Noise Protocol

The relevant assessment method in Victoria for industrial, commercial and trade premises is given in Victoria EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (the Noise Protocol).

The Noise Protocol in Part I-A sets out assessment criteria based on a receiver's location within rural or urban Victoria. This project is located within Major Urban area with the receivers considered in both Urban (north) and Rural (western) settings.

The Urban Area method establishes the criteria of a receiver by considering the zoning environment in its immediate (∅140 m) and intermediate (∅400 m) vicinity through an Influencing Factor and the nature of the background noise. The influencing factor calculations (IF-factor) and background noise levels are reproduced in Appendix B. A special case is made for the testing and maintenance of emergency equipment as discussed below.

The Rural Area method is a prescriptive approach considering source and receiver zoning. If conditions in the Protocol are met, distance between receiver and source zones, utility and background noise records are permitted to temper noise criteria for daytime, evening and night-time. A special case is made for the testing and maintenance of emergency equipment as discussed below. The prescriptive zoning table is reproduced in Appendix B.

For utilities that are located in a Road Zone (RDZ), Farming Zone (FZ), Rural Activity Zone (RAZ) or Green Wedge Zone (GWZ) prescriptive adjustments are identified that are to be applied. No utilities are located in the prescribed zones therefore utilities are not part of this assessment.

A summary of the applicable noise criteria for individual receivers for the Urban Area and Rural method are outlined in Table 3-1 and Table 3-2 respectively.

The noise monitoring data that informs on the applicable background is summarised in Appendix D.

Table 3-1 – Urban - General Plant Operations – Noise Criteria Development

Lcn	IF	Time	Zone (clause 7-15)	Background (clause 39-51)	R'ship	Source	Criteria (dBA)
R1	0.194	Day	53	36	Low	Clause 6a.i. BG+6	42
		Eve	47	39	Neutral	Clause 6b.ii. 0.5(Zone+BG) +3	46
		Night	42	30	Low	Clause 6c.i BG+3 or 55 dBA	35 (33)[2]
R2	0.388	Day	57	36	Low	Clause 6a.i. BG+6	42
		Eve	51	39	Low	Clause 6b.i BG +3	42
		Night	46	30	Low	Clause 6c.i BG+3 or 55 dBA	35 (33) [2]
R7	0.000	Day	50	36	Low	Clause 6a.i. BG+6	42
		Eve	44	39	Neutral	Clause 6b.ii. 0.5(Zone+BG) +3	44
		Night	39	30	Neutral	Clause 6c.ii. 0.5(Zone+BG) +3	38
R8	0.000	Day	50	36	Low	Clause 6a.i. BG+6	42
		Eve	44	39	Neutral	Clause 6b.ii. 0.5(Zone+BG) +3	44
		Night	39	30	Neutral	Clause 6c.ii. 0.5(Zone+BG) +3	38
R9	0.000	Day	50	36	Low	Clause 6a.i. BG+6	42
		Eve	44	39	Neutral	Clause 6b.ii. 0.5(Zone+BG) +3	44
		Night	39	30	Neutral	Clause 6c.ii. 0.5(Zone+BG) +3	38

Note 1. The Noise Protocol requires that assessment criteria are presented in whole numbers, rounded to the nearest figure

Note 2. Environment Protection Regulation 118(2)(a) & (b) provides a lowest dB value that may be applied i.e. base noise limit

Table 3-2 - Rural - General Plant Operations – Noise Criteria Development

Zoning and distances (source zone to receiver in metres)			Criteria (Source: PUZ1)[1]	Distance Adjust.	Utility Adjust	Operational Criteria dB(A)		
Name	Zone	Distance (m)	D\E\N	Adj., dB(A)	Adj., dB(A)	D	E	N

Zoning and distances (source zone to receiver in metres)			Criteria (Source: PUZ1)[1]	Distance Adjust.	Utility Adjust	Operational Criteria dB(A)		
R3_75 Como Road	GWAZ2	800	40\35\37	8	-	45 (37)[3]	37 (32)[3]	32 (27)[3]
R4_517-519 Maroondah Highway	GWAZ2	1,097	40\35\36	9	-	45(36)[3]	37 (31)[3]	32 (26)[3]
R5_564-566 Maroondah Highway	GWZ2	1,264	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]
R6_572 Maroondah Highway	GWZ2	1,380	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]
R10_11 Coldstream West Road Coldstream	GWZ4	1,111	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]
R11_19-21 Coldstream West Road Coldstream	GWZ4	1,304	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]
R12_23-27 Coldstream West Road Coldstream	GWZ4	1,064	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]
R13_138 Victoria Road	GWZ4	1,332	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]
R14_134 Victoria Road	GWZ4	1,381	43\38\39	9	-	45 (39)[3]	37 (34)[3]	32 (29)[3]

Note *1. D=Day; E=Evening; N=Night*

2. The Noise Protocol requires that assessment criteria are presented in whole numbers, rounded to the nearest figure

3. Environment Protection Regulation 118(2)(a) & (b) provides a lowest dB value that may be applied i.e. base noise limit

Emergency equipment maintenance is granted specific noise limits to permit the *testing and maintenance* of such equipment. The extension is applicable to noise limits developed for urban, or rural areas as well as utilities and earth resources. The adjustments are shown in Table 3-3.

Table 3-3 – Adjustment of noise limits due to testing and maintenance of emergency equipment

Condition	Reference	Day	Evening	Night
Testing and Maintenance of Emergency Equipment	Clause 37 Vic EPA Noise Protocol	Plant noise limit +10 dB(A)	Plant noise limit +5 dB(A)	Plant noise limit +5 dB(A)

4. Methodology

4.1 Noise Impact Assessment Methodology

The likely noise impacts from operation of the facility have been assessed by:

- Investigating the noise sources associated with the plant and recommending noise mitigation measures to minimise noise emissions from the site and thereby to minimise environmental harm due to noise
- predicting noise levels from site operations at the potentially affected receptors using computer modelling, and
- comparing the predicted noise emission levels at the receptors against the applicable noise limits

4.2 Noise Assessment Procedure

The noise assessment was implemented as outlined below:

- The area and facility layouts were determined from information provided by the client, satellite images and published data by the Victorian government / EPA.
- The Sound Power Levels were determined through manufacturer data and/or theoretical estimations of sound emissions of equipment. Sound Power Level data for noise sources assumed for the modelling is provided in Appendix C.
- The operating equipment duty point (percentage utilisation) varies but is modelled as continuous to represent a worst case scenario.
- Noise calculations were carried out in the software package Cadna using the ISO 9613 noise prediction methodology. All calculations utilise Z-weighted octave bands data. ISO 9613 considers noise attenuation by:
  - Geometric spreading
  - Atmospheric absorption
  - Ground effects
  - Meteorological conditions
  - Barriers
- The resultant sound pressure levels are compared to the day time, evening and night time criteria to determine if they are compliant with the requirements.
- If the facility is deemed to be non-compliant, generic noise controls options are developed to achieve compliance.

The recommended noise controls will be based on an array of minimum reductions of separate plant items in order to minimise the noise emissions so far as reasonably practicable as required by the GED as well as ensuring the combined total plant noise emissions to meet the entire facility's noise level targets. In some cases, the manufacturer(s) of noise control treatments may be able to achieve the equivalent reduction of the total plant's noise emissions with an alternative combination of different treatments applied to individual noise sources.

The client should engage with a noise control manufacturer or equipment manufacturer to ensure the facility noise control equipment installed will meet compliance.

4.3 Noise Assessment Scenarios

The operational noise scenarios that have been assessed are outlined below.

- Predicted sound pressure levels of the operation of all equipment in the facility under noise enhancing meteorological conditions.
- The emergency equipment (valve) also functions as part of their standard operations. No separate assessment of emergency equipment maintenance i.e. Flare will be carried out.
- Option 1: Considers the use of 20 kL Tanker for material removal max 1 load per day
- Option 2: Considers the use of 40 kL Tanker for material removal max 1 load per day

4.4 Iterative Review and Detailed Design

The analysis carried out in this document summarises the outcome of an iterative design review process resulting in the facilities compliance. To arrive at compliance, the initial facility is modelled in detail and noise sources that result in exceedances are flagged for noise control. Although there is no "noise control table" in this document, the noise control is reflected in the nominated sound power / sound pressure at a distance, that is characteristic of the equipment used (Appendix C).

4.5 Acoustic Model

Table 4-1 below lists the modelling parameters. The ISO 9613 method considers meteorological conditions (downwind and/or, moderate temperature inversion conditions) that enhance noise propagation. Such conditions do not occur all the time and the model therefore represents a worst case condition.

Table 4-1 - Model Settings

Model Setting	Value	Detail
Topography	Derived from 10 m interval data set	VIC government publishes contour dataset which were extracted for the purpose of this assessment
Buildings	Reflection loss 1 dB	Footprints for receiver and other buildings in the area surrounding works was determined from aerial photography. Heights and floor numbers were ascertained from Google Street view, or otherwise, assuming a building height of 3 metres per floor plus 2 m for the roof.
Receivers	1.5 m height (10 m from Façade)	Receivers were placed approx. 10 m from the façade of identified residential dwelling at 1.5 m height
Ground absorption	0.75	A 'rural' ground absorption factor of 0.75 was applied across the whole model area
	0.5	A 'urban' ground absorption factor of 0.5 was applied to Major Urban Area
	0.3	Facility where applicable
	0.0	Waterbodies and roads
Order of reflections	3	Reflection effects account for 3 orders of reflection
Noise Sources	Table	Sound powers were set as outlined in Appendix C with sources placed in free field
Foliage	Not included	Foliage especially densely forested areas can play a role in noise attenuation. The site is predominantly urban developments and Foliage has not been included in the noise calculation
Prediction Method	ISO 9613	Engineering method to calculate the attenuation of sound during propagation outdoors. The published accuracy for this standard is ±3 dBA between 100 m to 1,000 m. The method accounts for favourable propagation considering temperature inversion.

4.6 Operation Details

Quantities, periods of operation and associated operational assumptions for major noise sources are outlined in Table 4-2 below with further detail including the modelled Sound Power Levels provided in Appendix C

The facility will operate continuously but will undergo changes in operational duty depending on day, evening and night-time. The emergency valve may operate as part of emergency procedure or part of standard operation and has been modelled for day, evening and night-time period.

Care should be taken to select fan and motor selection to avoid multi-fan beat frequencies occurring.

Table 4-2 – Equipment Table

#	Name	Duty & Standby	Operation – Day/Evening/Night
1	Biofilter Fan	1 duty no standby	Day/Eve/Night
2	Jet Mixing Pump	1 duty, 1 standby for each tank	Day/Eve/Night
3	Depacker	1 duty no standby	Day/-/-
4	Inlet Pump	1 duty no standby	Day/Eve/-
5	RO Container	1 duty no standby	Day/-/-
6	Pelletiser	1 duty no standby	Day/-/-
7	Drying Conveyor	1 duty no standby	Day/-/-
8	Depacker pump	1 duty no standby	Day/-/-
9	Digestor Transfer Pump	1 duty no standby	Day/Eve/Night
10	Tank Blower	1 duty, 1 standby for each tank	Day/Eve/Night
11	Micro-compressor	1 duty no standby	Day/Eve/Night
12	Outlet Transfer Pump	1 duty no standby	Day/Eve/-
13	Sump Pump	1 duty no standby	Day/Eve/Night
14	Primary Air compressor	1 duty no standby	Day/Eve/Night
15	Chiller booster	1 duty no standby	Day/Eve/Night
16	CHP Generator	2 duty, no standby	Day/Eve/Night
17	Flare	1 duty, no standby	Day/Eve/Night
18.1	Delivery	max 8 delivery per hour, =>16 drive-bys	Day/Eve/-
18.2	25 kL tanker	1 per hour daytime only	Day/Eve/-
18.3	40 kL tanker	1 per hour daytime only	Day/Eve/-
19	Transformer	continuous	Day/Eve/Night
20	Digestor Blower	1 duty, 1 standby for aerobic digestor	Day/Eve/Night
21	Transfer Pump to UF	1 duty no standby	Day/Eve/Night
22	MBR UF Unit	1 duty no standby	Day/Eve/Night
23	RO Unit	1 duty no standby	Day/Eve/Night
24	Super Concentrator	1 duty no standby	Day/Eve/Night
25	Transfer Pump From UF Permeate	1 duty no standby	Day/Eve/Night
26	Transfer Pump From RO Reject Tank	1 duty no standby	Day/Eve/Night
27	Condenser Recycle Pump	1 duty no standby	Day/Eve/Night
28	Heat Exchanger Fan	1 duty no standby	Day/Eve/Night

As manufacturer's noise emissions data were not available in detail for this noise assessment, Jacobs has used estimated sound power level data. Jacobs has built conservativeness into the assessment but can provide no assurances regarding the accuracy of this data. It is recommended that all plant should be assessed at detailed design stage, before installation, to ensure that the source noise levels used in this assessment are consistent with the installed values.

4.7 Noise Characteristics

The predicted noise levels were **not** adjusted for acoustic characteristics according to the requirements of the Noise Protocol. The Noise Protocol requires adjustments to the predicted (or measured) noise levels based on sound characteristics including duration, tonality, impulse, intermittency, position and low frequency content.

The duration adjustment takes into account the duration of the proposed noise within a 30 minute timespan. All noise sources are expected to operate continuously and no duration adjustment is applied.

The tonality adjustment requires 1/3 octave band source noise level data to be available for the assessment. Such datasets could not be sourced, and the proponent is obligated to check that all noise sources on site are procured and installed with appropriate noise control so as to avoid tonal sounds at the receivers.

The impulse adjustment reflects impulse nature of the noise levels. All noise sources are expected to operate continuously or ramp up or down in a smooth continuous manner and no impulse adjustment is applied.

The intermittency adjustment reflects regular or semi-regular changes in noise levels. All noise sources are expected to operate continuously or ramp up or down in a smooth continuous manner and no intermittency adjustment is applied.

A position adjustment is applied for all receivers located within 1-2 m of an acoustic reflective surface. The receivers are modelled in free field and no position adjustment is applied.

An adjustment is applied for environmental noise containing strong low-frequency content. The adjustment is applied depending on the magnitude and the frequency spectrum of the low-frequency noise. The low frequency noise adjustment requires low frequency source noise level data to be available for the assessment. Such datasets could not be sourced, and the proponent is obligated to check that all noise sources on site are procured and installed with appropriate noise control so as to avoid high levels of low frequency sounds at the receivers. Nonetheless, an initial screening study for potential low-frequency impacts based on the available data is provided in Section 5.

5. Predicted Noise Level Results

5.1 Option 1: 20 kL Tanker

Table 5-1 summarises the sound pressure level (SPL) predictions from the model for each receiver in the study area with the nominated operating equipment for Option 1. Due to lack of detailed data the output is not adjusted for character as per requirements of the Noise Protocol.

Although not part of "The Protocol" an indication of noise character for low frequency content is given by considering the level difference between dBC & dBA. Values above 15 indicates a strong low frequency component affecting the character of the sound and potentially attracting penalties provided that the overall noise level is also simultaneously sufficiently high.

It is strongly recommended to carry out a detailed study (1/3 octave sound power data, including low-frequency bands) in the design phase to confirm the compliance noise character (tonality, impulse, intermittency and low-frequency) as outlined by the Protocol.

Figure 5-1 to Figure 5-3 provides a map of noise level contours showing the SPL under normal operating conditions for the day, evening and night-time periods.

Table 5-1 – Option 1, Predicted Noise Levels – General operations $L_{Aeq(30\ minutes)}$ (dBA) (outdoor, free-field)

Receiver	Day			Eve			Night		
	Crit	SPL	dBC-dBA	Crit	SPL	dBC-dBA	Crit	SPL	dBC-dBA
R1_Prop_4 Saintly Place	42	27.5	8.5	46	27.5	8.5	35	27	8.2
R2_60 Trafalgar Crescent	42	27.4	10.0	42	27.4	10.0	35	26.4	10.1
R3_75 Como Road	45	21.1	11.3	37	21.1	11.3	32	17.4	12.4
R4_517-519 Maroondah Hwy	45	20.9	12.6	37	20.9	12.6	32	8.3	12.0
R5_564-566 Maroondah Hwy	45	21.6	10.8	37	21.6	10.8	32	8	12.0
R6_572 Maroondah Hwy	45	32.3	5.5	37	32.3	5.5	32	16.6	12.1
R7_5 Ingram Road	42	28	11.1	44	28	11.1	38	19.3	11.4
R8_584 Maroondah Hwy	42	36.3	7.0	44	36.3	7.0	38	21.9	11.2
R9_74 Station Street	42	24.9	9.7	44	24.9	9.7	38	21	11.2
R10_11 Coldstream West Road	45	26	9.9	37	26	9.9	32	23.4	11.0
R11_19-21 Coldstream West Road	45	24.8	10.3	37	24.8	10.3	32	23.3	10.6
R12_23-27 Coldstream West Road	45	25.3	11.9	37	25.3	11.9	32	23.3	9.6
R13_138 Victoria Road	45	23.4	9.1	37	23.4	9.1	32	22.9	8.6
R14_134 Victoria Road	45	20.5	9.4	37	20.5	9.4	32	19.9	8.6

The results shown in Table 5-1 indicate that the facility contribution is expected to comply with the noise limit criteria at all identified receivers under day, evening and night-time operation, under the modelled worst-case meteorological conditions.

Comparison of the predicted effective noise levels against the noise limits confirms that the proposed noise controls to be incorporated into the plant design will minimise the risks of environmental harm due to noise impact so far as reasonably practicable.

The receivers R6 and R8 are most affected by Option 1 trucking is around 6 dB or more below the day and evening noise limit criteria.

Table 5-4 outlines a source ranking of the contributing noise sources at the nearest sensitive receiver R1 which is a proposed receiver building located at 4 Saintly Place, Lilydale.

Table 5-2 - Source Ranking -R1_Prop_4 Saintly Place

Day			Evening		Night	
#	Sources	SPL dBA	Sources	SPL dBA	Sources	SPL dBA
1	16_CHP2_Generator_Wall	20.4	16_CHP2_Generator_Wall	20.4	16_CHP2_Generator_Wall	20.4
2	10_Prim_Digestor1_Dome_blower2_all parts	19.2	10_Prim_Digestor1_Dome_blower2_all parts	19.2	10_Prim_Digestor1_Dome_blower2_all parts	19.2
3	10_Prim_Digestor1_Dome_blower1_all parts	18.5	10_Prim_Digestor1_Dome_blower1_all parts	18.5	10_Prim_Digestor1_Dome_blower1_all parts	18.5
4	16_CHP2_Generator_Roof	17.8	16_CHP2_Generator_Roof	17.8	16_CHP2_Generator_Roof	17.8
5	16_CHP1_Generator_Roof	17.8	16_CHP1_Generator_Roof	17.8	16_CHP1_Generator_Roof	17.8
6	18_Truck _Delivery_60kmh	17.3	18_Truck _Delivery_60kmh	17.3	16_CHP1_Generator_Wall	17.3
7	16_CHP1_Generator_Wall	17.3	16_CHP1_Generator_Wall	17.3	10_Prim_Digestor2_Dome_blower1_all parts	9.5
8	10_Prim_Digestor2_Dome_blower1_all parts	9.5	10_Prim_Digestor2_Dome_blower1_all parts	9.5	10_Prim_Digestor2_Dome_blower2_all parts	9.5
9	10_Prim_Digestor2_Dome_blower2_all parts	9.5	10_Prim_Digestor2_Dome_blower2_all parts	9.5	A3_TransferPumptoUF	8.5
10	A3_TransferPumptoUF	8.5	A3_TransferPumptoUF	8.5	A7_Transfer-Pump-From-UF-Permeate	7.5
	Sum of remaining sources	0.4	Sum of remaining sources	0.4	Sum of remaining sources	0.3
	TOTAL Equipment	27.5	TOTAL Equipment	27.5	TOTAL Equipment	27.0
	Ambient Noise	0.0	Ambient Noise	0.0	Ambient Noise	0.0
	Cumulative SPL	27.5	Cumulative SPL	27.5	Cumulative SPL	27.0

The source ranking shown in Table 5-4 indicates that the Generator components (CHP 1& 2), and the Primary Digestor 1& 2 Dome blower are the dominant noise sources contributing to the combined total of the received noise levels. Although these noise sources have not been penalised for sound characteristics in this assessment, the nature of these sources can attract *"noise character"* penalties (5-10 dB) and should be examined in their detailed components (exhaust, cooler, air intake, etc) in terms of their 1/3 octave profile during the Detailed Design stage.

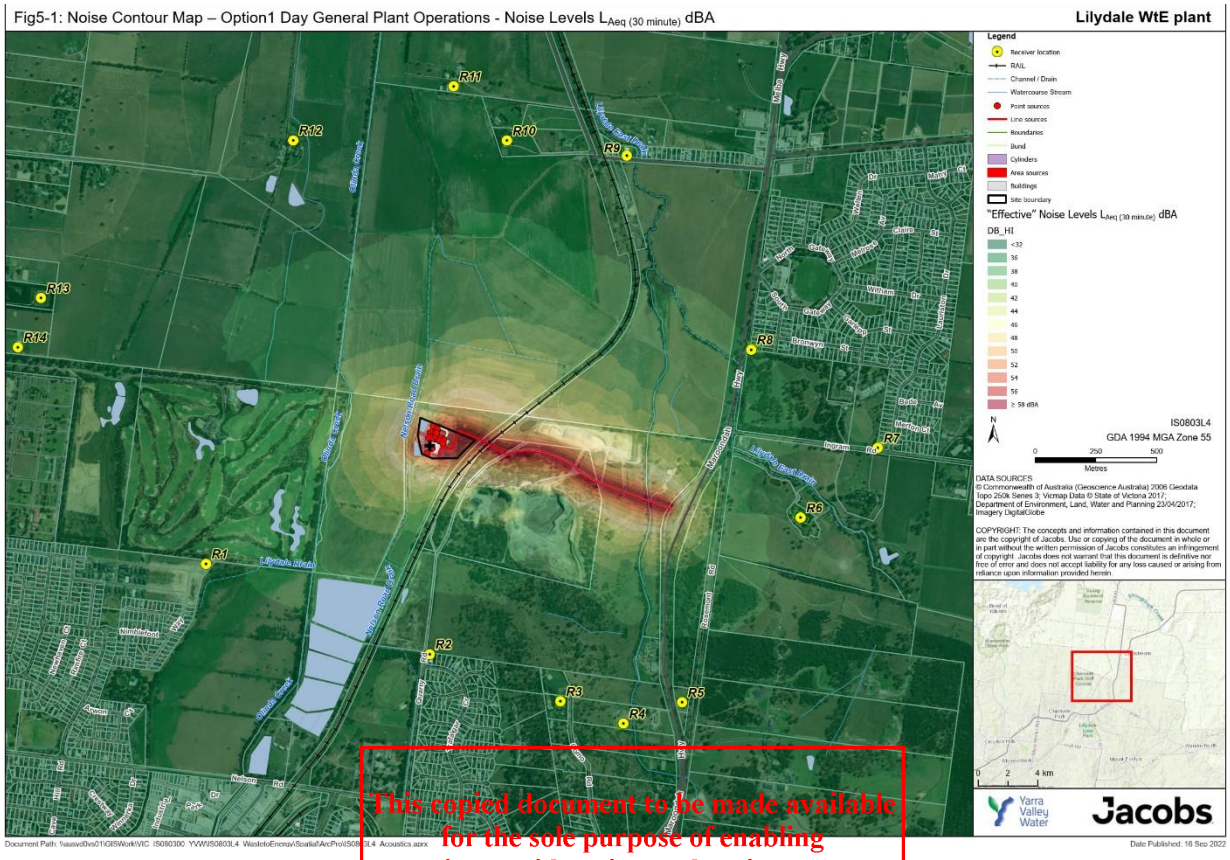

Figure 5-1 Noise Contour Map Option 1 – Day - General Plant Operations - Noise Levels $L_{Aeq(30\ minute)}$ dBA

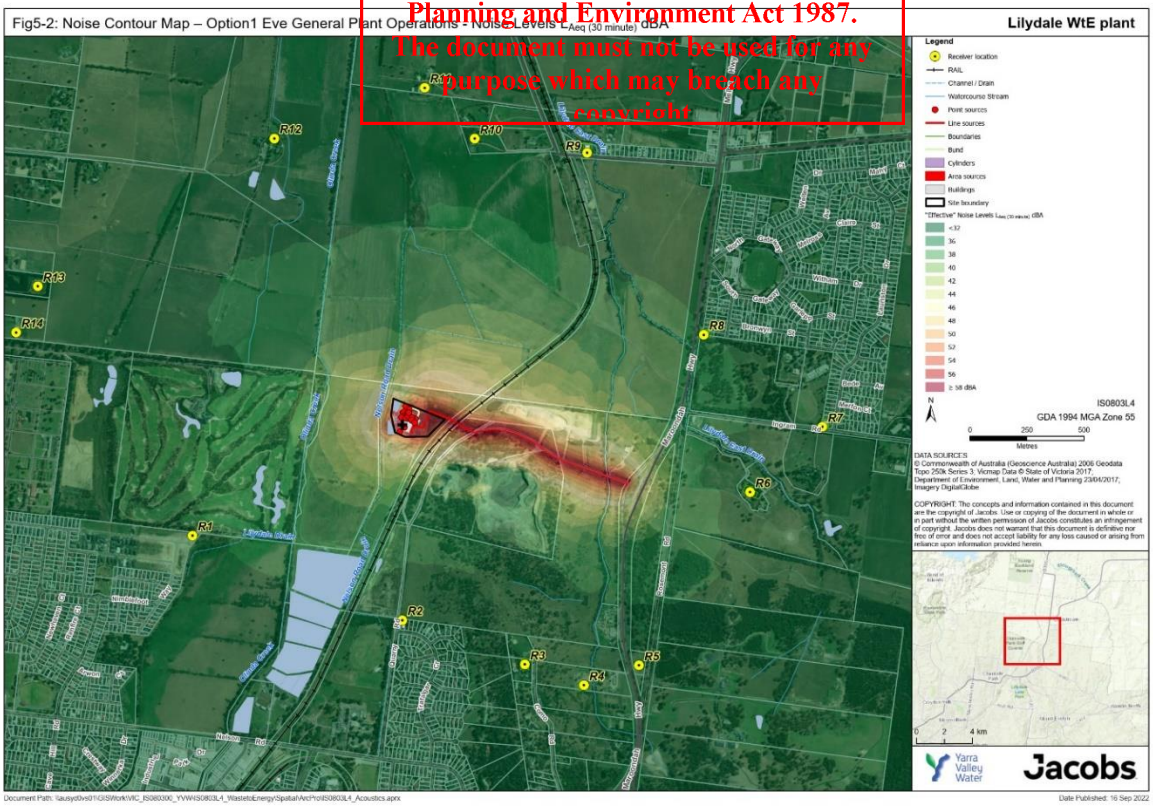

Figure 5-2 Noise Contour Map Option 1 – Evening-General Plant Operations - Noise Levels $L_{Aeq(30\ minute)}$ dBA

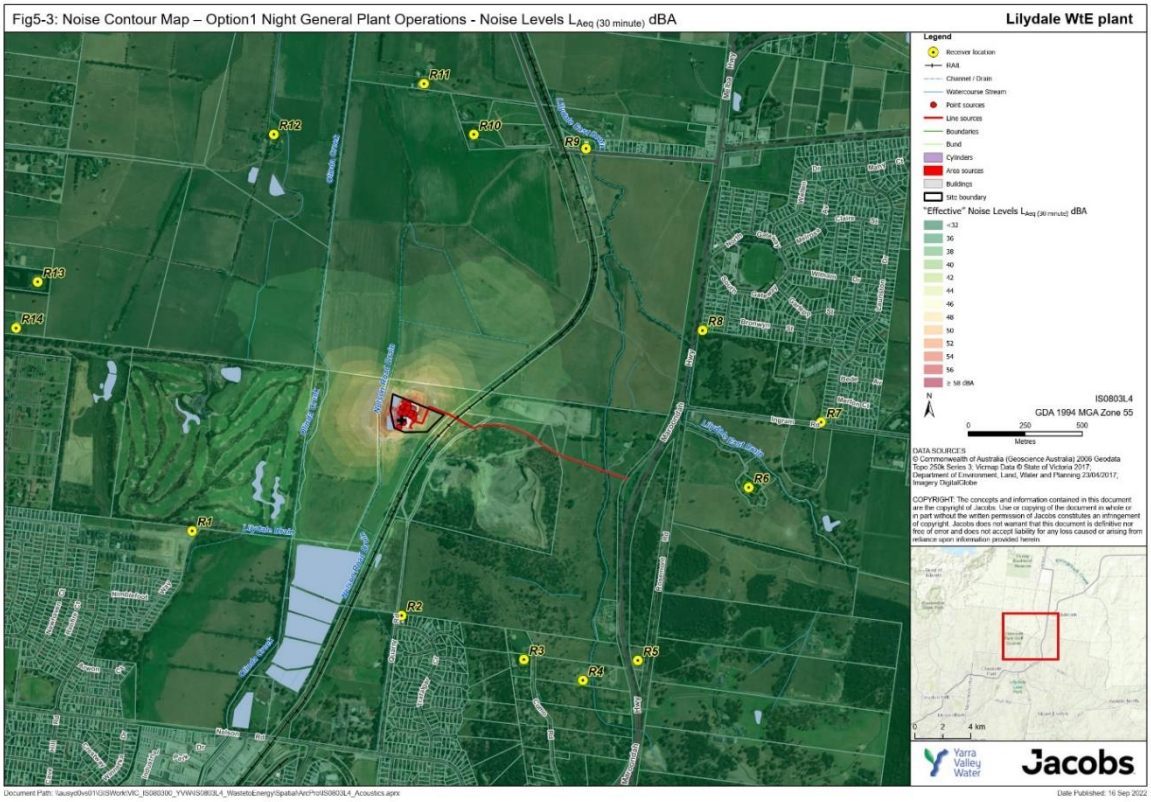

Figure 5-3 Noise Contour Map Option 1 – Night-General Plant Operations - Noise Levels $L_{Aeq(30\ minute)}$ dBA

5.2 Option 2: 40 kL Tanker

Table 5-3 summarises the sound pressure level (SPL) predictions from the model for each receiver in the study area with the nominated operating equipment Option 2. Due to lack of detailed data the output is not adjusted for character as per requirements of the Noise Protocol.

Although not part of the Noise Protocol an indication of noise character for low frequency content is given by considering the level difference between dBC & dBA. Values above 15 indicates a strong low frequency component affecting the character of the sound and potentially attracting penalties provided that the overall noise level is also simultaneously sufficiently high.

It is strongly recommended to carry out a detailed study (1/3 octave sound power data, including low-frequency bands) in the design phase to confirm the compliance noise character (tonality, impulse, intermittency and low-frequency) as outlined by the Protocol.

Figure 5-4 to Figure 5-6 provides a map of noise level contours showing the SPL under normal operating conditions for daytime, evening and night-time periods.

Table 5-3 – Option 2, Predicted Noise Levels – General operations $L_{Aeq(30\ minutes)}$ (dBA) (outdoor, free-field)

Receiver	Day			Eve			Night		
	Crit	SPL	dBC-dBA	Crit	SPL	dBC-dBA	Crit	SPL	dBC-dBA
R1_Prop_4 Saintly Place	42	**27.6**	9.0	46	**27.6**	9.0	35	**27**	8.2
R2_60 Trafalgar Crescent	42	**27.5**	10.4	42	**27.5**	10.4	35	**26.4**	10.1
R3_75 Como Road	45	**21.3**	12.3	37	**21.3**	12.3	32	**17.4**	12.4
R4_517-519 Maroondah Hwy	45	**21.3**	14.9	37	**21.3**	14.9	32	**8.3**	12.0
R5_564-566 Maroondah Hwy	45	**21.9**	13.2	37	**21.9**	13.2	32	**8**	12.0
R6_572 Maroondah Hwy	45	**32.6**	6.9	37	**32.6**	6.9	32	**16.6**	12.1
R7_5 Ingram Road	42	**28.3**	13.5	44	**28.3**	13.5	38	**19.3**	11.4
R8_584 Maroondah Hwy	42	**36.6**	9.2	44	**36.6**	9.2	38	**21.9**	11.2
R9_74 Station Street	42	**25**	10.6	44	**25**	10.6	38	**21**	11.2
R10_11 Coldstream West Road	45	**26.1**	10.6	37	**26.1**	10.6	32	**23.4**	11.0
R11_19-21 Coldstream West Road	45	**24.9**	10.7	37	**24.9**	10.7	32	**23.3**	10.6
R12_23-27 Coldstream West Road	45	**25.5**	13.8	37	**25.5**	13.8	32	**23.3**	9.6
R13_138 Victoria Road	45	**23.4**	9.6	37	**23.4**	9.6	32	**22.9**	8.6
R14_134 Victoria Road	45	**20.5**	10.2	37	**20.5**	10.2	32	**19.9**	8.6

The results shown in Table 5-3 indicates that the facility contribution is expected to comply with the noise limit criteria at all identified receivers under day, evening and night-time operation under the modelled worst-case meteorological conditions.

Comparison of the predicted effective noise levels against the noise limits confirms that the proposed noise controls to be incorporated into the plant design will minimise the risks of environmental harm due to noise impact so far as reasonably practicable.

The receivers most affected by Option 2 are R6 and R8 where the predicted noise levels are around 5 dB or more below the nominated day and evening criteria.

Table 5-4 - Source Ranking -R1_Prop_4 Saintly Place

Day			Evening		Night	
#	Sources	SPL dBA	Sources	SPL dBA	Sources	SPL dBA
1	16_CHP2_Generator_Wall	20.4	16_CHP2_Generator_Wall	20.4	16_CHP2_Generator_Wall	20.4
2	10_Prim_Digestor1_Dome_blower2_all parts	19.2	10_Prim_Digestor1_Dome_blower2_all parts	19.2	10_Prim_Digestor1_Dome_blower2_all parts	19.2
3	10_Prim_Digestor1_Dome_blower1_all parts	18.5	10_Prim_Digestor1_Dome_blower1_all parts	18.5	10_Prim_Digestor1_Dome_blower1_all parts	18.5
4	16_CHP2_Generator_Roof	17.8	16_CHP2_Generator_Roof	17.8	16_CHP2_Generator_Roof	17.8
5	16_CHP1_Generator_Roof	17.8	16_CHP1_Generator_Roof	17.8	16_CHP1_Generator_Roof	17.8
6	18_Truck _Delivery_60kmh	17.3	18_Truck _Delivery_60kmh	17.3	16_CHP1_Generator_Wall	17.3
7	16_CHP1_Generator_Wall	17.3	16_CHP1_Generator_Wall	17.3	10_Prim_Digestor2_Dome_blower1_all parts	9.5
8	18_Truck _Opt2 40kL_60kmh	9.7	18_Truck _Opt2 40kL_60kmh	9.7	10_Prim_Digestor2_Dome_blower2_all parts	9.5
9	10_Prim_Digestor2_Dome_blower1_all parts	9.5	10_Prim_Digestor2_Dome_blower1_all parts	9.5	A3_TransferPumptoUF	8.5
10	10_Prim_Digestor2_Dome_blower2_all parts	9.5	10_Prim_Digestor2_Dome_blower2_all parts	9.5	A7_Transfer-Pump-From-UF-Permeate	7.5
	Sum of remaining sources	0.5	Sum of remaining sources	0.5	Sum of remaining sources	0.3
	TOTAL Equipment	27.6	TOTAL Equipment	27.6	TOTAL Equipment	27.0
	Ambient Noise	0.0	Ambient Noise	0.0	Ambient Noise	0.0
	Cumulative SPL	27.6	Cumulative SPL	27.6	Cumulative SPL	27.0

The source ranking shown in Table 5-4 indicates that the generator components (CHP 1& 2), and the Primary Digestor 1 & 2 Dome blower are the dominant noise sources contributing to the combined total of the received noise levels. Although these noise sources have not been penalised for sound characteristics in this assessment, the nature of these sources can attract *"noise character"* penalties (5-10 dB) and should be examined in their detailed components (exhaust, cooler, air intake, etc) in terms of their 1/3 octave profile during the Detailed Design stage.

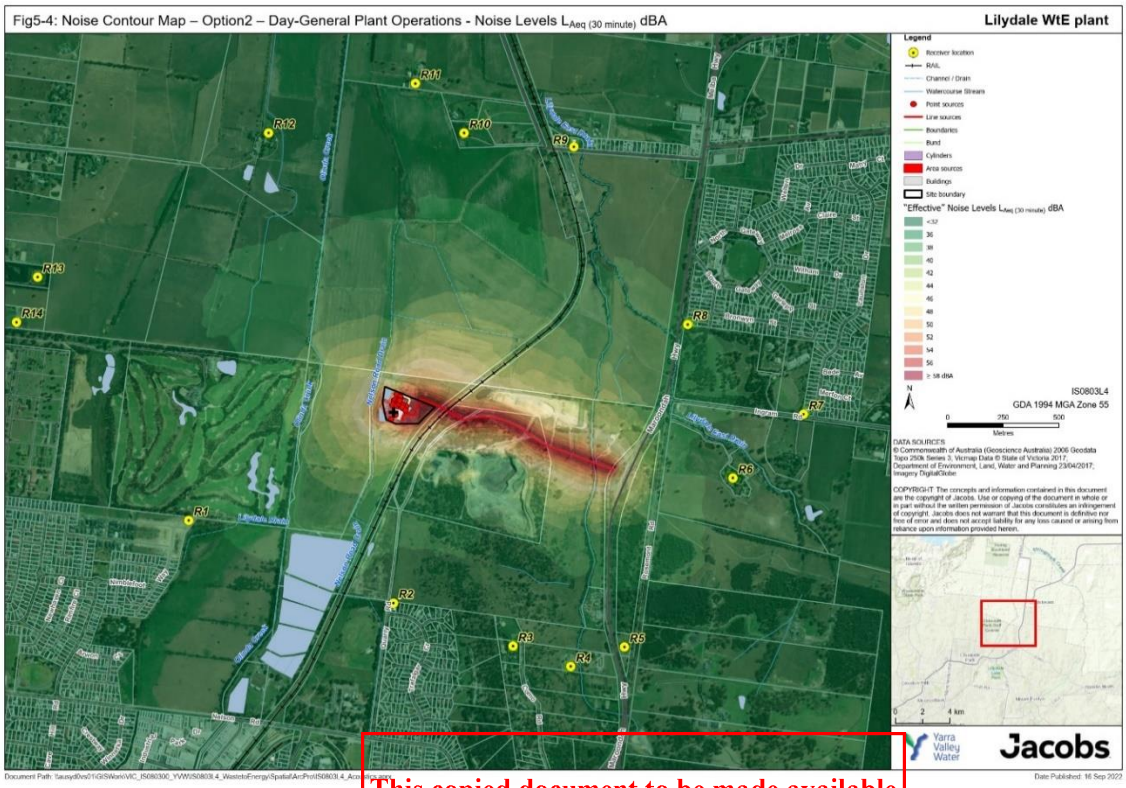

Figure 5-4 Noise Contour Map Option 2 – Day-General Plant Operations - Noise Levels $L_{Aeq(30\ minute)}$ dBA

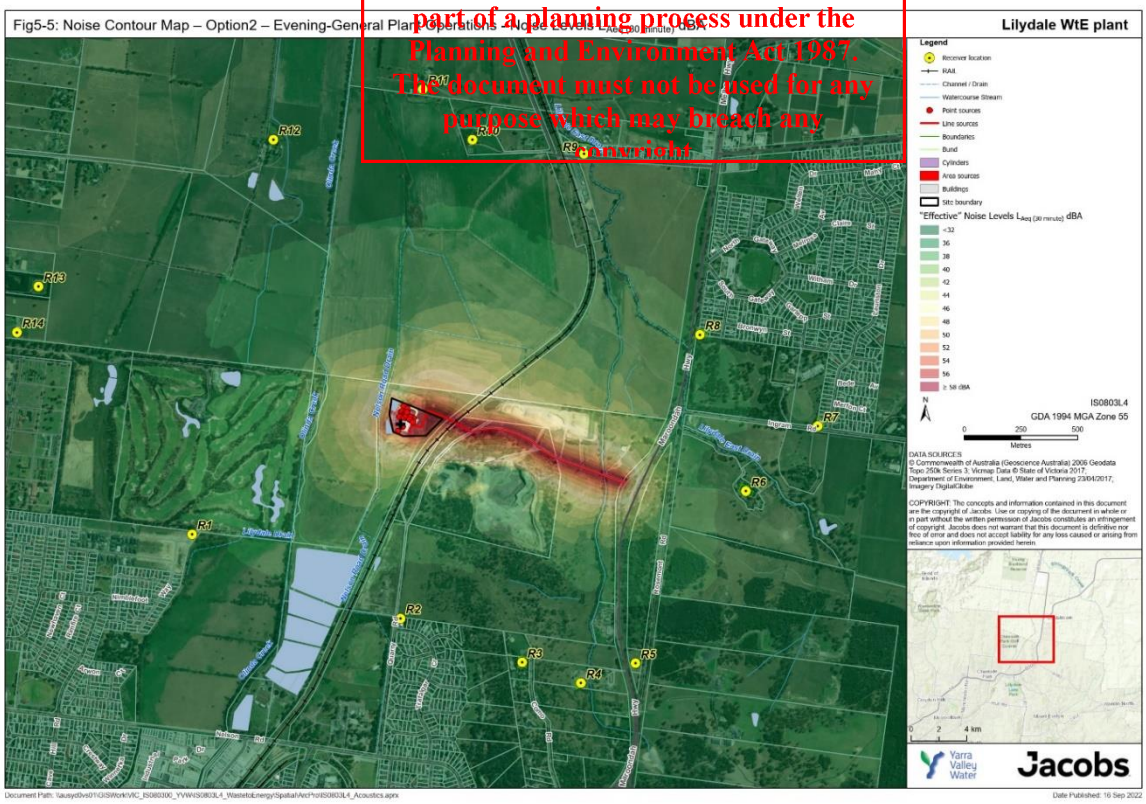

Figure 5-5 Noise Contour Map Option 2 – Evening-General Plant Operations - Noise Levels $L_{Aeq(30\ minute)}$ dBA

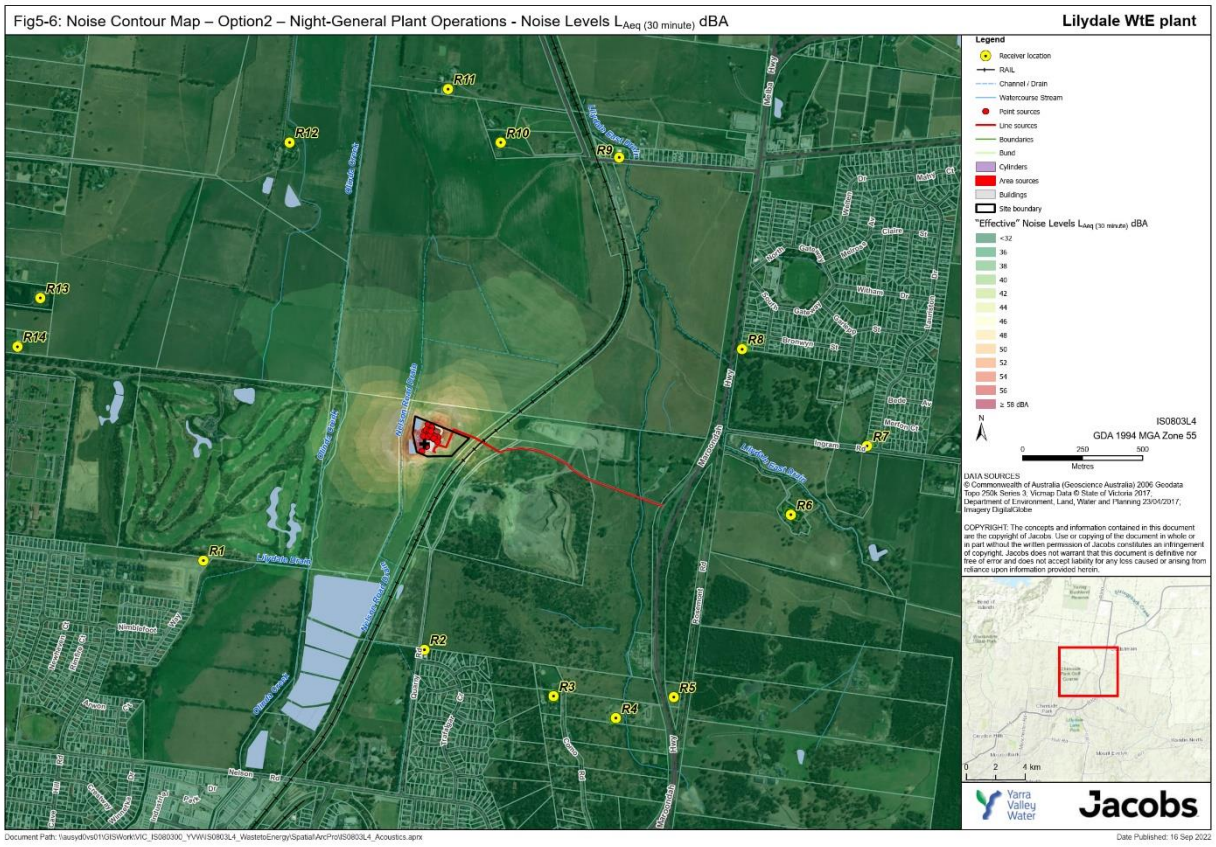

Figure 5-6 Noise Contour Map Option 2 – Night-General Plant Operations - Noise Levels $L_{Aeq(30\ minute)}$ dBA

6. Conclusion

A noise assessment has been performed for operational conditions and two trucking methods of the proposed waste to energy installation.

A range of measures have been implemented to minimise the risks of impacts from noise at sensitive receptors so far as reasonably practicable in accordance with the GED. The operational assessment results indicate that the facility contribution is expected to meet the noise limits at all receivers during steady state operation during the day, evening and night-time conditions, under worst-case meteorological conditions associated with enhanced noise propagation.

Predicted noise impacts for both Option 1 and Option 2 are very similar, as the difference in expected noise levels are less than 1 dB(A) which would not be subjectively noticeable.

For both Option 1 and Option 2, the predicted noise levels during the day and evening time periods are lower than the noise limits criteria at all receivers.

For both Option 1 and Option 2, during the night-time period most impacted receiver is a proposed receiver building R1 located at 4 Saintly Place, Lilydale, approximately 1,040 m WSE from the facility. The predicted noise levels at this receiver during the night-time period are approximately 8 dB(A) below the noise limit criteria under the worst-case noise-enhancing meteorological conditions modelled. Noise limits applicable to testing and maintenance of the emergency equipment will also form part of the operating conditions and will not be assessed separately. If the facility is compliant during operation it will also be compliant under the relaxed emergency equipment testing condition which is based on the normal noise limits +10 dB(A) during the day or +5 dB(A) during the evening and night time periods.

6.1 Recommendations

As detailed manufacturer's noise emissions data were not available for this noise assessment, Jacobs has used estimated detailed sound power level data. Jacobs has built conservativeness into the assessment but can provide no assurances regarding the accuracy of this data. It is recommended that all plant should be assessed at detailed design stage, before installation, to ensure that the source noise levels used in this assessment are consistent with the installed values.

It is also recommended that the Detailed Design specifications for the facility explicitly incorporate the requirement to minimise potential risk of environmental harm due to noise impacts, by considering the noise emissions from all noise sources and incorporating cost-effective noise control measures into all plant, equipment and means of transportation.

Appendix A References

Datakustik GmbH (DataKustik). 2021 Build 187.5163 *Cadna/A Computer Aided Noise Abatement model*, Munich, Germany.

Software: *Strutt* Version 5.22.02E, Arup Acoustics

Victoria Environmental Protection Authority Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*

Victorian Government – Major Urban Area – locations polygons and table, Feb 2022, Major Urban Area - location polygons and table - Dataset - Victorian Government Data Directory

International Organization for Standardization Standard 9613-1, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 1: Calculation of Absorption of Sound by the Atmosphere*, Geneva Switzerland.

International Organization for Standardization Standard 9613-2, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General method of Calculation*, Geneva Switzerland.

Appendix B Criteria Development

Receiver 1 Proposed 4 Saintly Place

Table B-1 – Receiver Zoning ∅ 140m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ1	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 1	5,778.365
ZN	YARRA RANGES	GWZ4	GREEN WEDGE ZONE - SCHEDULE 4	3,985.168
ZN	YARRA RANGES	SUZ1	SPECIAL USE ZONE - SCHEDULE 1	5,634.565

Table B-2 – Receiver Zoning ∅ 400

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ1	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 1	3,3018.38
ZN	YARRA RANGES	GWZ4	GREEN WEDGE ZONE - SCHEDULE 4	3,5834.25
ZN	YARRA RANGES	SUZ1	SPECIAL USE ZONE - SCHEDULE 1	5,6825.66

Table B-3 – Receiver Zoning & Designation

∅140m			∅400m		
Zone	Area	Des. Type	Zone	Area	Des. Type 2 or 3
NRZ1	5778.365	-	NRZ1	33018.38	-
GWZ4	3985.168	-	GWZ4	35834.25	-
SUZ1	5634.565	3	SUZ1	56825.66	3

Table B-4 – Influencing Factor (IF), Zoning level, Background (BG) and Criteria

IF	Time	Zone (clause 7-15)	Background (clause 39-51)	R'ship	Source	Criteria (dBA)	Criteria (w. tonal adj)
0.194	Day	53	36	Low	Clause 6a.i. BG+6	42	32
	Eve	47	39	Neutral	Clause 6b.ii. 0.5(Zone+BG)+3	46	36
	Night	42	30	Low	Clause 6c.i BG+3 or 55dBA	35 (33)[1]	23

Note 1. Environment Protection Regulation 118(2)(a) & (b) provides a lowest dB value that may be applied i.e. base noise limit

Receiver 2 60 Trafalgar Crescent

Table B-5 – Receiver Zoning ∅ 140 m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ1	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 1	6772.232
ZN	YARRA RANGES	IN3Z	INDUSTRIAL 3 ZONE	1518.683
ZN	YARRA RANGES	SUZ1	SPECIAL USE ZONE - SCHEDULE 1	4494.081

Table B-6 – Receiver Zoning ∅ 400 m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ1	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 1	39305.96
ZN	YARRA RANGES	IN3Z	INDUSTRIAL 3 ZONE	23992.78
ZN	YARRA RANGES	SUZ1	SPECIAL USE ZONE - SCHEDULE 1	33955.49
ZN	YARRA RANGES	PUZ1	PUBLIC USE ZONE - SERVICE AND UTILITY	28424.89

Table B-7 – Receiver Zoning & Designation

Ø140m			Ø400m		
Zone	Area	Des. Type 2 or 3	Zone	Area	Des. Type 2 or 3
NRZ1	6772.232	-	NRZ1	39305.96	
IN3Z	1518.683	2	IN3Z	23992.78	2
SUZ1	4494.081	3	SUZ1	33955.49	3
PUZ1	2610.696	2	PUZ1	28424.89	2

Table B-8 – Influencing Factor (IF), Zoning level, Background (BG) and Criteria

IF	Time	Zone (clause 7-15)	Background (clause 39-51)	R'ship	Source	Criteria (dBA)	Criteria (w. tonal adj)
0.388	Day	57	36	Low	Clause 6a.i. BG+6	42	32
	Eve	51	39	Low	Clause 6b.i BG+3	42	32
	Night	46	30	Low	Clause 6c.i BG+3 or 55dBA	35 (33)[1]	23

Note 1. Environment Protection Regulation 118(2)(a) & (b) provides a lowest dB value that may be applied i.e. base noise limit

Receiver 7_5 Ingram Road Coldstream

Table B-9 – Receiver Zoning ∅ 140 m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	4763.053
ZN	YARRA RANGES	GWZ2	GREEN WEDGE ZONE - SCHEDULE 2	6733.157

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	PUZ2	PUBLIC USE ZONE - EDUCATION	3899.683

Table B-10 – Receiver Zoning ∅ 400

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	33524.94
ZN	YARRA RANGES	GWZ2	GREEN WEDGE ZONE - SCHEDULE 2	60075.01
ZN	YARRA RANGES	PPRZ	PUBLIC PARK AND RECREATION ZONE	8702.54
ZN	YARRA RANGES	PUZ2	PUBLIC USE ZONE - EDUCATION	23378.27

Table B-11 – Receiver Zoning & Designation

∅140 m			∅400 m		
Zone	Area	Des. Type 2 or 3	Zone	Area	Des. Type 2 or 3
NRZ3	4763.053	-	NRZ3	33524.94	
GWZ2	6733.157	-	GWZ2	60075.01	
PUZ2	3899.683	-	PPRZ	8702.54	-
	0		PUZ2	23378.27	-

Table B-12 – Influencing Factor (IF), Zoning level, Background (BG) and Criteria

IF	Time	Zone (clause 7-15)	Background (clause 39-51)	R'ship	Source	Criteria	Criteria (w. tonal adj)
0.000	Day	50	36	Low	Clause 6a.i. BG+6	42	32
	Eve	44	39	Neutral	Clause 6b.ii. 0.5(Zone+BG)+3	44	34
	Night	39	30	Neutral	Clause 6c.ii. 0.5(Zone+BG)+3	38	28

Receiver 8 584 Maroondah Highway

Table B-13 – Receiver Zoning ∅ 140 m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	4649.525
ZN	YARRA RANGES	PPRZ	PUBLIC PARK AND RECREATION ZONE	4525.536
ZN	YARRA RANGES	TRZ2	TRANSPORT ZONE 2 - PRINCIPAL ROAD NETWORK	6220.775

Table B-14 – Receiver Zoning ∅ 400 m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m^2)
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	33541.83
ZN	YARRA RANGES	GWZ2	GREEN WEDGE ZONE - SCHEDULE 2	30492.82
ZN	YARRA RANGES	PPRZ	PUBLIC PARK AND RECREATION ZONE	33646.59
ZN	YARRA RANGES	TRZ2	TRANSPORT ZONE 2 - PRINCIPAL ROAD NETWORK	27999.06

Table B-15 – Receiver Zoning & Designation

∅140m			∅400 m		
Zone	Area	Des. Type 2 or 3	Zone	Area	Des. Type 2 or 3
NRZ3	4649.525	-	NRZ3	33541.83	-
PPRZ	4525.536	-	GWZ2	30492.82	-

Ø140m			Ø400 m		
TRZ2	6220.775	-	PPRZ	33646.59	-
			TRZ2	27999.06	-

Table B-16 – Influencing Factor (IF), Zoning level, Background (BG) and Criteria

IF	Time	Zone (clause 7-15)	Background (clause 39-51)	R'ship	Source	Criteria (dBA)	Criteria (w. tonal adj)
0.000	Day	50	36	Low	Clause 6a.i. BG+6	42	32
	Eve	44	39	Neutral	Clause 6b.ii. 0.5(Zone+BG)+3	44	34
	Night	39	30	Neutral	Clause 6c.ii. 0.5(Zone+BG)+3	38	28

Receiver 9_11 Coldstream Road

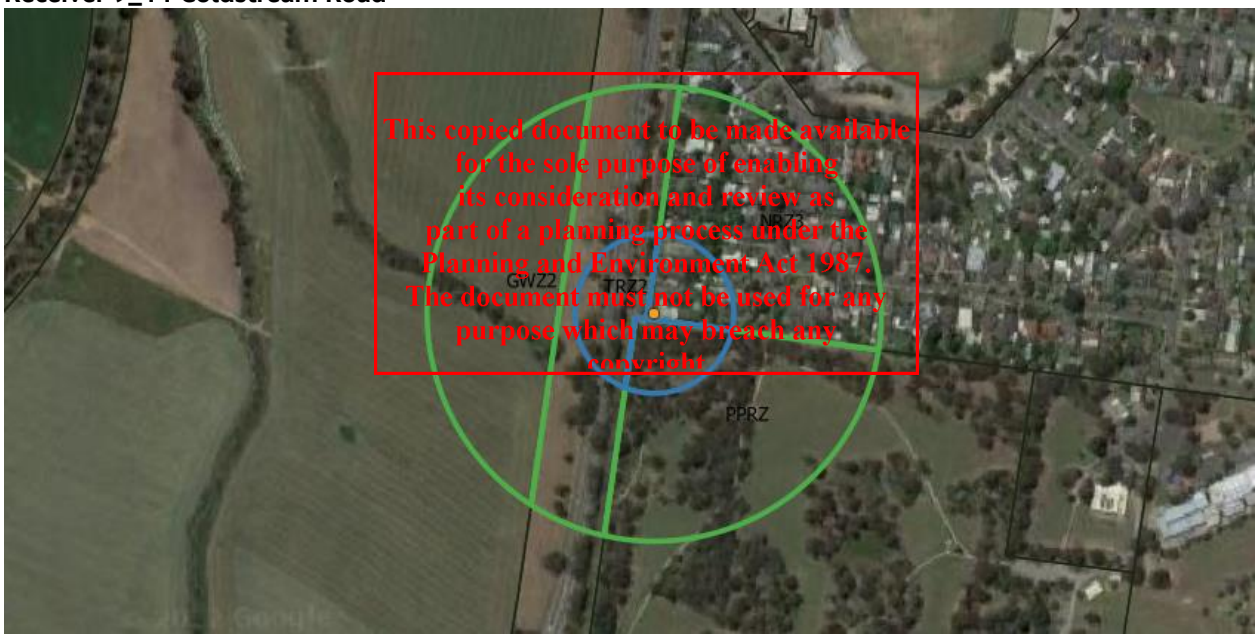

Table B-17 – Receiver Zoning ∅ 140 m

Scheme Code	LGA	Zone_Code	Zone Description	Area (m²)
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	324.678
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	4802.356
ZN	YARRA RANGES	GWZ2	GREEN WEDGE ZONE - SCHEDULE 2	1446.31
ZN	YARRA RANGES	GWZ4	GREEN WEDGE ZONE - SCHEDULE 4	5890.627
ZN	YARRA RANGES	TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	532.256

Scheme Code	LGA	Zone_Code	Zone Description	Area (m²)
ZN	YARRA RANGES	TRZ3	TRANSPORT ZONE 3 - SIGNIFICANT MUNICIPAL ROAD	2399.553

Table B-18 – Receiver Zoning ∅ 400

Scheme Code	LGA	Zone_Code	Zone Description	Area (m²)
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	6924.892
ZN	YARRA RANGES	NRZ3	NEIGHBOURHOOD RESIDENTIAL ZONE - SCHEDULE 3	6578.168
ZN	YARRA RANGES	GWZ2	GREEN WEDGE ZONE - SCHEDULE 2	21271.04
ZN	YARRA RANGES	GWZ4	GREEN WEDGE ZONE - SCHEDULE 4	46818.14
ZN	YARRA RANGES	GWZ4	GREEN WEDGE ZONE - SCHEDULE 4	8000.478
ZN	YARRA RANGES	TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	6806.397
ZN	YARRA RANGES	TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	20307.17
ZN	YARRA RANGES	TRZ3	TRANSPORT ZONE 3 - SIGNIFICANT MUNICIPAL ROAD	8973.562

Table B-19 – Receiver Zoning & Designation

∅140m			∅400m		
Zone	Area	Des. Type 2 or 3	Zone	Area	Des. Type 2 or 3
NRZ3	324.678	-	NRZ3	6924.892	-
NRZ3	4802.356	-	NRZ3	6578.168	-
GWZ2	1446.31	-	GWZ2	21271.04	-
GWZ4	5890.627	-	GWZ4	46818.14	-
TRZ1	532.256	-	GWZ4	8000.478	-
TRZ3	2399.553	-	TRZ1	6806.397	-
			TRZ1	20307.17	-
			TRZ3	8973.562	-

Table B-20 – Influencing Factor (IF), Zoning level, Background (BG) and Criteria

IF	Time	Zone (clause 7-15)	Background (clause 39-51)	R'ship	Source	Criteria (dBA)	Criteria (w. tonal adj)
0.000	Day	50	36	Low	Clause 6a.i. BG+6	42	32
	Eve	44	39	Neutral	Clause 6b.ii. 0.5(Zone+BG)+3	44	34
	Night	39	30	Neutral	Clause 6c.ii. 0.5(Zone+BG)+3	38	28

Non Major Urban Area Receivers

Table B-21 –Zone Levels (Noise Protocol Table B.1)

Table B.1: Zone levels (dB(A)) for rural area method for commercial, industrial and trade premises

Generating Zone ↓ / Receiving zone →	Green Wedge A GWAZ, Rural Living RLZ Group E CDZ, SUZ & UGZ (*)	Low Density Residential LDRZ Public Conservation and Resource PCRZ Public Park and Conservation PPCZ Public Use 2,5 PUZ2 & PUZ5 Urban Floodway UFZ	Green Wedge GW GRZ Neighbour Residential Zone NRZ Residential Growth Zone RGZ, Rural Activity Zone RAZ, Township Zone TZ Urban Growth Zone before an incorporated precinct structure plan UGZ Group B CDZ, SUZ & UGZ (*)	Commercial 1 Zone C1Z B1Z B2Z B5Z Commercial 3 Zone C3Z Mixed use Zone MUZ Activity Centre Zone ACZ Public Use Zone 1,3,4,6&7 PUZ1 PUZ3 PUZ4 PUZ6 & PUZ7 Road RDZ1 RDZ2 Group A CDZ, SUZ & UGZ (*)	Industrial 3 IN3Z Group C CDZ, SUZ & UGZ (*)	Commercial 2 Zone C2Z B3Z B4Z	Industrial 2 Zone IN2Z Industrial 1 Zone IN1Z Group D CDZ, SUZ, UGZ (*)
Low Density Residential LDRZ Public Conservation and Resource PCRZ Public Park and Conservation PPCZ Public Use 2,5 PUZ2 & PUZ5 Urban Floodway UFZ Group E CDZ, SUZ & UGZ (*)	Day 45 Evening 37 Night 32	Day 45 Evening 39 Night 34	Day 45 Evening 40 Night 35	Day 47 Evening 42 Night 37	Day 48 Evening 43 Night 38	Day 50 Evening 45 Night 40	Day 53 Evening 48 Day 43
Farming FZ (*) Green Wedge GWZ, Green Wedge A GWAZ Public Use 2 & 5 PUZ2, PUZ5 Rural Activity RAZ Rural Conservation RCZ Rural Living RLZ Urban Growth Zone before an incorporated precinct structure plan (UGZ) Group B CDZ, SUZ & UGZ (*)	Day 45 Evening 38 Night 33	Day 45 Evening 40 Night 35	Day 46 Evening 41 Night 36	Day 48 Evening 43 Night 38	Day 50 Evening 45 Night 40	Day 52 Evening 47 Night 42	Day 54 Evening 49 Night 44
Commercial 1 CZ1 B1Z B2Z BZ5 Mixed Use MUZ Activity Centre Zone ACZ Public Use 1,2,3,4,6 & 7 PUZ1 PUZ3 PUZ4 PUZ6 PUZ7 Group A CDZ, SUZ & UGZ (*)	Day 45 Evening 40 Night 35	Day 47 Evening 42 Night 37	Day 48 Evening 43 Night 38	Day 50 Evening 45 Night 40	Day 52 Evening 47 Night 42	Day 53 Evening 48 Night 43	Day 55 Evening 50 Night 45
Industrial 3 IN3Z Group C CDZ, SUZ & UGZ (*)	Day 46 Evening 41 Night 36	Day 49 Evening 44 Night 39	Day 50 Evening 45 Night 40	Day 52 Evening 47 Night 42	Day 53 Evening 48 Night 43	Day 55 Evening 50 Night 45	Day 56 Evening 51 Night 46
Commercial 2 C2Z, B3Z, B4Z Commercial 3 C3Z	Day 48 Evening 43 Day 38	Day 50 Evening 45 Night 40	Day 52 Evening 47 Night 42	Day 54 Evening 49 Night 44	Day 55 Evening 50 Night 45	Day 56 Evening 51 Night 46	Day 57 Evening 52 Night 47
Industrial 1, 2 IN1Z IN2Z Group D CDZ, SUZ & UGZ (*)	Day 50 Evening 45 Night 40	Day 51 Evening 47 Night 42	Day 53 Evening 48 Night 43	Day 55 Evening 50 Night 46	Day 56 Evening 51 Night 46	Day 57 Evening 52 Night 47	Day 58 Evening 53 Night 48

(*) For Comprehensive Development Zone (CDZ), Special Use Zone (SUZ) and Urban Growth Zone (UGZ) refer to Table B.2

Table B-22 –Zoning to Receiver Distance Adjustment

Zoning and distances (source zone to receiver in meters)				Criteria (Source: PUZ1)		Utility	Operational Criteria dB(A)	
Name	Zone	Distance	D/E/N	Adj.	Adj.	Day	Evening	Night
R3_75 Como Road	GWAZ 2	800	40\35\37	8	-	45 (37)[2]	37 (32)[2]	32 (27)[2]
R4_517-519 Maroondah Highway	GWAZ 2	1097	40\35\36	9	-	45(36)[2]	37 (31)[2]	32 (26)[2]
R5_564-566 Maroondah Highway	GWZ2	1264	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]
R6_572 Maroondah Highway	GWZ2	1380	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]
R10_11 Coldstream West Road Coldstream	GWZ4	1111	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]
R11_19-21 Coldstream West Road Coldstream	GWZ4	1304	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]
R12_23-27 Coldstream West Road Coldstream	GWZ4	1064	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]

Zoning and distances (source zone to receiver in meters)				Criteria (Source: PUZ1)	Distance	Utility	Operational Criteria dB(A)	
R13_138 Victoria Road	GWZ4	1332	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]
R14_134 Victoria Road	GWZ4	1381	43\38\39	9	-	45 (39)[2]	37 (34)[2]	32 (29)[2]

Note 1. The Noise Protocol requires that assessment criteria are presented in whole numbers, rounded to the nearest figure

Note 2. Environment Protection Regulation 118(2)(a) & (b) provides a lowest dB value that may be applied i.e. base noise limit

Appendix C Equipment Table and Sound Power Levels

Quantities, periods of operation and associated operational assumptions for each item of equipment associated with the facility are presented in the Table below.

It has been conservatively assumed that all facilities on site will operate continuously (24 hrs), with the exception of testing and maintenance of the emergency valves which will operate during daytime only.

The Sound Power Levels of all existing and future noise sources at the facility were estimated by Jacobs for all sources modelled in this assessment. It is good practice to accommodate uncertainty of sources and modelling to incorporate a 3 dB safety margin on the dominant equipment.

Standard practice for estimating noise emissions from proposed noise sources is to obtain sound power level data either through theory (T), manufacturer data (M) or previous study (P). The preferred source(s) of noise emissions data is from manufacturer's published test results as it reduces the risk of under- or over-estimating noise emissions from plant items.

Where noise emission data has been estimated by Jacobs (i.e. octave band spectrum) using either theoretical methods or reproduced from a previous study, Jacobs can provide no assurances regarding the accuracy of the data.

Table C-1 – Sound power levels of proposed noise sources used in modelling

#	Name	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	Duty & Standby	Comments
1	Biofilter Fan	75.0	0.0	76.9	80.9	79.9	71.9	66.9	61.9	56.9	56.9	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen: Backward Curved Centrifugal Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
2	Jet Mixing Pump	85.0	0.0	75.4	76.4	78.4	78.4	81.4	78.4	74.4	68.4	1 duty, 1 standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen 11.6: Pumps Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
3	Depacker	85.0	0.0	0.0	0.0	0.0	88.2	0.0	0.0	0.0	0.0	1 duty no standby	based on 75 dBA at 1 m of noise generating equipment Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
4	Inlet Pump	85.0	0.0	75.4	76.4	78.4	78.4	81.4	78.4	74.4	68.4	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen 11.6: Pumps Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
5	RO Container	75.0	0.0	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	1 duty no standby	based on 55 dBA at 1 m resulting in 75 dBA sound power for the enclosure Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
6	Pelletiser	78.0	0.0	0.0	0.0	0.0	81.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client information of estimated breakout sound power Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
7	Drying Conveyor	65.0	0.0	0.0	0.0	0.0	68.2	0.0	0.0	0.0	0.0	1 duty no standby	no data Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
8	Depacker pump	85.0	0.0	75.4	76.4	78.4	78.4	81.4	78.4	74.4	68.4	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen 11.6: Pumps Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
9	Digestor Transfer Pump	85.0	0.0	75.4	76.4	78.4	78.4	81.4	78.4	74.4	68.4	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen 11.6: Pumps Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown

#	Name	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	Duty & Standby	Comments
10	Tank Blower	95.0	0.0	96.8	100.8	99.8	91.8	86.8	81.8	76.8	76.8	1 duty, 1 standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen: Backward Curved Centrifugal Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
11	Micro-compressor	85.0	0.0	74.4	74.4	73.4	76.4	79.4	79.4	77.4	74.4	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Laymore Miller: Empirical small air compressor Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
12	Outlet Transfer Pump	85.0	0.0	75.4	76.4	78.4	78.4	81.4	78.4	74.4	68.4	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen 11.6: Pumps Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
13	Sump Pump	75.6	0.0	66.0	67.0	69.0	69.0	72.0	69.0	65.0	59.0	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Bies & Hansen 11.6: Pumps Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
14	Primary Air compressor	85.0	0.0	74.4	74.4	73.4	76.4	79.4	79.4	77.4	74.4	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Laymore Miller: Empirical small air compressor Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
15	Chiller booster	85.0	0.0	77.7	78.7	80.7	81.7	80.7	77.7	73.7	68.7	1 duty no standby	Sound Power to encompass casing breakout, duct breakout, inlet and discharge Source: Laymore Miller: Empirical small air compressor Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
16	CHP Generator	99.2	0.0	0.0	0.0	0.0	102.4	0.0	0.0	0.0	0.0	1 duty, 1 standby	Sound Power to encompass wall breakout, inlet and discharge ventilation, combustion air, muffler casing, radiator. No detail provided to identify individual components for modelling or noise control purposes Source: Client Email Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
17	Flare	98	0.0	0.0	0.0	0.0	101.2	0.0	0.0	0.0	0.0	1 duty, no standby	Based on client information est. Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown

#	Name	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	Duty & Standby	Comments
18.1	Delivery	110.9	0.0	110.0	108.0	106.0	103.0	104.0	106.0	103.0	97.0	max 8 delivery per hour, =>16 drive-bys	based on client email and UK DEFRA Noise Database Make: unknown, Model: unknown
18.2	25kL tanker	110.9	0.0	115.0	104.0	101.0	109.0	107.0	103.0	96.0	90.0	1 per hour daytime only	based on client email and UK DEFRA Noise Database Make: unknown, Model: unknown
18.3	40kL tanker	113.7	0.0	124.0	107.0	103.0	107.0	110.0	108.0	100.0	95.0	1 per hour daytime only	based on client email and UK DEFRA Noise Database Make: unknown Model: unknown
19	Transformer	64.9	0.0	67.5	69.5	64.5	64.5	58.5	53.5	48.5	41.5	continuous	est. based on client emails Make: unknown, Model: unknown, Duty point: unknown, Noise Tx: unknown Motor: unknown
20	Digestor Blower	75	0.0	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	1 duty, 1 standby	based on client email Make: unknown Model: unknown
21	Transfer Pump to UF	85	0.0	0.0	0.0	0.0	88.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown
22	MBR UF Unit	75	0.0	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown
23	RO Unit	75	0.0	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown
24	Super Concentrator	75	0.0	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown
25	Transfer Pump From UF Permeate	85	0.0	0.0	0.0	0.0	88.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown
26	Transfer Pump From RO Reject Tank	85	0.0	0.0	0.0	0.0	88.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown

#	Name	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	Duty & Standby	Comments
27	Condenser Recycle Pump	85	0.0	0.0	0.0	0.0	88.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown
28	Heat Exchanger Fan	75	0.0	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	1 duty no standby	based on client email Make: unknown Model: unknown

Appendix D Noise Logging

The outcome of noise logging are outlined in the Tables and Figures below. Quantities, periods of operation and associated operational assumptions for each item of equipment associated with the facility are presented.