Figure 12.1 Nearest sensitive receptors (Air Quality Assessment)

Prospect Hill Energy from Waste | PROSPECT HILL INTERNATIONAL

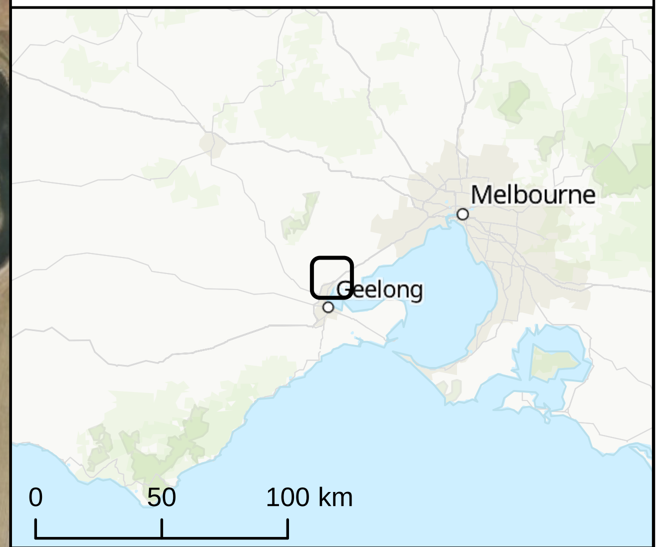
Nearest sensitive receptors (air quality)
Population Centres
Rail Station
Railway
Project site
Major Urban Area

N
A3
1:22,000

IS305100
GDA 1994 MGA Zone 55

0 0.5 1
Kilometres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) Geodata Topo 250k Series 3; Vicmap Data © State of Victoria; Jacobs.
Earthstar Geographics, Vicmap, Esri, HERE, Garmin, FAO, NOAA, USGS



Jacobs

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Created by ABerman on 6/10/2020

12.2 Existing environment

Sources of air pollution in the Project area includes traffic on surrounding roads, industry, shipping, Avalon Airport and railways. For example, exposed soil and traffic on unpaved roads are sources of dust emissions and sources of smoke particles include bushfires, domestic wood heaters and open fireplaces.

Existing air quality for the study area was derived from measurements made by the EPA at Geelong South air quality monitoring station (and the EPA Footscray monitoring station for particulate matter as ‘PM_{10}’ and ‘$PM_{2.5}$’). These data are considered to be conservatively representative of the Project site as Geelong South is expected to be subject to greater emissions from traffic and industry. A summary of the existing air quality levels in the study area is provided in Table 12.2.

Table 12.2: Summary of existing air quality in the study area

Pollutant	Main sources in the study area	Existing levels
Carbon monoxide (CO)	Road vehicle traffic, bushfires and industry	Low – the majority of results from the period 2014-2019 are less than 10% of the SEPP (AAQ) objective of 9.0 parts per million (ppm). These measurements are consistent with CO not usually being assessed as a high-risk air pollutant.
Oxides of nitrogen (NOx); harmful component is nitrogen dioxide	Road vehicle traffic, bushfires and industry	Most nitrogen dioxide (NO_2) is created in the atmosphere from emissions of NOx. Results from the period 2014-2019 show NO_2 concentrations are less than 50% of the SEPP AAQ objective of 120 part per billion (ppb).
Ozone (O_3)	Created in the atmosphere from chemical reactions between NOx and other pollutants	Results from the period 2014-2019 indicate O_3 concentrations are up to 70-80% of the SEPP (AAQ) O_3 objective of 100 ppb. The majority of O_3 in the study area would be formed from emissions by road traffic in the wider Geelong and Melbourne regions. Also, there is a significant amount of ‘baseline’ O_3 in the clean (marine) air environment that is not associated with any Australian air emissions; e.g. see Cape Grim Baseline Air Pollution Station reports.
Sulfur dioxide (SO_2)	Burning of fossil fuels, industry, vehicles, shipping	Results from the period 2014-2019 are substantially lower (max 24%) than the SEPP (AAQ) objective of 200 ppb. Normally SO_2 is low risk unless there is a significant industrial SO_2 source in the vicinity.
Particulate matter (PM_{10})	Wind-blown dust from distant, drought-affected regional areas far away from most monitoring stations, and, more locally in the case of Geelong South, vehicles using unpaved areas in the vicinity of the monitoring station, wind-blown dust, and controlled burns (EPA).	Results from the period 2014-2019 indicate a small number of exceedances per year of 24-hours average SEPP (AAQ) objective of 50 $\mu g/m^3$ however annual averages did not exceed the annual average objective (20 $\mu g/m^3$). The EPA PM_{10} data from Geelong South probably were affected by vehicle activity on these adjacent unpaved areas: motorcycle track, showgrounds, and racecourse, so were likely to overestimate background PM_{10}. Measurements of small airborne particles or airborne Particulate Matter (PM) in the size range 0-10 microns (μm), tend to be higher than for most other pollutants, in relation to ambient air quality standards and objectives. This is the case for many monitoring stations around Australia, including for EPA Geelong South.

Pollutant	Main sources in the study area	Existing levels
Particulate matter ($PM_{2.5}$)	Small smoke particles from the combustion of fossil fuels, extensive use of domestic wood heaters, and, occasionally, from controlled burns and bushfires. Motor vehicles and power plant emissions are also a major source of $PM_{2.5}$	Results from the period 2014-2019 indicate a small number of exceedances per year of 24-hours average SEPP (AAQ) objective of 25 $\mu g/m^3$ however annual averages did not exceed the annual average objective (8 $\mu g/m^3$) Measurements of smaller particles as $PM_{2.5}$ tend to be high relative to $PM_{2.5}$ monitoring standards and objectives. This is the case for many monitoring stations around Australia, including for EPA Geelong South and EPA Footscray.
Hydrogen fluoride (HF)	Industry	Hydrogen fluoride is used in some refineries to produce some fuels and may be released on rare occasions. However, note Geelong's Viva Energy refinery was scaling back production in April 2020 due to COVID-19 impacts on its business. HF releases from refineries are rare because normally HF is completely used. Measurements of atmospheric HF are rare. Measured over 24-hour periods, the background HF concentration in the Port Phillip Air Quality Control Region is expected to be approximately 0.1 $\mu g/m^3$
Ammonia (NH_3)	Animal waste, emissions from soils and industrial emissions	Assumed to be zero Over land, main sources of NH_3 are animal waste, emissions from soils, and industrial emissions. Cattle feed lots are a significant source of higher NH_3 concentrations however measurements in Victoria have shown background NH_3 near feed lots is approximately 1-2 ppb only (very small).
Hydrogen chloride	No known sources of HCl in the study area	Assumed to be zero Measurements of atmospheric HCl are rare. In the absence of any known HCl sources in the study area, background HCl was assumed to be zero for this assessment
Hydrocarbons	Road traffic and combustion processes	Low Measurements by EPA indicate benzene and formaldehyde concentrations are substantially less than monitoring investigation levels
Polycyclic aromatic hydrocarbons	Industry and combustion processes	Low Measurements by EPA indicate typical background levels in the Port Phillip Air Quality Region are less than monitoring investigation levels
Dioxins and Furans	No known sources in the study area	Low
Metals (as a component of particulate matter)	No known sources	Very low

12.3 Industrial Residual Air Emissions (IRAE)

The EPA Publication 1518 *Recommended separation distances for Industrial Residual Air Emissions* (IRAEs) sets out separation distances for 'unintended' or non-routine emissions that can be intermittent or episodic and may originate at or near ground level. The purpose of a separation distance is to avoid the potential consequences of IRAEs. An adequate separation distance should allow IRAEs to dissipate without adverse impacts on sensitive land uses.

The EfW Plant is classified as a Waste Management – Advanced Resource Technology Facility, defined as:

> “Waste treatment facility for the immobilisation, thermal degradation, chemical conversion biological oxidation (aerobic or anaerobic), incineration or gasification or other treatment of solid waste”

There is no set separation distance for such facilities and rather they are required to be assessed on a ‘case by case’ basis.

The proposed Prospect Hill EfW Project is suitably located within the Industrial 2 Zone (IN2Z) and the Geelong Ring Road Employment Precinct (GREP) which are areas designated for industrial land uses. Clause 33.02 (Industrial 2 Zone) of the Greater Geelong Planning Scheme identifies that the purpose of the IN2Z is to provide for industry in "a manner which does not affect the safety and amenity of local communities." The majority of surrounding land uses are also industrial and potential impacts to the safety and amenity of local communities are largely avoided as a result. Whilst some residential properties exist within the Rural Living Zone (RLZ) to the site's northwest, the Project does not generate emissions that are predicted to affect the safety and amenity of these residents.

The IN2Z also aims to "keep the core of the zone free of uses which are suitable for location elsewhere so as to be available for manufacturing industries and storage facilities that require a substantial threshold distance." Given that the Project does not require a substantial threshold distance due to its limited potential for impacts on amenity and safety, it is considered that the Project is appropriately located outside of the core of the IN2Z. This ensures that the core of the IN2Z is reserved for land uses that do require substantial buffers from any sensitive land uses.

Land within the GREP (formerly the Heales Road Industrial Estate) was first identified under the Geelong Industrial Land Study (Geelong Regional Commission, 2001) and set aside as an industrial estate that would be attractive to heavy industry due to its significant buffer from residential development. At this time, a 1,000m buffer zone was provided around the Industrial Estate (Figure 12.2). This buffer has limited the southward expansion of residential development within the Lara township. The Lara Structure Plan (City of Greater Geelong, 2011) reaffirmed this buffer by setting a policy direction to "maintain[ing] a buffer of non-sensitive land uses between the [GREP] and the Lara township to the north".

The land in the buffer zone is zoned for farming (FZ) and rural residential uses (RRZ). The rural residential properties along the southern side of side of Minyip Road between McManus Road and Bacchus Marsh Road are subject to a Design and Development Overlay – Schedule 7 (Heales Road Industrial Estate Environs) (DDO7). The design objective of the DDO7 is:

> “*To ensure that an effective buffer distance is maintained between dwellings on the south side of Minyip Road, Lara and the Heales Road Industrial Estate [the GREP]*”

Under the DDO7, a planning permit is required to construct or carry out works associated with a dwelling. Additionally, dwellings along Minyip Road and Bacchus Marsh Road should not be set back more than 100 m from the road, to maintain the buffer distance to the Industrial Estate.

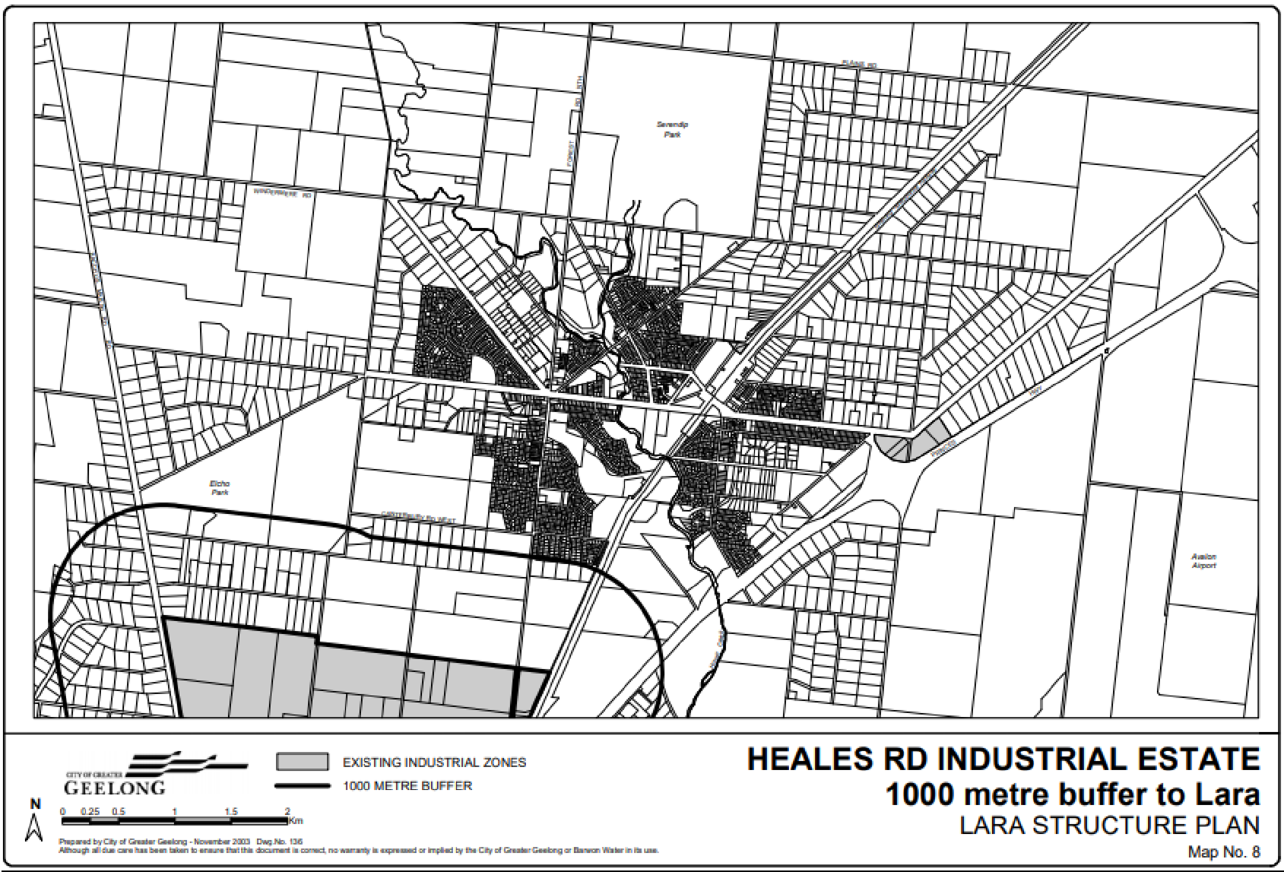


Figure 12.2: Buffer provided between industrial estate and Lara township

12.4 Air quality emission criteria

12.4.1 Emission limits

EPA Victoria's *Energy from Waste* guideline (EPA, 2017d), provides a range of information and requirements relevant to air pollution emissions from the Plant facilities. The guideline states that proponents of proposals that require a Works Approval or Licence will be expected to demonstrate that the siting, design, construction and operation of the Plant facilities will incorporate best practice measures for the protection of air environments as well as for energy efficiency and GHG emissions management.

In order to demonstrate best practice, emission discharges for the Project must meet the emission standards outlined in the following key documents:

- 2010 EC IED (European Commission, 2010). This document regulates emission to air from EfW plants in Europe through the application of Best Available Techniques (BAT) for air emission controls and sets stringent emission limits for pollutants
- *Best Available Techniques (BAT) Reference Document for Waste Incineration* (EC, 2019a). This document includes a review of emissions measurements in the 2010 EC IED and provides recommendations for updates
- Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration (European Commission, 2019b). This updates the BAT conclusions that must be applied in the 2010 EC IED

The EfW emissions limits for both the 2010 EC IED and 2019 EC BREF are provided in Table 12.3.

Table 12.3: European Union EfW emissions limits

Pollutant	IED 2010/75/EU (European Commission, 2010)			IED 2010/75/EU (European Commission, 2019b)	
	Emission limit (mg/Nm^3)	Emission limit (mg/Nm^3) 97th percentile	Averaging time	BAT-associated emission levels (BAT-AELs) (mg/Nm^3)	Averaging time
Pollutants (general)					
Total dust	10	–	24 hours	< 2-5	24 hours
TVOC	–	–	–	< 3-10	24 hours
Hydrogen chloride (HCl)	10	–	24 hours	< 2-6	24 hours
Hydrogen fluoride (HF)	1	–	24 hours	< 1	24 hour or average over the sampling period
Sulfur dioxide (SO_2)	50	–	24 hours	5 – 30	24 hours
Oxides of nitrogen (NO_x) as nitrogen dioxide (NO_2)	200	–	24 hours	50 – 120	24 hours
Carbon monoxide (CO)	50	–	24 hours	10 – 50	24 hours
Total dust	30	10	0.5 hour	–	–
Total organic carbon (TOC)	20	10	0.5 hour	–	–
Hydrogen chloride (HCl)	60	10	0.5 hour	–	–
Hydrogen fluoride (HF)	4	2	0.5 hour	–	–
Sulfur dioxide (SO_2)	200	50	0.5 hour	–	–
Oxides of nitrogen (NO_x) as nitrogen dioxide (NO_2)	400	200	0.5 hour	–	–
Carbon monoxide (CO)	100	–	0.5 hour	–	–
Carbon monoxide (CO)	150	–	10-minute	–	–
Pollutants (heavy metal)					
Cd + Tl	0.05	–	0.5 hours	0.005-0.02	Average over the sampling period$
Hg	0.05	–	0.5 hours	<0.005 - 0.02	24 hour or average over the sampling period$
Hg	–	–	–	0.001 - 0.01	Long term sampling period*
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	0.5	–	0.5 hours	0.01-0.3	Average over the sampling period$

* Defined in electrical conductivity (2019b) as a sampling period of 2 to 4 weeks.

$ Defined in European Commission (2019b) as average value of three consecutive measurements of at least 30 minutes each, unless a longer period is required due to sampling or analytical limitations.

12.4.2 Ambient air quality standards

Ambient air quality standards are used to assess air quality by monitoring and/or modelling. The ambient air quality standards relevant to the Project include:

- The AAQ NEPM (AG, 2016). The standards relate to six criteria air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), photochemical oxidants (O_3), sulfur dioxide (SO_2), lead (Pb) and coarse particulate matter (PM_{10} and $PM_{2.5}$)
- A proposed variation to the AAQ NEPM, released for public consultation in 2019. The proposed variation provides new standards for O_3, NO_2, SO_2, PM_{10} and $PM_{2.5}$ and removes the 'allowable exceedances', replaced by a requirement for jurisdictions to record and report 'exceptional events', specifically smoke and dust occurrences causing exceedences of the proposed PM_{10}, $PM_{2.5}$ and ozone standards
- The *State Environment Protection Policy (Ambient Air Quality)* or the 'SEPP (AAQ)', (EPA, 1999; EPA, 2016), which incorporates the standards of the AAQ NEPM except for a more stringent value adopted for annual average PM_{10}. While the NEPM (AG, 2016) indicates the standards may be used to interpret monitoring or modelling results, the SEPP (AAQ) focus is on air quality monitoring by the state of Victoria
- The AAQ NEPM and the SEPP (AAQ) are compared in The AAQ NEPM 2019 draft – proposed standards are shown in Table 12.5.

Table 12.4: AAQ NEPM 2016 standards and SEPP AAQ 2016 objectives

Pollutant	AAQ NEPM (AG, 2016)			SEPP AAQ (EPA, 1999; EPA, 2016)		
	Averaging period	Maximum concentration standard	Maximum allowable exceedances	Averaging period	Environmental quality objective	Maximum allowable exceedances
CO	8 hours	9.0 ppm	1 day a year	8 hours	9.0 ppm	1 day a year
NO_2	1 hour	120 ppb	1 day a year	1 hour	120 ppb	1 day a year
	1 year	30 ppb	None	1 year	30 ppb	None
O_3	1 hour	100 ppb	1 day a year	1 hour	100 ppb	1 day a year
	4 hours	80 ppb	1 day a year	4 hours	80 ppb	1 day a year
SO_2	1 hour	200 ppb	1 day a year	1 hour	200 ppb	1 day a year
	1 day	80 ppb	1 day a year	1 day	80 ppb	1 day a year
	1 year	20 ppb	None	1 year	20 ppb	None
PM_{10}	1 day	50 µg/m^3	None	1 day	50 µg/m^3	None
	1 year	25 µg/m^3	None	1 year	20 µg/m^3	None
$PM_{2.5}$	1 day	25 µg/m^3	None	1 day	25 µg/m^3	None
	1 year	8 µg/m^3	None	1 year	8 µg/m^3	None

Note. A variation in the SEPP (AQM) 2001 deleted the SEPP (AAQ) 1999 8-hour averages for ozone.

Table 12.5: AAQ NEPM 2019 draft - proposed standards

Pollutant	Averaging period	Proposed maximum concentration standard from 2020	Proposed maximum concentration standard from 2025
CO	8 hours	9.0 ppm	9.0 ppm
NO_2	1 hour	90 ppb	80 ppb
	1 year	19 ppb	15 ppb
O_3	8 hours	65 ppb	65 ppb
SO_2	1 hour	100 ppb	75 ppb
	1 day	20 ppb	20 ppb
PM_{10}	1 day	50 µg/m^3	50 µg/m^3
	1 year	25 µg/m^3	25 µg/m^3
$PM_{2.5}$	1 day	25 µg/m^3	20 µg/m^3
	1 year	8 µg/m^3	7 µg/m^3

12.4.3 SEPP (AQM)

The SEPP (AQM) sets the framework for managing emissions to the air environment. The SEPP (AQM) provides a list of 'indicators' (substances) and concentrations for the assessment of model predictions for Ground Level Concentrations (GLCs). The design criteria for class 1, class 2 and class 3 indicators, for the purpose of assessing proposals for new emission sources or modifications to existing emission sources, are established in Schedule A of the SEPP (AQM). The design criteria are used in conjunction with the modelling procedures outlined in Schedule C of SEPP (AQM).

The indicators and their design criteria used for this assessment of the Project are listed in Table 12.6: SEPP (AQM) design criteria relevant to the Project

Table 12.6: SEPP (AQM) design criteria relevant to the Project

Substance	Reason for classification	Averaging time (99.9 percentiles)	Design criterion ($\mu g/m^3$)[1]	Design criterion (ppb)
Carbon monoxide (CO)	Toxicity	1 hour	29,000	25,000
Nitrogen dioxide (NO_2)	Toxicity	1 hour	190	100
Sulfur dioxide (SO_2)	Toxicity	1 hour	450	170
Particulate Matter 10 (PM_{10})	Toxicity	1 hour	80	–
Particulate Matter 2.5 ($PM_{2.5}$)	Toxicity	1 hour	50	–
Hydrogen fluoride (HF) / Fluoride	Bioaccumulation	24 hour[2]	2.9	3.4
		7 day[2]	1.7	2.0
		90 day[2]	0.5	0.59
Hydrogen chloride (HCl)	Toxicity	3 minutes	250	170
Ammonia (NH3)	Toxicity	3 minutes	600	830
Dioxins and Furans (DF) (see SEPP(AQM))	IARC3 Group 1 carcinogen	3 minutes	3.7×10^{-6}	–
Polycyclic Aromatic Hydrocarbons (PAH) as Benzo(a)Pyrene (B(a)P)	IARC3 Group 2A carcinogen	3 minutes	0.73	–
Hexavalent chromium (Cr(VI))[4]	IARC3 Group 1 carcinogen	3 minutes	0.17	–
Cadmium (Cd)[5]	IARC3 Group 1 carcinogen	3 minutes	0.033	–
Mercury (Hg) – Organic	Bioaccumulation	3 minutes	0.33	–

Note 1. Gas volumes are expressed at 25°C and at an absolute pressure of one atmosphere (101.325 kPa).

Note 2. Averaging periods of greater than 1 hour are maxima; 1 hour and less are 99.9 percentiles.

Note 3. International Agency for Research on Cancer.

Note 4. There are no design criteria for cobalt (Co), thallium (Tl) and vanadium (V) – an assumption was that Cr(VI), which is an IARC Group 1 carcinogen, would be the highest risk element in this group with all Cr assumed Cr(VI).

Ambient air quality monitoring objectives such as those defined in the SEPP (AAQ) are not usually used for the assessment of industrial facilities by modelling. However, the monitoring objectives set out in the 2016 variation to the SEPP (AAQ) were used for the assessment of model-predicted PM_{10} and $PM_{2.5}$ GLCs for this Project (Table 12.7). The reason for this is national and state standards and objectives for PM_{10} and $PM_{2.5}$ for the protection of human health, based on 24-hour and annual averages, are better known than effects over the hourly average periods of the SEPP (AQM) design criteria for PM_{10} and $PM_{2.5}$.

Table 12.7: SEPP (AAQ) objectives adopted as project objectives

Substance	SEPP (AAQ) monitoring objective	SEPP (AAQ) objective adopted as Project objective ($\mu g/m^3$)	SEPP (AAQ) 2025 goal ($\mu g/m^3$)
PM_{10}	Maximum 24-hour average	50	No change
	Maximum annual average	20	No change
$PM_{2.5}$	Maximum 24-hour average	25	20
	Maximum annual average	8	7

12.5 Assessment methodology

The assessment for the Project was undertaken in accordance with the SEPP (AQM). Modelling was performed using Victoria's regulatory model AERMOD with a five-year dataset of hourly meteorological data (representing a total of approximately 43,000 meteorological tests). Meteorological data most representative of the proposed site was determined to be from the Bureau of Meteorology Avalon Airport weather station located 9.2 km east-northeast of the proposed site. For the assessment at least 90% of five years of hourly meteorological data was used in the modelling; i.e., a minimum of approximately 40,000 hourly records. This meant that almost all possible meteorological conditions, including seasonal and annual variations, were considered in the simulations.

The latest version of AERMOD (Version 19190; 13/8/2019), was used for predictions of air pollutant concentrations at ground-level (USEPA, 2019). Further details regarding the AERMOD modelling methods can be found in Appendix D.

12.6 Assessment results

The AERMOD results of worst-case GLCs including background, for each substance are compared with their design criteria in Table 12.8. The results listed are the maxima for all grid receptors, which were higher than all discrete (sensitive) receptor results.

Table 12.8: Worst case GLCs for air pollutants (including backgrounds)

Parameter	Averaging time	Maximum grid receptor result ($\mu g/m^3$)	Design criterion (or objective) ($\mu g/m^3$)	Fraction of design criterion (or objective)
CO	1-hour average	1,602	29,000	5.5%
NO_2	1-hour average	68.0	190	35.8%
SO_2	1-hour average	100	450	22.2%
PM_{10}	1-hour average	399	80 (SEPP AQM)	499%
PM_{10}	24-hour average	286	50 (SEPP AAQ)	572%
PM_{10}	Annual average	19.9	20 (SEPP AAQ)	99.5%
$PM_{2.5}$	1-hour average	44.6	50 (SEPP AQM)	89.2%
$PM_{2.5}$	24-hour average	32.7	25 (SEPP AAQ)	1.36%
$PM_{2.5}$	Annual average	8.6	8 (SEPP AAQ)	107.5%
HF	24-hour average	0.14	2.9	4.83%
HF	7-day average	0.05	1.7	2.9%
HF	90-day average	0.01	0.5	2.0%
HCl	3-minute	38.9	250	15.6%
NH_3	3-minute	19.4	600	3.2%
Dioxins & furans[4]	3-minute	7.1E-08	3.7E-06	1.9%
PAH as B(a)P[5]				
TOC as formaldehyde[6]	3-minute	13.1	40 (formaldehyde)[6]	33%

Parameter	Averaging time	Maximum grid receptor result ($\mu g/m^3$)	Design criterion (or objective) ($\mu g/m^3$)	Fraction of design criterion (or objective)
Metals				
Cd	3-minute	0.013	0.033	39.4%
Tl	n/a	0.007	n/a	n/a
Hg	3-minute	0.013	0.33 (organic) 3.3 (inorganic)	3.9% 0.39%
Sb	3-minute	0.020	17	0.1%
As	3-minute	0.039	0.17	22.9%
Pb	1-hour	0.068	3 (1-hour avg)	2.3%
Cr III	3-minute	0.039	17	0.2%
Cr VI	3-minute	0.039	0.17	22.9%
Co	n/a	0.002	No criterion	n/a
Cu	3-minute	0.195	6.7	2.9%
Mn	3-minute	0.039	33	0.1%

12.7 Potential impacts

The air quality impact assessment tested a large number of air pollutants by conservative (high) estimates of emissions by individual substances, and air dispersion modelling. The effects of emissions of air pollutants from the proposed Plant are minimal in relation to existing air quality impacts and air quality standards. Emissions from the EfW Plant will meet all 2010 EC IED and SEPP (AQM) emission limits.

Apart from PM_{10} and $PM_{2.5}$, the AERMOD-predicted air emissions from the Plant caused no exceedences of the SEPP (AQM) design criteria. The AERMOD results showed that emissions of PM_{10} and $PM_{2.5}$ are unlikely to cause additional exceedences of their (hourly average) design criteria, with the results heavily dominated by the high background levels. The background levels were obtained from the EPA Geelong South monitoring station and were likely affected by local dust sources such as gravel pits (Chapter 12.2). More generally, existing levels of PM_{10} and $PM_{2.5}$ may be high on some days due to sources such as raised dust, smoke from fires and domestic wood burning, and road traffic. These background levels are high relative to the small contributions expected from the Plant, which will employ world's best practice, Best Available Techniques emissions controls.

Further to the assessment using the SEPP (AQM) design criteria, the modelling showed that particulate emissions from the Plant are unlikely to cause additional exceedences of the SEPP (AAQ) maximum 24-hour average and annual average monitoring objectives for PM10 and $PM_{2.5}$.

The potential air quality impacts from the air pollutants assessed is summarised in Table 12.9.

Table 12.9: Potential air quality impacts

Pollutant	Assessment summary	Potential impact
CO	The AERMOD results demonstrated that CO emissions from the Plant will have only a small effect on existing levels of CO with no exceedences of the SEPP (AQM) design criterion (29 mg/m^3) (including background CO). Several years of CO monitoring by the EPA Geelong South monitoring station show that all CO concentrations in the Geelong area have been low, with the majority of concentrations less than 10% of the monitoring objective.	Very low
NO_2 and O_3	Most NO_2 in the atmosphere is not a direct emission from combustion – NO_x from the combustion of fuels (including waste) comprises mostly NO and smaller amounts of NO_2. In the atmosphere, NO may be oxidised to NO_2 by a reaction with ambient ozone (O_3). The EPA's monitoring data show there is always some ambient O_3 available for this reaction. The EPA Geelong South results for NO_2 show that, in general, NO_2 concentrations are low, with the monitoring objective for NO_2 not exceeded at any time over 2014-2019. Maximum hourly averages over the whole period were less than 50% of the monitoring objective. The AERMOD results for NO_x emissions from the Plant were assessed in two ways: (1) assuming a very high 100% conversion rate of NO_x to NO_2 to determine the maximum possible contributions to existing NO_2 levels; and (2) based on measured, high NO_x concentrations, a NO_2/NO_x conversion ratio of 30% was used and added to the hourly-varying, background NO_2. Using (2) for the higher concentrations, there were no model-predicted exceedences of the design criterion for NO_2 (maximum fraction 36%, including background).	Low
SO_2	The SO_2 monitoring results from EPA Geelong South over 2014-2019 were low, demonstrating a low risk of air quality impact due to existing, local emissions of this substance. The AERMOD results for SO_2, including conservative estimates for background SO_2 for each annual meteorological simulation, did not cause any exceedences of the design criterion for SO_2.	Low
PM_{10}	EPA Geelong South and EPA Footscray monitoring data show existing, high concentrations of PM_{10} are expected for the Project study area on several days each year due to a variety of sources; e.g., raised dust, and fires (Chapter 12.2). Over a 6-year period to the end of 2019 there were 3-11 exceedence days per year at Geelong South, and 0-7 exceedence days per year at EPA Footscray. Although, none of the measurements exceeded Victoria's SEPP (AAQ) objective for annual average PM_{10} (20 μg/m^3) nor the equivalent NEPM standard of 25 μg/m^3. The Plant will employ BAT controls on the particulate emissions from the stack, so the PM_{10} emissions will be low relative to these highest background levels. The AERMOD results for PM_{10} due to emissions from the Plant including the hourly-varying, background PM_{10} levels, (which were transposed from the EPA Geelong South monitoring site to the Project site), showed the results were heavily dominated by high background levels. The AERMOD results showed emissions from the Plant are unlikely to cause additional exceedences of SEPP (AAQ) monitoring objectives and corresponding NEPM standards. Contributions of PM_{10} from the Plant were small relative to the highest background PM_{10} levels.	Low (based on Project contributions)
$PM_{2.5}$	EPA Geelong South and EPA Footscray monitoring data showed existing, high $PM_{2.5}$ concentrations are expected for the Project study area (the case for $PM_{2.5}$ is similar to PM_{10}). Sources of the high background $PM_{2.5}$ levels include road traffic; i.e., petrol and diesel combustion, domestic wood burning, and, occasionally, controlled burns and bushfires that could be distant from Geelong and Lara. Measurements of $PM_{2.5}$ were obtained at Geelong South over 2016-2019 and 2014-2019 at EPA Footscray. Over these monitoring periods, there were 0-2 exceedence days per year at Geelong South, and 0-4 exceedence days at EPA Footscray. The measured annual average $PM_{2.5}$ exceeded the SEPP (AAQ) objective for annual average $PM_{2.5}$ (8 μg/m^3), in one year only (2015).	Low (based on Project contributions)

Pollutant	Assessment summary	Potential impact
	The AERMOD results for $PM_{2.5}$ due to emissions from the Plant were similar to those for PM_{10}. The $PM_{2.5}$ results included hourly-varying, background $PM_{2.5}$ concentrations, and again the combined results were heavily dominated by these high background levels. The AERMOD results showed emissions from the Plant are unlikely to cause additional exceedences of SEPP (AAQ) monitoring objectives and corresponding NEPM standards.	
HF	The AERMOD results for hydrogen fluoride (HF) did not cause exceedences of the SEPP (AQM) design criteria for maximum 24-hour average, maximum 7-day average, and maximum 90-day average HF concentrations. The modelling shows there is a low risk of air quality impact due to HF emissions expected from the Plant.	Very low
Other substances – non metals	There were no exceedences of SEPP (AQM) design criteria for HCl, NH_3, dioxins and furans, PAHs as B(a)P, and hydrocarbons. All the hydrocarbon emissions were assumed to be formaldehyde, a conservative step in the assessment given formaldehyde is a higher risk hydrocarbon in combustion products.	Low
Other substances – metals	There were no exceedences of SEPP (AQM) design criteria, (where criteria were available), for all the metals that could be tested. In relation to the first 2010 EC IED metals group total, (Cd+Tl), review of the literature indicated the majority of Cd+Tl emissions from EfW is cadmium (Cd), therefore the assessment was based on all the emission being Cd. There is no design criterion for thallium (Tl), but the assumption of 100% Cd is expected to be conservative for the assessment. The 2010 EC IED emissions limits do not distinguish between organic and inorganic mercury (Hg). The maximum EfW emission was assessed against both SEPP (AQM) design criteria for Hg (organic and inorganic). The risk of air quality impact from mercury emissions expected from the Plant, was found to be low. In relation to the second 2010 EC IED metals group total: Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V; from a review of the literature, assessment of each of these individual elements was by conservative (high) estimates of fractions of the 2010 EC IED emission limit for the total. None of the AERMOD-predicted concentrations for the individual metals exceeded their SEPP (AQM) design criteria, (where criteria were available). While there were no exceedences of design criteria, the highest risk metals/elements were identified as: highest-risk; cadmium (Cd); equal second-highest risk; arsenic (As) and chromium-6 (Cr VI); and third-highest risk; nickel (Ni).	Low

12.8 Management and monitoring

12.8.1 Air emissions control technologies

Air emissions controls begin with combustion control in the furnace. Secondary combustion air is heated and injected above the grate to promote better mixing, maximising destruction of VOCs and minimising carbon monoxide (CO) in the flue gases. The waste is combusted in a reducing environment, which means less air is used than otherwise would be required for full combustion of the waste; this reduces NO_x emissions (NO_x is a precursor for the photochemical air pollutants nitrogen dioxide and ozone).

EfW plants can achieve compliance with NO_x emission limits through the use of a SNCR system. This process injects ammonia (NH_3) or urea ($CO(NH_2)_2$) solutions into the top of the furnace where the temperature is typically around 800°C to 1,000°C depending on the design of the boiler and the SNCR system. The ammonia or urea reacts with NO_x in the combustion gases producing water and molecular nitrogen (N_2). Molecular nitrogen is a harmless gas – the lower atmosphere comprises of 78% N_2. To avoid overdosing the reagent, NH_3 levels are monitored in the flue gas. This SNCR approach has been specified for this Project.

The flue gas leaving the boiler is expected to be around 170°C and will enter the top of either a dry or semi-dry deacidification (rotary spray reaction tower) system. Lime slurry reacts with the acid gases in the flue gas; e.g., hydrogen chloride (HCl), hydrogen fluoride (HF), and SO_2. Activated carbon powder and dry slaked lime powder are injected directly into the flue gas duct before the flue gas enters bag filters. The effect of the lime powder is to reduce concentrations of acidic gases such as HCl and SO_x. Activated carbon powder will absorb heavy metals in the flue gas such as mercury, and other pollutants such as dioxins and furans.

The flue gas enters the bag filters which aims to capture APCr and fly ash to reduce particulate concentrations to below 2010 EC IED limits. In the bag filters, the acidic gases continue to react with the slaked lime, and the activated carbon continues to absorb heavy metals and dioxins and furans. Various particles, including fly ash from the boiler, condensed heavy metals, reaction products, unreacted reagents, and activated carbon, are entrained onto the surface of the bag filters and blown into a dust hopper by compressed air.

A portion of the collected dust will be recirculated back into the duct or the reactor for re-use. Re-circulation of the collected particulate residues, which contain some unspent reagent, allows a reduction in the amount of lime used and thus reduces operating costs. Also, this allows a significant reduction to the volume of APCr generated. This is a requirement of European Commission (2019b).

The flue gas treatment equipment will comprise of a dry or semi-dry system. Any water that may be used will be fully evaporated within the gas duct, which will typically operate at a temperature of approximately 140°C at the point of discharge from the stack. No liquid effluent will be produced from the flue gas treatment system.

The activated carbon injection will absorb heavy metals that may exist in small amounts in the waste, and also toxic VOCs such as dioxins and furans. The spent carbon dust containing the absorbed pollutants is also collected in the downstream bag filters.

These approaches for the control of emissions of acid gases, toxic VOCs and heavy metals are considered BAT by European Commission (2019b).

Typically, the bag filters to be employed for the Project achieve particulate emission levels less than 5 mg/Nm^3, which meets 2010 EC IED requirements, and is a considerably more stringent limit than limits required by other industries in Victoria. The SEPP (AQM) lowest particulate emissions limit for Air Quality Control Regions is 250 mg/Nm^3 (0°C, 1013.25 hectopascals [hPa], gas volume calculated to 12% CO_2).

12.8.2 Monitoring

A CEMS certified by National Association of Testing Authorities (NATA) Australia will be provided on each boiler for measuring all pollutant and duct process condition parameters as required for on-line measurement under the 2010 EC IED and SEPP (AQM), as well as NH_3 for SNCR dosing control optimisation. The CEMS will monitor and report emissions in accordance with the 2010 EC IED. The CEMS will provide indication and recording of the following corrected concentrations of gases in the chimney, as a minimum, on a continuous basis: Stack gas flow; temperature; pressure; gas moisture content; oxygen; carbon dioxide; total dust; Total Organic Carbon (TOC); hydrogen chloride (HCl); hydrogen fluoride (HF); sulfur dioxide (SO_2); oxides of nitrogen (NO_x) as nitrogen dioxide (NO_2); carbon monoxide (CO); ammonia (NH3); and mercury.

A 'hot' spare CEMS will also be provided which can be switched into service when the duty CEMS on a combustion line chimney is not operating for maintenance, calibration or instrument faults.

13. Noise

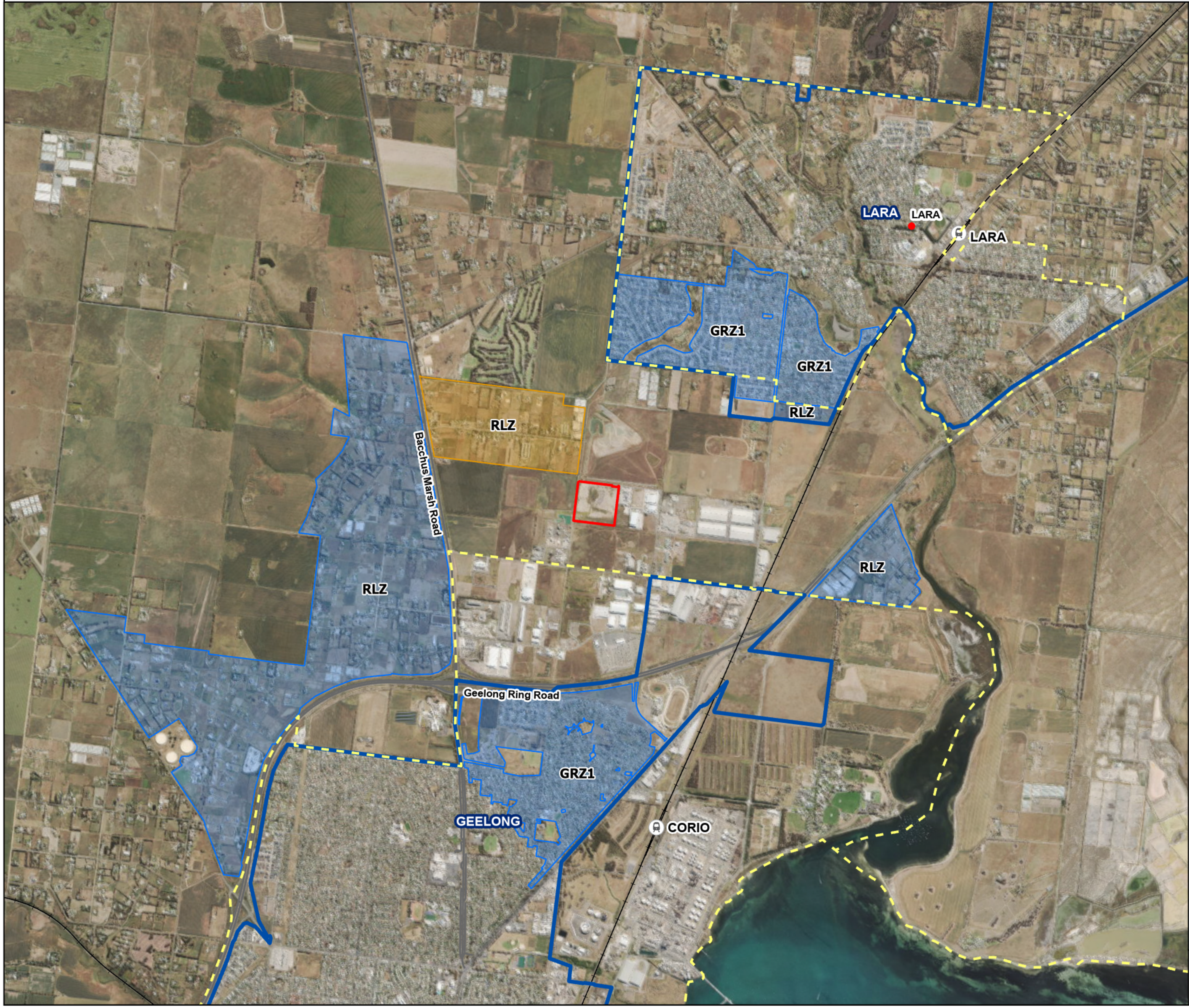
A noise assessment was undertaken by Jacobs and is provided in Appendix E. A summary of the assessment is provided below.

13.1 Existing environment

The site and the immediate surrounding area (to the east, south and west) is industrial with a mixture of businesses such as freight logistics, manufacturing and gas supply companies. Directly north of the site is an old quarry surrounded by unused farmland. To the northwest of the site, in a rural residential zone, are several small properties. These properties are generally less than 2 ha in size and used for lifestyle and hobby purposes with planted gardens, sheds and equipment around a dwelling. The township of Lara is 1.2 km north of the site.

The nearest Noise Sensitive Areas (NSAs) to the site are the properties in the rural residential area along Minyip Road and Gibbons Road, with 180 Minyip Road being the closest individual noise sensitive receiver (0.3 km from the site). Figure 13.1 shows this noise sensitive area and other noise sensitive receiver areas (such as the town of Lara) which are further than 1 km from the site. The nearest sensitive receptors along Minyip Road are shown in Figure 13.2.

Figure 13.1: Noise sensitive areas



- Project site
- Closest Noise Sensitive Area
- Other Noise Sensitive Areas
- Major Urban Area
- ABS Urban Centres
- Major Road
- Railway
- Rail Station
- Population Centres

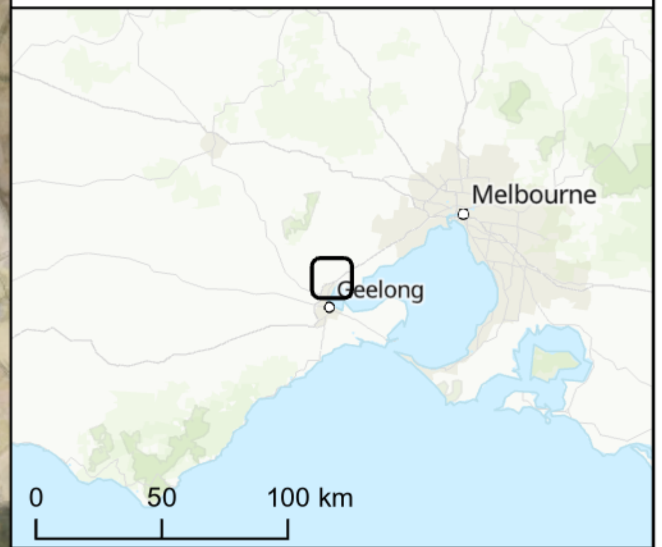
N

A3
1:35,000

IS305100
GDA 1994 MGA Zone 55

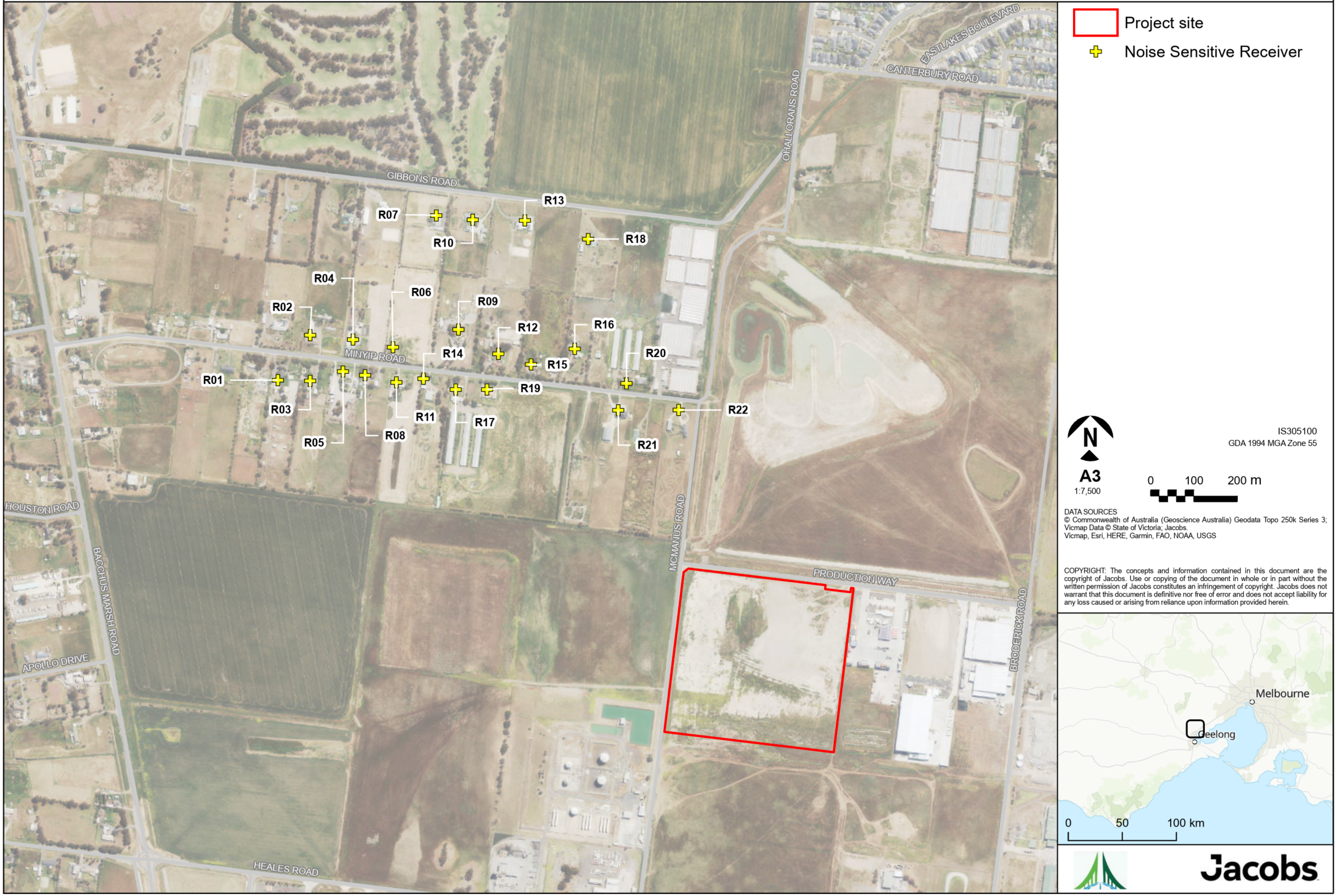
0 0.5 1 Kilometers

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) Geodata Topo 250k Series 3; Vicmap Data © State of Victoria; Jacobs.
Vicmap, Esri, HERE, Garmin, FAO, NOAA, USGS, Maxar



Jacobs

Figure 13.2: Nearest noise sensitive receivers (Minyip Road)



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Created by WARDA on 17/09/2020

13.2 Noise emission sources and best practice noise mitigation

The main noise sources associated with the proposed Project are presented in Table 13.1. Sound power levels associated with each noise source are provided in Appendix E.

Table 13.1: Noise generating equipment

No	Equipment	Location	Height (m)	Quantity
1	Stack	Stack	80	1
2	Mechanical induced draft cooling towers	Cooling towers	15	4
3	ID fan	Flue gas cleaning hall	7	1
4	Lime blowers	Flue gas cleaning hall	2	1
5	Air compressor	Compressor house	2	1
6	Truck	Tipping hall	7	1
7	Transformer	Transformer room / switchyard	5	1
8	Furnace wall cooling fan	Boiler room	13.5	1
9	Primary fan	Boiler room	3	1
10	Secondary fan	Boiler room	17.5	1
11	Activated blowers	Flue gas cleaning hall	2	1
12	Pumps	Steam turbine hall and pump house	2	2
13	Turbine	Steam turbine hall	8.5	1

The proposed EfW Plant will be designed in accordance with best available techniques for noise reduction. It has been assumed with regards to modelling of the Project that:

- The steam turbine hall, flue gas cleaning hall, tipping hall and boiler room will be constructed with steel, with a thickness of 20 centimetres (cm)
- The pump house, demineralisation water plant and compressor house, as well as the FW/RW pump room will be constructed with a concrete wall with a thickness of 20 cm
- Wet-cooling tower units are assumed to be area sources on top of the cooling towers
- All equipment is assumed to operate continuously and simultaneously for day, evening and night scenarios.

13.3 Assessment methodology and criteria

The proposed site and the nearest noise sensitive residences are based in regional Victoria and outside the major urban areas (population centres) of Lara and Geelong and, therefore, *Noise from Industry in Regional Victoria* (NIRV, Publication 1411, October 2011) is applicable to this Project. NIRV sets out procedures for setting levels for industry noise emissions with the recommended maximum noise levels the maximum allowable.

In NIRV, recommended maximum noise levels are described for different periods of the day. The periods are defined as follows:

Day Period: 07:00 to 18:00 hours

Evening Period: 18:00 to 22:00 hours

Night Period: 22:00 to 07:00 hours

(Note that 13:00 hours to 22:00 hours on Saturday and 07:00 hours to 22:00 hours on Sundays and public holidays are defined as the Evening Period)

Recommended maximum noise levels for the nearest NSAs to the Project have been derived using the methodology outlined in NIRV. An additional -5 dB(A) has been applied to each recommended maximum noise limit to account for the cumulative noise impact caused by the multiple industrial operations in the area. Effective RMNLs for the day, evening and night periods are presented in Table 13.2.

Table 13.2: Effective Recommended Maximum Noise Levels (Effective RMNL)

Receiver name	Address	Day RMNL dB(A)	Evening RMNL dB(A)	Night RMNL dB(A)	Noise character adjustment dB(A)	Effective day RMNL dB(A)	Effective evening RMNL	Effective night RMNL dB(A)
R01	40 Minyip Rd	60	54	49	-5	55	49	44
R02	45 Minyip Rd	60	54	49	-5	55	49	44
R03	50 Minyip Rd	60	54	49	-5	55	49	44
R04	55 Minyip Rd	60	54	49	-5	55	49	44
R05	60 Minyip Rd	60	54	49	-5	55	49	44
R06	65 Minyip Rd	60	54	49	-5	55	49	44
R07	70 Gibbons Rd	60	54	49	-5	55	49	44
R08	70 Minyip Rd	60	54	49	-5	55	49	44
R09	75 Minyip Rd	60	54	49	-5	55	49	44
R10	80 Gibbons Rd	60	54	49	-5	55	49	44
R11	80 Minyip Rd	60	54	49	-5	55	49	44
R12	85 Minyip Rd	60	54	49	-5	55	49	44
R13	90 Gibbons Rd	60	54	49	-5	55	49	44
R14	90 Minyip Rd	60	54	49	-5	55	49	44
R15	95 Minyip Rd	60	54	49	-5	55	49	44
R16	99 Minyip Rd	60	54	49	-5	55	49	44
R17	100 Minyip Rd	60	54	49	-5	55	49	44
R18	110 Gibbons Rd	60	54	49	-5	55	49	44
R19	110 Minyip Rd	60	54	49	-5	55	49	44
R20	115 Minyip Rd	60	54	49	-5	55	49	44
R21	160 Minyip Rd	60	54	49	-5	55	49	44
R22	180 Minyip Rd	60	54	49	-5	55	49	44