Air Quality Assessment

Macorna Wind Farm

Atmos MWV Pty Ltd

Prepared by:

SLR Consulting Australia Pty Ltd

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Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.1	15 April 2026	J Shepherd	K Lawrence	J Shepherd

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Atmos MWV Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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Acronyms and Abbreviations

%	percentage
APAC	air pollution assessment criterion
AAQMS	ambient air quality monitoring station
Air NEPM	National Environment Protection (Ambient Air Quality) Measure
AQIA	air quality impact assessment
Atmos	Atmos Renewables
AWS	automatic weather station
BESS	battery energy storage system
BoM	Bureau of Meteorology
DMP	Dust Management Plan
EES	Environment Effects Statement
EP Act	*Environment Protection Act 2017*
EPA	Environment Protection Authority
ERS	Environment Reference Standard
EVC	Ecological Vegetation Class
GED	general environmental duty
GLC	ground level concentration
ha	hectare
HV	high voltage
km	kilometres
kV	kilovolt
LGA	Local Government Area
LV	low voltage
m	metre
mm	millimetre
m^2	square metre
m^3	cubic metre
MAWF	Macorna Wind Farm
MV	medium voltage
MW	megawatt
MWh	Megawatt hour
NEM	National Electricity Market
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen

NPI	National Pollutant Inventory
PM_{10}	particles with equivalent aerodynamic diameters of less than 10 µm
$PM_{2.5}$	particles with equivalent aerodynamic diameters of less than 2.5 µm
ppb	parts per billion
ppm	parts per million
SLR	SLR Consulting Australia Pty Ltd
SO_2	sulfur dioxide
SRTM DEM	Shuttle Radar Topography Mission Derived Digital Elevation Model
SS	substation
TSP	total suspended particles in the air (typically ranging up to 30 - 50 µm
µm	micrometres
µg/m^3	micrograms per cubic metre
VNI	Victoria to New South Wales Interconnector
VOC	volatile organic compound
WTG	wind turbine generators

1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Atmos Renewables (Atmos) to provide an air quality assessment for the Macorna Wind Farm Project (the Project) as part of the Environmental Effects Statement (EES) referral process.

2.0 Project Description

2.1 Project Overview

The Macorna Wind Farm (MAWF) is a proposed utility-scale renewable energy development located in northern Victoria. The Project is being developed by Atmos Renewables, on behalf of Macorna SPV – Atmos MWV Pty Ltd as trustee for the Atmos MHV Trust.

The Project will comprise up to 114 wind turbine generators (WTGs) with a combined nameplate capacity of approximately 820.8 megawatts (MW). The turbines are anticipated to be Vestas V172–7.2 MW units, or similar, with a hub height of up to 166 metres (m) and a maximum blade tip height of approximately 252 m above ground level.

Electricity generated by the wind farm will be supplied into the National Electricity Market (NEM) via connection to the proposed Victoria to New South Wales Interconnector (VNI) West Tragowel Terminal Station, which forms part of the VNI West transmission project.

The Project will contribute to Victoria's renewable energy transition and is expected to generate sufficient electricity to power approximately 590,000 homes annually, supporting State targets for renewable energy and emissions reduction.

2.2 Project Location

The proposed location of the Project at Faulkner Road, Tragowel 3579, is within and surrounding the locality of Macorna in the Gannawarra Shire and Loddon local government areas (LGAs). The Project is located in Victoria's Loddon Mallee Region.

The Project comprises approximately 26 landowner groups, within the localities of Macorna, Macorna North, Loddon Vale, Tragowel, Mincha West and Macorna North. The Project Area is approximately 23,000 hectares (ha), with an expected development or construction footprint of 749.75 ha.

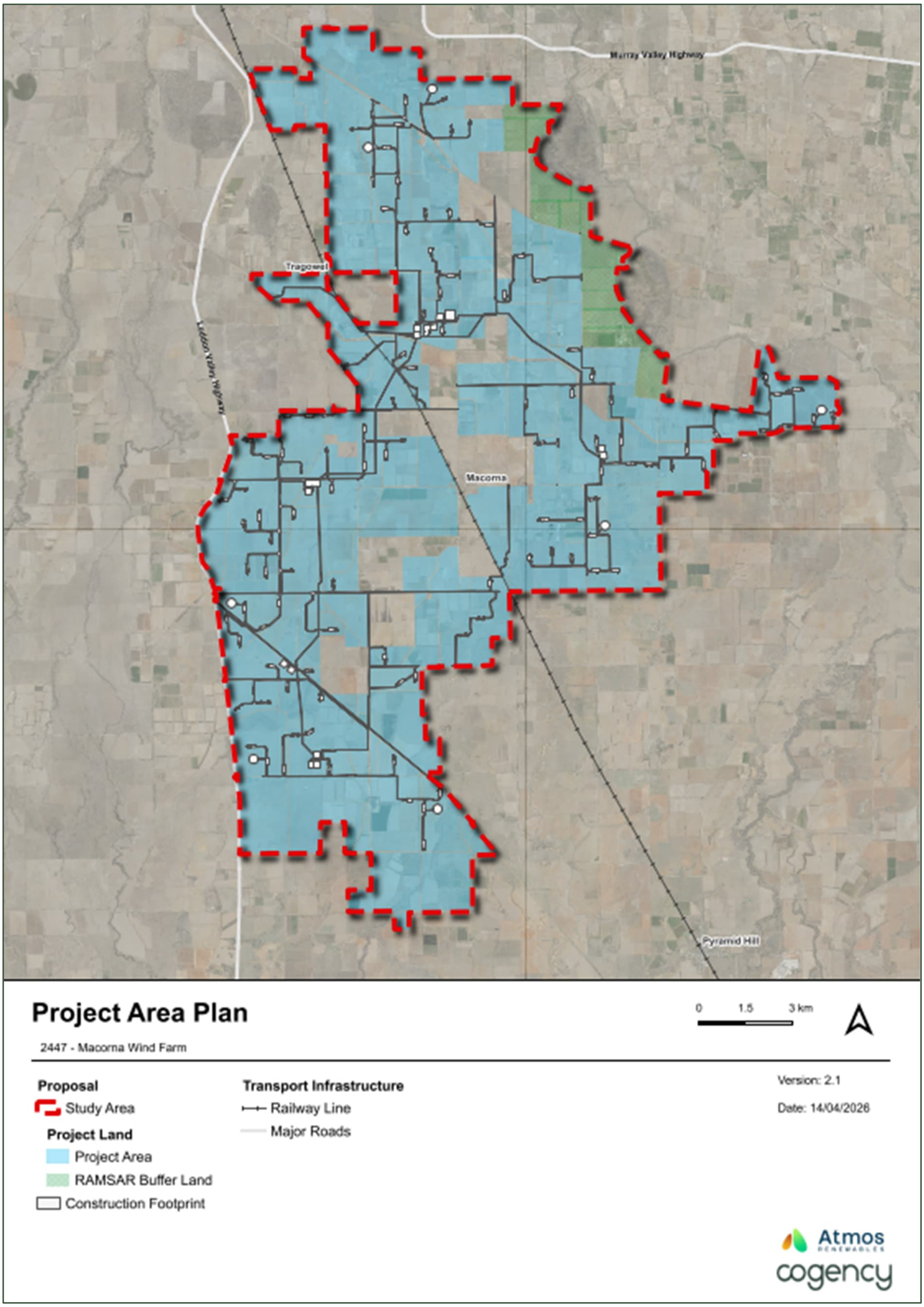
Figure 1 presents a Project Area Plan, outlining the various features of the Project Area including:

- Study Area – Approximately 26,000 ha – the broad area investigated for the Project
- Project Area – Approximately 23,000 ha – the properties investigated for inclusion in the Project
- Temporary construction footprint – 749.75 ha – the land proposed to be disturbed for the purposes of construction of the Project.

Of the temporary construction footprint, an estimated 40% of this area will remain as the development footprint for use during operation of the Project.

The majority of land within the Project Area would be undeveloped and used exclusively for existing agricultural and farming practices during the construction and operations phases of the Project.

Figure 1 Project Area overview



2.3 Project Components

Development of the Project is expected to involve:

- foundations, crane hardstand, crane boom laydown blade laydown and a rotor assembly area
- access tracks, including:
    - new and upgraded tracks within Project Area generally comprising a nominal 6.5 m wide access track for light vehicles
    - 30-40 m wide corridor for oversize overmass (OSOM) vehicles within the Project Area
- upgrades to the proposed transport access route, as required
- underground cabling (low voltage (LV) and medium voltage (MV)) and overhead transmission lines (MV and high voltage (HV)) within the Project Area
- up to four collector substations, with associated battery energy storage systems (BESS; size and duration to be determined)
- connection to the grid via the adjacent proposed Victoria to New South Wales Interconnector (VNI) West Tragowel terminal station
- electrical switching station (noting that the switching station infrastructure will be constructed, owned and operated by the electricity provider, rather than the Proponent)
- up to seven permanent meteorological masts
- construction compounds and laydown areas
- concrete batching plants
- operational and maintenance facilities
- potential construction workers accommodation facility
- potential communications towers
- native vegetation removal and vegetation screening as required and identified by technical assessments
- fencing, gates and signage.

Construction is expected to commence in 2029 (subject to planning and environmental approvals). The construction phase is expected to be completed over 3.5 years, with initial energisation/operations expected to occur from late 2030. The Project may be delivered in stages. It is also noted that the Projects schedule is currently aligned to the delivery of the VNI West project, which provides the proposed connection point for the Project.

3.0 Potential Emissions to Air

3.1 Construction

During construction, the potential for dust to be emitted from the Project will be directly influenced by the nature of the activities being performed. Emissions to air resulting from construction are generally those associated with fugitive dust from constructing access tracks, turbine and transmission line footings, trenching for cables and foundations for substation/s and offices etc. In particular, the following construction activities are likely to generate dust emissions:

- vegetation removal
- bulldozing/grading during access road construction and site preparation
- excavating and soil handling for foundations
- light vehicle and truck movements on unsealed roads
- wind erosion of stockpiles and exposed areas
- concrete batching.

Temporary emissions of particulate matter and local dust are generally unavoidable as part of the construction works, particularly where those activities are undertaken during periods of low rainfall and/or windy conditions. The impact of these dust emissions on local air quality is dependent upon the potential for particulates to become and remain airborne prior to being deposited as dust or experienced as an ambient particulate concentration.

Particulate matter (the smaller particles in airborne dust emissions), impacts on human health, can cause nuisance effects, and is categorised by size and/or by chemical composition. The potential for harmful effects depends on both. Particulate size ranges are generally defined as:

- TSP – refers to all (total) suspended particles in the air. In practice, the upper size range is typically 30 micrometres (µm) to 50 µm.
- PM_{10} – refers to all particles with equivalent aerodynamic diameters of less than 10 µm.
- $PM_{2.5}$ – refers to all particles with equivalent aerodynamic diameters of less than 2.5 µm diameter. These are sometimes referred to as ‘fine’ particles and are a sub-component of PM_{10}.
- Deposited dust – refers to particulate matter that has settled out of the air under the influence of gravity, measured as a dust deposition rate, which is dust settled out over a given area and time. Deposited dust can include particles of any size, but it generally comprises particles larger than 20 µm in diameter that rapidly settle out of the air near the point of emission. It is measured to assess if an emission source is causing a nuisance, such as soiling of property and materials, including rainwater tanks.

Both natural and anthropogenic processes contribute to the atmospheric load of particulate matter. Coarse particles ($PM_{2.5-10}$) are derived primarily from mechanical processes, resulting from the suspension of dust, soil, or other crustal materials from construction, roads, farming, quarrying, earthworks, dust storms, etc. Coarse particles also include sea salts, pollen, mould, spores, and other plant parts.

Fine particles, or $PM_{2.5}$, are derived primarily from combustion processes, such as vehicle emissions, wood burning, gas, diesel or coal burning for power generation, hazard reduction burns and bush fires. Fine particles also consist of transformation products, including sulphate and nitrate particles, and secondary organic aerosols formed from volatile organic compound emissions.

The size of particles determines their behaviour in the respiratory system, including how far the particles are able to penetrate, where they deposit, and how effective the body's clearance mechanisms are in removing them. Additionally, particle size is an important parameter in determining the residence time and spatial distribution of particles in ambient air, which are key considerations in assessing exposure.

$PM_{2.5}$, and in particular the ultrafine sub-micron particles, may penetrate beyond the larynx and into the thoracic respiratory tract, and evidence suggests that particles in this size range are more harmful than the coarser component of PM_{10}.

While both PM_{10} and $PM_{2.5}$ are likely to be emitted as a result of construction, it is PM_{10} that has the potential to be emitted in greater quantities as a result of the mechanical processes of Project construction.

Emissions of air pollutants associated with the combustion of diesel fuel from heavy equipment, trucks and light vehicles include $PM_{2.5}$, carbon monoxide (CO), oxides of nitrogen (NO_X), sulphur dioxide (SO_2) and volatile organic compounds (VOCs). Vehicle emissions associated with Project construction are unlikely to compromise air quality at the closest receptors due to the scale of the emissions and the distances to receptors. For example, elevated concentrations of these pollutants monitored next to busy roadways are found to decrease to background levels within 100 m to 200 m (Roorda-Nape et al., 1998; Hitchens et al., 2000; Zhu et al., 2000; Gilbert et al., 2003).

Emissions to air during operation are envisaged to be negligible, limited only to those associated with site maintenance vehicles.

3.2 Operation

During the operational phase, emissions to air are likely to be limited to minor vehicle exhaust and wheel-generated dust emissions from light vehicle movements on internal unsealed roads as part of routine inspection and maintenance activities etc. Given the scale and duration of these emissions and the distance to nearby sensitive receptors, these emissions would not be expected to have any measurable impact on off-site air quality and a detailed assessment of potential impacts is not warranted.

3.3 Decommissioning

Decommissioning activities would likely generate similar emissions to construction activities as discussed above, however, the intensity and resulting emissions to air from decommissioning would likely be of a lower magnitude.

4.0 Methodology

This section describes the methodologies used to understand the existing conditions and assess the potential impacts of the Project on air quality arising from the construction of the Project. Operation and decommissioning phases are discussed in **Section 7.2** and **Section 7.3**, respectively.

4.1 Existing Conditions Assessment

The existing conditions assessment comprised of the following tasks:

- Desktop review of the nearby sensitive receptors.
- Review of publicly available air quality monitoring data considered representative of the Project area.
- Review of publicly available meteorological monitoring data considered representative of the Project area.
- Consideration of local topography.

4.2 Construction Impact Assessment

A risk-based qualitative assessment methodology has been adopted from the Institute of Air Quality Management (UK) (IAQM) document, *"Assessment of dust from demolition and construction"* (IAQM 2024). This guidance document provides a structured approach for classifying construction sites according to the potential risk of air quality impacts and identifying appropriate mitigation measures.

The IAQM risk-based assessment methodology takes account of a range of impact descriptors, including the following:

- **Nature of Impact:** does the impact result in an adverse or beneficial environment?
- **Sensitivity:** how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude:** what is the anticipated scale of the impact?

The IAQM approach has been used widely in Australia for the assessment of air quality impacts from construction projects and the identification of appropriate mitigation measures and has been accepted by regulators across all states and territories for a variety of construction projects.

The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- **Step 1:** Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2:** Assess potential risk of dust effects from activities based on:
  - the scale and nature of the works, which determines the potential dust emission magnitude; and
  - the sensitivity of the area surrounding dust-generating activities.

  This follows the description of consequence and likelihood of a potential impact, and includes standard mitigation expected by relevant regulations, policy, guidance and standards that would typically be incorporated into the delivery of infrastructure projects of similar type, scale and complexity.

  Step 1 and 2 inform the potential plausible impact pathways from the Project based on a cause and effect.
- **Step 3:** Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4:** Assess significance of remaining activities after management measures have been considered.

5.0 Legislative Context and Assessment Criteria

The key Victorian legislation, regulations and guidelines that apply to the air quality impacts from the Project are summarised in **Table 1**.

Of particulate note for the Project is the general environmental duty (GED), which requires the risk of harm from emissions to air to be eliminated or minimised, e.g., using pollution control equipment, so far as reasonably practicable.

Table 1 Legislation, Policy, Guidelines and Standards Relevant to the Project

Document Title	Summary	Relevance to Project
Commonwealth Government		
National Environment Protection (Ambient Air Quality) Measure (NEPC 2021)	The National Environment Protection (Ambient Air Quality) Measure (Air NEPM) developed by the National Environment Protection Council (NEPC) contains standards and goals for key pollutants that are required to be achieved nationwide, with due regard to population exposure. Air NEPM standards apply at performance monitoring locations, with each station located in such a manner that it obtains a representative measure of air quality likely to be experienced by the general population in a region or sub-region of 25,000 people or more. The desired environmental outcome of the Air NEPM is ambient air quality that allows for the adequate protection of human health and well-being.	The standards are not intended to be applied as modelling criteria for assessing air emissions from individual sources, specific industries or roadside locations and are therefore not strictly appropriate for this AQIA. However, the Victorian Environmental Reference Standard which provides assessment criteria relevant to this AQIA adopts (in part) the Air NEPM standards.
Victorian Government		
Environment Protection Act 2017 (Victoria State Government 2017)	The *Environment Protection Act 2017* (EP Act) provides a legislative framework to protect the environment and human health in Victoria, including the protection of air, land and water from pollution and waste. The EP Act introduces: • a general environmental duty (GED), which requires everyone, including businesses and individuals, conducting activities that pose a risk to human health or the environment from pollution or waste to understand those risks and take reasonably practicable steps to eliminate or minimise them. • a duty to notify, which requires a person in management or control of land to notify Environment Protection Authority Victoria (EPA) as soon as practicable if the contamination or pollution incident may pose a risk to human health or the environment.	The GED is relevant to the Project requiring risks of harm from emissions to air to be eliminated or minimised so far as reasonably practicable. In determining whether it is reasonably practicable to minimise risks of harm to human health and the environment, the following matters are relevant: • the likelihood of the risk eventuating • the degree of harm that would result if the risk eventuated • what the person knows, or ought reasonably to know about the harm or risks of harm and ways of eliminating or reducing those risks • the availability and suitability of ways to eliminate or reduce the risk • the cost of eliminating or reducing the risk.
Environmental Reference Standard (Victoria Government 2022)	Under the *Environmental Protection Act 2017*, the Environment Reference Standard (ERS) is to be used to assess and report on environmental conditions in the whole or any part of Victoria. It	The ERS sets out ambient air quality objectives for *criteria pollutants*, some of which are relevant to the Project, including: • PM_{10}

Document Title	Summary	Relevance to Project
	sets out indicators and objectives for the ambient air environment. The ERS provides a reference to help make decisions. It does not: • create specific obligations that must be followed • set out enforceable compliance limits • describe levels that it is permitted to pollute up to.	• $PM_{2.5}$ For the most part, the ERS adopts the Air NEPM standards for these pollutants, which aim to provide for the adequate protection of human health and well-being.
Guideline for Assessing and Minimising Air Pollution in Victoria (EPAV 2025)	Publication 1961.2 "*Guideline for assessing and minimising air pollution in Victoria*" provides a framework to assess and control risks associated with air pollution. It is a technical guideline for air quality practitioners and specialists with a role managing pollution discharges to air. The air pollution assessment criteria (APACs) in Publication 1961.2 are concentrations of air pollutants that provide a benchmark to understand potential risks. They are risk-based concentrations that help identify when or if an activity is likely to pose an unacceptable risk to human health and the environment. This represents a change in attitude to air quality criteria which were previously concentrations that facilities could effectively 'pollute up to'. There are now no concentrations below which no action, management and/or mitigation of emissions to air is required.	Publication 1961.2 sets out levels of quantitative assessment and APACs that the Project must comply with, though compliance with an APAC does not absolve a person from the obligation to minimise risks of harm from emissions under the GED. Publication 1961.2 APACs for criteria pollutants are adopted from the ERS and should be updated to reflect any future update to the ERS.
Civil construction, building and demolition guide (EPAV 2023)	Publication 1834.1 "*Civil construction, building and demolition guide*" supports the civil construction, building and demolition industries to eliminate or reduce the risk of harm to human health and the environment through good environmental practice.	This guide provides an overview of duties under the EP Act, and general controls that can be put in place to manage risk and general information to help manage obligations associated with environmental aspects, including air quality. It does not provide a method for assessing the impacts of construction.
Planning guidance: Assessing an application for a concrete batching plant (EPAV 2023)	Publication 3001 "*Planning guidance: Assessing an application for a concrete batching plant*" is generally intended for use by responsible authorities and planning permit applicants, to assist in the preparation and assessment of planning permit applications.	Provides discussion on the separation distances (to sensitive receptors) that apply to concrete batching plants.
Other Jurisdictions		

Document Title	Summary	Relevance to Project
Assessment of dust from demolition and construction (IAQM 2024)	The Institute of Air Quality Management (UK) (IAQM) guidance document, "*Assessment of dust from demolition and construction*" provides a structured approach for classifying construction sites according to the risk of air quality impacts, to identify relevant mitigation measures appropriate to the risk.	Quantitative plume dispersion modelling assessment of potential construction dust emissions is seldom considered appropriate due to the level of uncertainty in the details of equipment, scheduling etc. Instead, the IAQM approach has been used widely in Australia for the assessment of air quality impacts from construction projects and the identification of appropriate mitigation measures, and has been accepted by regulators across all states and territories for a variety of construction projects.

5.1 Air Pollution Assessment Criteria

Relevant air pollution assessment criteria (APAC) sourced from Publication 1961.2 are provided in **Table 2.** The APACs are risk-based concentrations that help identify when, or if, an activity is likely to pose an unacceptable risk to human health and the environment. The APACs and are not to be considered concentrations below which no management and/or mitigation of emissions to air is required. In accordance with the GED, the Project must take steps to eliminate or minimise those emissions so far as reasonably practicable.

Table 2 Project APACs

Substance	Averaging Time	APAC ($\mu g/m^3$)
PM_{10}	24 hours	50
	1 year	20
$PM_{2.5}$	24 hours	25
	1 year	8
Cumulative APACs apply to the total concentration (Project plus background). Substances with averaging periods of 24 hours or greater are assessed at discrete sensitive receptor locations.		

It is the cumulative concentration resulting from the addition of the incremental source emissions, in this case, the Project, to the existing background concentrations that are assessed against the impact assessment criteria. Therefore, impact assessment outcomes can be strongly influenced by the existing background concentrations of pollutants where these may be relatively elevated compared to their criteria, as is often the case for $PM_{2.5}$.

6.0 Existing Conditions

6.1 Land Use and Sensitive Receptors

The Project Site is predominantly cleared farmland with pockets of remnant vegetation. The surrounding land uses include rural residential, mixed farming, dairy, grazing and cropping. Two Rasmsar wetlands adjoin the northeast boundary.

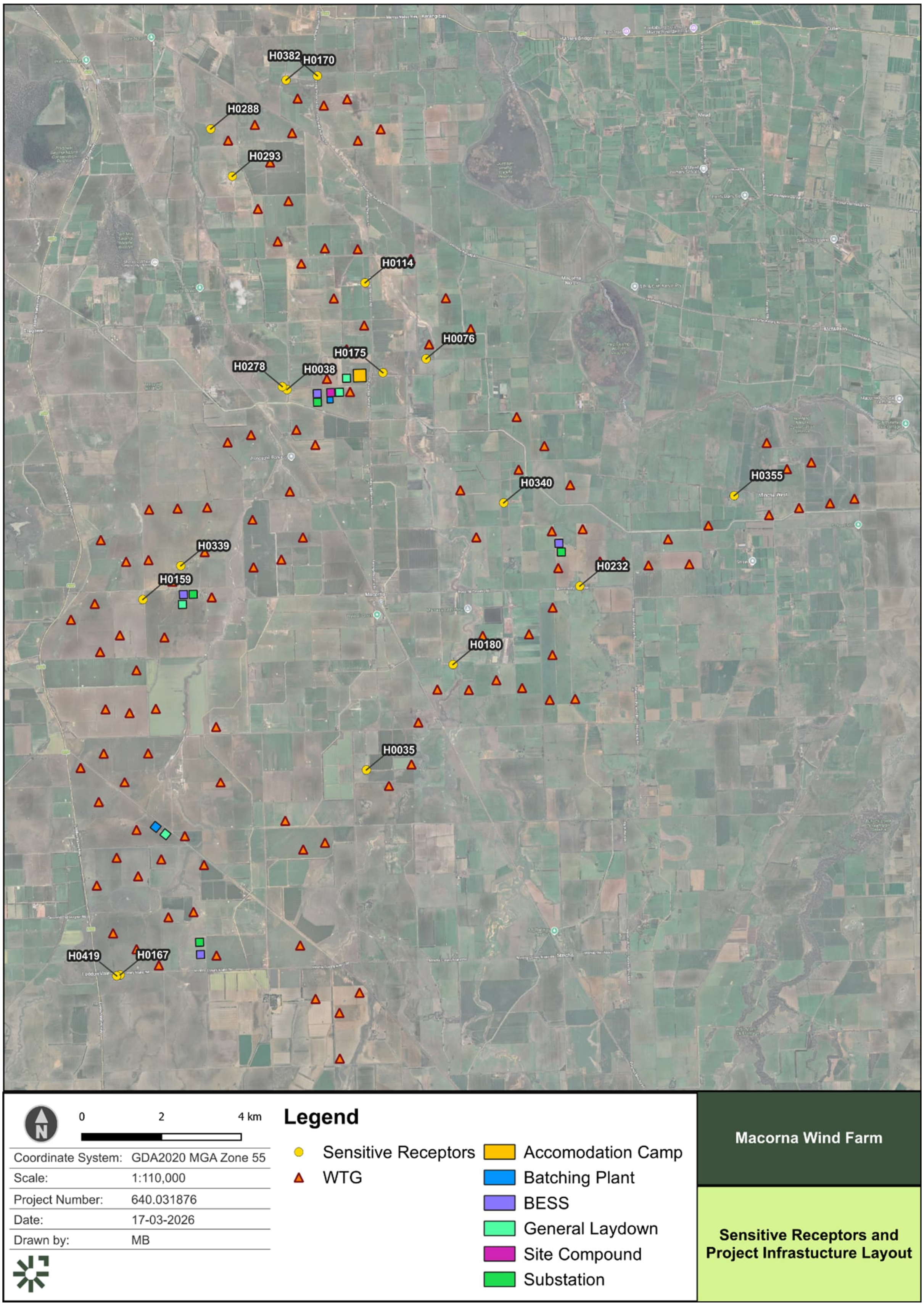
6.1.1 Sensitive Human Receptors

Publication 1961.2 defines sensitive land uses (receptors) as land where it is plausible for people to be exposed over extended durations. Examples of sensitive land use include, but are not limited to, residential premises, educational and childcare facilities, nursing homes, retirement villages and hospitals. Over 250 sensitive land uses have been identified in the vicinity of the Project (within 5 kilometres; km), which are primarily rural residential properties. The closest receptors (with 1 km) to Project infrastructure are listed in **Table 3** and presented in **Figure 2**. Note the Project's GED to avoid and minimise the risk of harm (refer **Section 5.0**) applies to all sensitive receptors, including those that are involved in the Project.

Table 3 Sensitive Receptors in Proximity to Project Infrastructure

Receptor ID	Easting (m)	Northing (m)	Distance to Nearest Infrastructure (km)
H0035	231,667	6,016,575	0.7
H0038	229,673	6,026,157	0.7
H0076	233,170	6,026,930	0.4
H0114	231,636	6,028,841	0.9
H0159	226,050	6,020,865	0.9
H0167	225,478	6,011,413	0.8
H0170	229,649	6,033,946	0.5
H0175	232,082	6,026,580	0.4
H0180	233,846	6,019,229	0.7
H0232	237,033	6,021,203	0.7
H0278	229,554	6,026,230	0.8
H0288	227,756	6,032,718	0.5
H0293	228,296	6,031,527	0.9
H0339	227,004	6,021,715	0.5
H0340	235,120	6,023,309	0.9
H0355	240,913	6,023,488	1.0
H0382	230,436	6,034,051	0.8
H0419	225,392	6,011,388	0.8

Figure 2 Sensitive Receptors in Proximity to Project Infrastructure



6.1.2 Sensitive Ecological Receptors

It is understood that the Project area includes five Ecological Vegetation Classes (EVCs) classified as endangered (<10% pre-European extent remains) or vulnerable (10-30% pre-European extent remains) (Ecology and Heritage Partners 2024). The proponent has undertaken considerable effort to avoid and minimize any impacts to native flora and fauna as far as reasonably practicable. It is understood that a design consideration is for the Project turbines to be greater than 2 km from the Ramsar wetlands to the northeast.

While dust falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration (Highways England 2019), literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 30 g/m^2/month, with most species unaffected until dust deposition rates are at levels considerably higher than this (Farmer 1993). This represents a level of impact an order of magnitude greater than dust deposition levels normally monitored on the boundaries of construction sites where levels below 4 g/m^2/month are generally achieved. Given this, an assessment of impacts to ecological receptors is not considered to be warranted.

6.2 Air Quality

In general, Victoria's air quality is good, although there are periods of poor air quality due mostly to smoke (wood fire and bushfire), occasional dust storms and urban pollution (EPAV 2018, 2020, 2021, 2022).

Due to the rural and sparsely populated location, air quality in the vicinity of the Project is unlikely to be significantly impacted by anthropogenic sources such as domestic wood burning or industrial emissions. Likewise, light to moderate road traffic and occasional rail emissions in the vicinity of the Project are unlikely to significantly impact air quality.

Local agricultural sources; e.g., ploughing, harvesting, slashing, stubble burning, livestock movement etc., and windblown dust may lead to periods of elevated PM_{10} concentrations. Regional air quality may also be impacted on occasion by bush fires and prescribed planned fuel reduction burns that have the potential to result in elevated concentrations of $PM_{2.5}$ and other pollutants.

6.2.1 Air Quality Monitoring

EPA monitors air quality at various locations at performance ambient air quality monitoring station (AAQMS) for assessment against the standards and pollutant goals defined in the Air NEPM (refer **Section 4.0**). EPA also operates particle sensor monitors located in sites across regional Victoria. These sensors are less accurate than most other types of particle monitoring equipment but give a general indication of air quality. For example, a high reading from a sensor could indicate that the air is impacted by burn-off or bush-fire smoke.

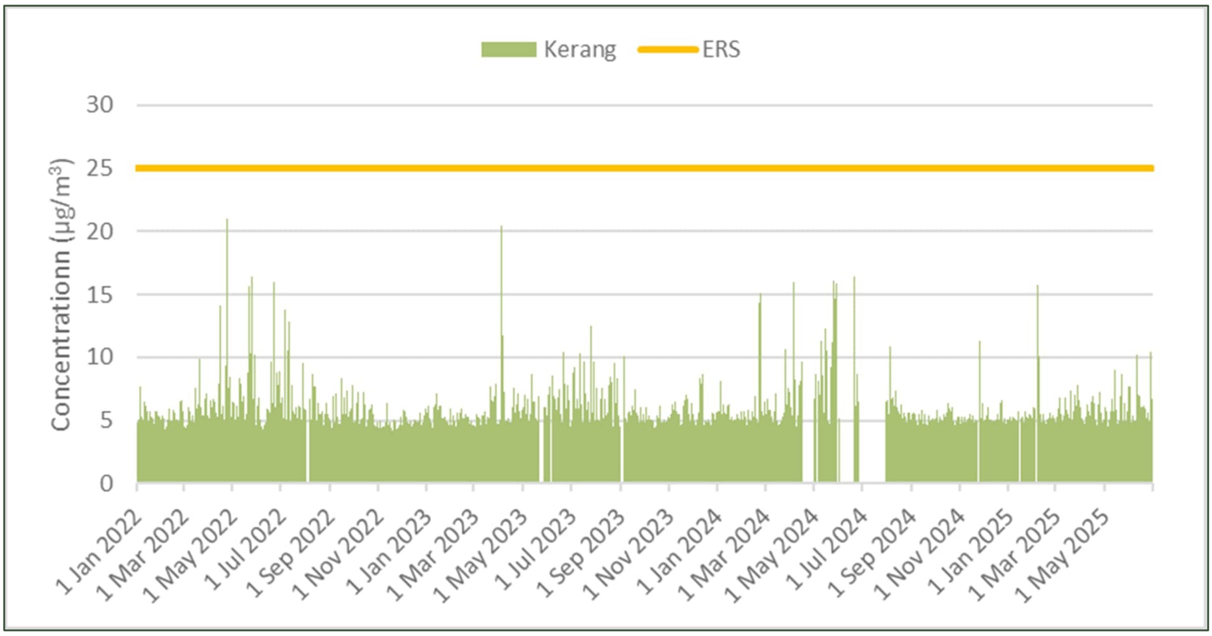
EPA operates a $PM_{2.5}$ particle sensor monitor in Kerang, approximately 10 km north of the Project. The air quality in Kerang is likely to be impacted more by anthropogenic activity than the Project area, being a regional suburban area with local vehicular traffic and light industry. It may therefore be considered to conservatively represent the air quality of the Project area.

The 24-hour average $PM_{2.5}$ data for Kerang for the years January 2022 to June 2025 is presented in **Figure 3** and compared to the $PM_{2.5}$ ERS objective. The background concentrations of $PM_{2.5}$ are generally below the relevant ERS objective but intermittent approaches of the objective are not unusual, likely due to those sources of emissions discussed above.

In the absence of PM_{10} data, PM_{10} concentrations may be considered to be equal to approximately 2 to 3 times that of the $PM_{2.5}$ concentrations, except for periods of elevated

$PM_{2.5}$ concentrations, e.g., during smoke events, when PM_{10} concentrations would likely be approximately equal to $PM_{2.5}$ concentrations.

Figure 3 Kerang Daily 24-Hour Average $PM_{2.5}$ Concentrations 2022-2025



Annual average $PM_{2.5}$ concentrations for Kerang for the years January 2022 to June 2025 are presented in **Table 4**.

Table 4 Kerang Annual Average $PM_{2.5}$ Concentrations

Year	Concentration (µg/m^3)
2022	5.8
2023	5.7
2024	5.9
2025 (to June)	5.6
Average	**5.8**

6.2.2 Local Emissions – National Pollutant Inventory Reporting

The National Pollutant Inventory (NPI) is an online database that provides information to the public regarding estimated emissions of 93 substances in Australia, together with the source and location of these emissions. The NPI is implemented cooperatively by the Australia Government and, in Victoria, by EPA.

The NPI contains 17 years of emissions data from more than 4,000 industrial facilities nationwide. The NPI also includes estimated emissions data for non-industrial (diffuse) sources such as motor vehicle exhausts, wood heaters, lawn mowers and commercial and leisure boating. Major source types and emissions are identified for regions such as local government areas (LGAs).

The requirement to report emissions estimates to the NPI is determined by the processes being undertaken at the facility, and also whether those processes exceed process-specific thresholds, in terms of activity rates (i.e. throughput and/or consumption). The requirement to report emissions to the NPI does not necessarily mean that these activities will be significant in terms of their potential for impact. Conversely, the NPI database does not list all the sources of industrial emissions e.g. those that operate below the activity threshold specified for the industry and those that are inconsistent with the parameters specified for reporting under the NPI program.

6.2.2.1 Industrial Sources

During the 2023/2024 reporting period (the most recent data set available at the time of preparing this report) over 930 facilities in Victoria emitted 77 different air pollutants. A search of the NPI database was undertaken for those in the area surrounding the Project identifying Pyramid Hill Quarry and Denyer Road Landfill approximately 10 km east and 18 km west of the Project area, respectively.

The annual emissions to air of particulate matter reported by these facilities for the 2023/2024 financial year are provided in **Table 5**.

Emissions from these sources are relatively low and emitted from over several kilometres away and are therefore not anticipated to have any significant potential for cumulative impacts during project construction.

Table 5 Local NPI Emissions to Air 2021/2024

Substance	Total Emission (kg)	Largest Reporting Sources		
		Category	Facility	Emission (kg)
PM_{10}	21,746.8	Construction Material Mining	Pyramid Hill Quarry	21,700
		Waste Treatment	Denyer Rd Landfill	46.8
$PM_{2.5}$	318.9	Construction Material Mining	Pyramid Hill Quarry	276
		Waste Treatment	Denyer Rd Landfill	42.9

6.2.2.2 Diffuse and Non-Industrial Sources

Non-industrial emission sources not identified in the NPI reporting data may include:

- motor vehicles
- railways
- aeroplanes
- fuel combustion (sub-reporting threshold facilities)
- gaseous fuel burning (domestic)
- solid fuel burning (domestic)
- lawn mowing
- burning (fuel reduction, regeneration, agriculture) / wildfires
- liquid fuel burning (domestic)
- barbeques
- backyard incinerators
- windblown dust
- vehicle exhaust and wheel-generated dust from paved / unpaved roads.

6.3 Meteorology

Meteorological conditions play a crucial role in dust generation and dispersion. Higher temperatures can dry out the soil, making it more susceptible to dust generation, while rainfall helps to settle dust particles and bind soil, reducing dust generation. Relative humidity influences dust dispersion by causing particles to clump together and settle, thus reducing airborne dust. Wind speed and direction are also significant factors; strong winds can lift and transport dust particles over long distances, while the wind direction determines the path of dust dispersion. Overall, dry and windy conditions contribute to higher dust generation and dispersion, whereas wet and humid conditions tend to reduce it.

Surface roughness, which is determined by features such as the topography of the land and the presence of buildings, structures and trees, also influences the rate of dispersion of air pollutants as it affects the degree of mechanical turbulence of winds.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The nearest available BoM automatic weather station (AWS) collecting data suitable for use in a quantitative air dispersion modelling study is located at Swan Hill Aerodrome (Station 77094) at an approximate elevation of 71 m, 60 km northwest of the Project. With few significant topographical features between Swan Hill and the Project area, the Swan Hill AWS is likely subject to similar conditions to, and therefore can be considered representative of, the Project area. The Swan Hill AWS has data available from as early as 1996 to present and has data available for the following parameters:

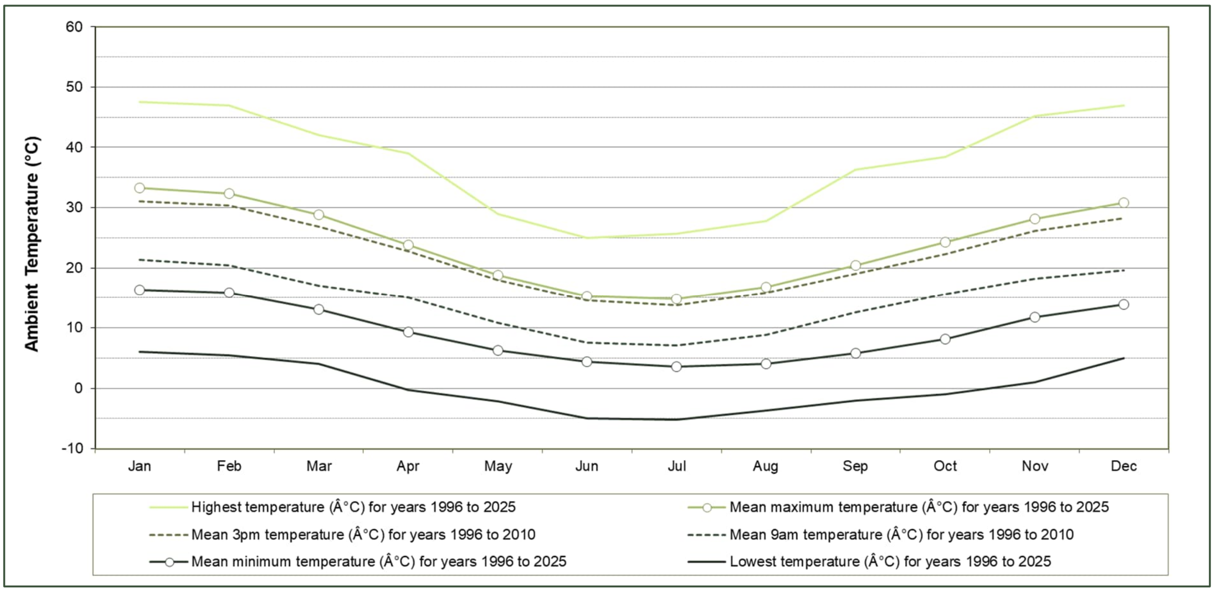
- Temperature (°C)
- Rainfall (mm)
- Relative humidity (%)
- Wind speed (m/s) and wind direction (degrees).

A review of the long-term data collected by this AWS is provided in the following sections.

6.3.1 Temperature

Temperature statistics for Swan Hill between 1996 and 2025 are summarised in **Figure 4**. Mean maximum temperatures range from 14.8 °C in winter to 33.3 °C in summer, while mean minimum temperatures range from 3.6 °C in winter to 16.3 °C in summer.

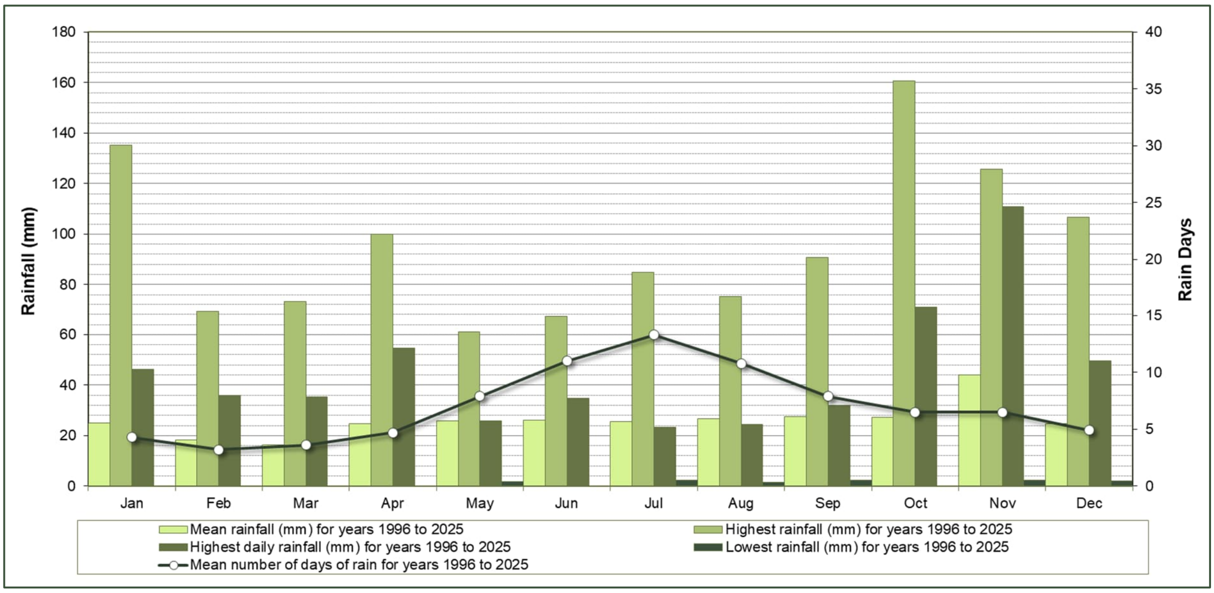
Figure 4 Temperature Trends for Swan Hill Aerodrome



6.3.2 Rainfall

Rainfall statistics for Swan Hill Aerodrome for the years 1996 to 2025 are summarised in **Figure 5**. The mean annual rainfall is 311.5 millimetres (mm). The average monthly rainfall is highest in spring, peaking at approximately 44 mm/month in November, with the highest monthly rainfall of 160.6 mm/month recorded in October. The average number of rain days peaks during winter however, with a maximum of 13.3 days reported for July. The lowest monthly average rainfall of 16.4 mm/month is in March, with a lowest average of 3.2 days of rain occurring in February.

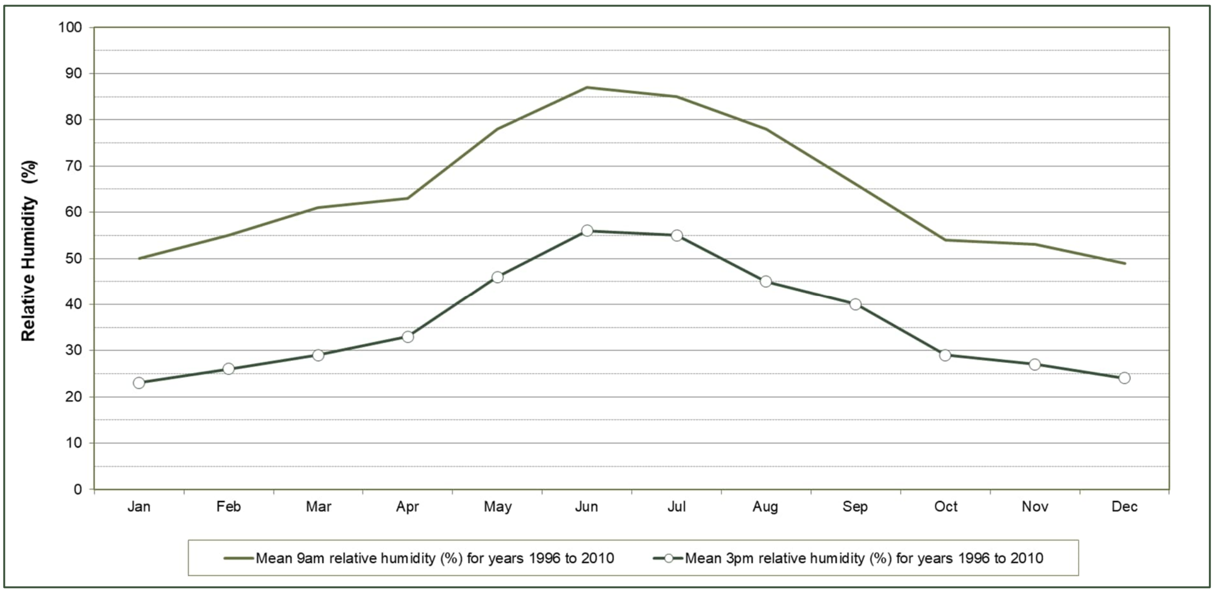
Figure 5 Long Term Monthly Rainfall Data for Swan Hill Aerodrome



6.3.3 Relative Humidity

Humidity statistics (9:00 am and 3:00 pm monthly averages) for Swan Hill Aerodrome for the years 1996 to 2010 are summarised in **Figure 6**. Morning humidity levels range from an average of 87% in winter to 49% in summer. Afternoon humidity levels are lower, at around 56% in winter dropping to around 23% in summer.

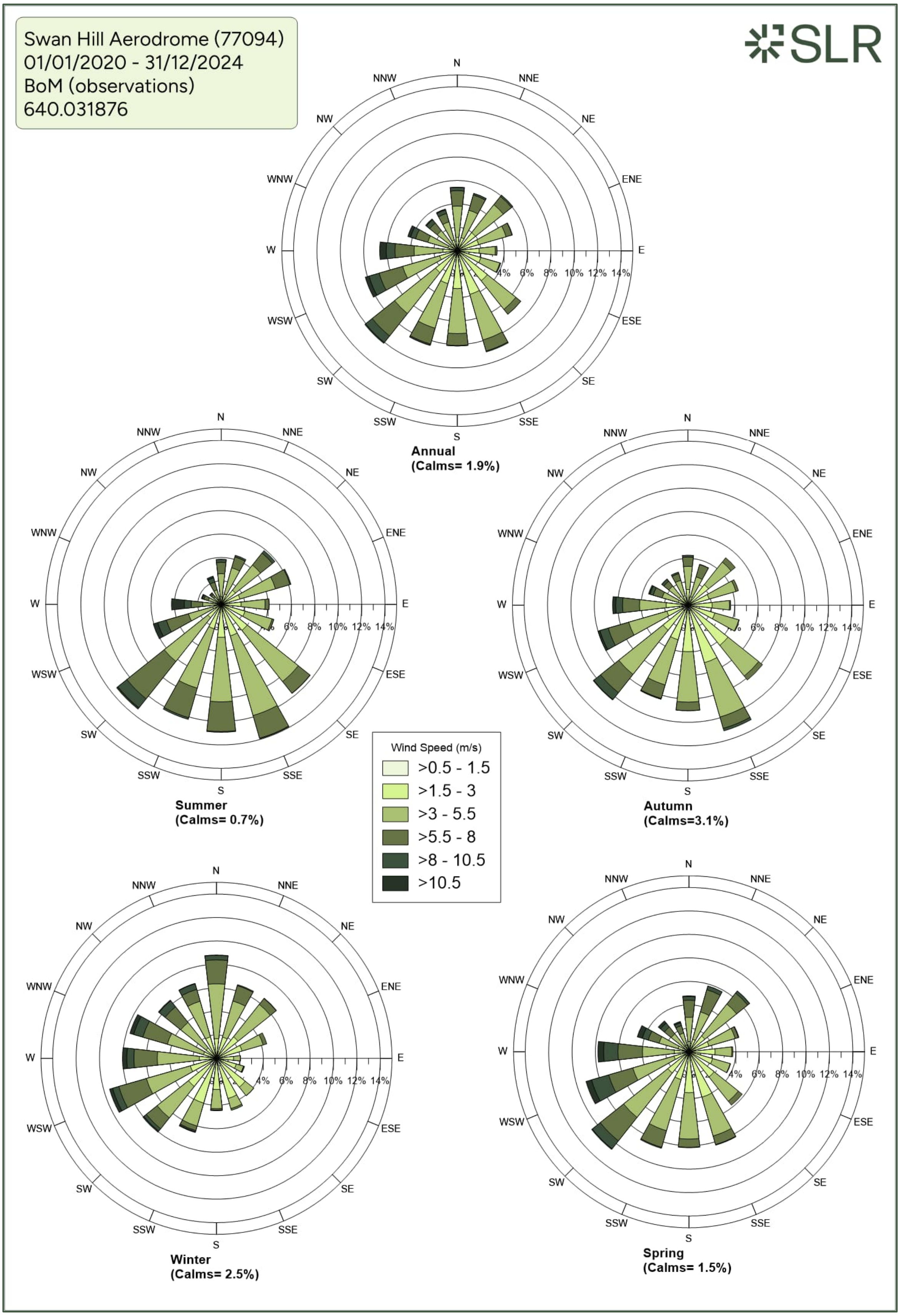
Figure 6 Humidity Data for Swan Hill Aerodrome



6.3.4 Wind

Annual and seasonal wind roses for Swan Hill Aerodrome for the years 2020 to 2024 are presented in **Figure 7**. The wind roses show that annually, winds from the west and southwest are dominant. This is also the case for summer, autumn and spring, however in winter winds from the southwest, west and north are more predominant. Swan Hill reports calm (less than 0.5 m/s) conditions on average 1.9% of the time.

Figure 7 Annual and Seasonal Wind Roses for Swan Hill Aerodrome (2020 – 2024)



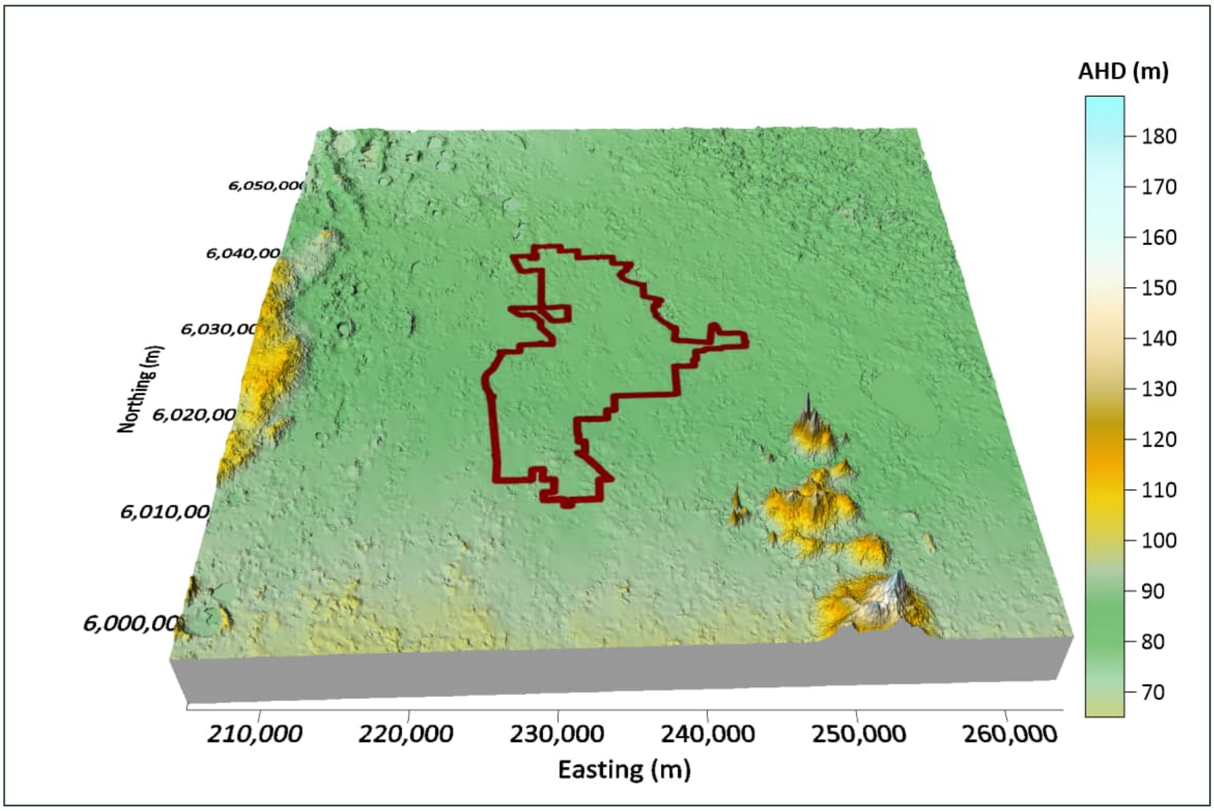
6.3.5 Summary

Based on a review of the meteorological conditions at the BoM Swan Hill Aerodrome AWS, it is anticipated that, as one would expect, there would be a greater risk of dust generation during the summer and early autumn months (December to March) when the temperatures are highest, the number of days of rain are lowest, and the relative humidity is lowest. These conditions are likely to lead to soil drying and becoming susceptible to particle lift-off in winds. Receptors to the north of the Project construction areas would be at most risk of impacts with summer winds blowing predominately from the south.

6.4 Topography

The topography of the area surrounding and including the Project is generally flat or gently undulating. **Figure 8** presents a three-dimensional representation of the topographical features in the area surrounding the Project site. Topographical features greater than 10 km to the southeast are unlikely to significantly influence winds in the vicinity of the Project.

Figure 8 Project Area Topography



7.0 Impact Assessment

7.1 Construction

7.1.1 Dust

The first step of the IAQM qualitative assessment methodology (provided in full in **Appendix A**) is a screening assessment for further assessment based on the presence of human receptors such as residences, or sensitive ecological receptors, within specific distances from the boundary of the site or construction vehicle routes.

The potential impacts for surrounding sensitive receptors include:

- adverse amenity / annoyance due to dust deposition (soiling of surfaces) and visible dust plumes
- health impacts due to elevated suspended particulate concentrations.

The nearest sensitive receptor to a Project infrastructure construction location, as identified and provided in **Table 3**, is 400 m.

An ecological receptor, for the purposes of this assessment, refers to any particularly sensitive habitat such as special conservation areas that may suffer ecological stress from dust deposition, e.g., on foliage. During long dry periods, dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Rainfall removes the deposited dust from foliage and can rapidly leach chemicals into the soil. Plant communities near short-term works are likely to recover within a year of the dust soiling stress ceasing. However, large scale construction sites may give rise to dust deposition over an extended period of time and adversely affect vascular plants. For example, cement dust deposited on leaves can increase the surface alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt.

While Ramsar wetlands are adjacent to the Project area (refer **Section 6.1.2**), there is a separation of approximately 2 km between the wetlands and the nearest proposed turbine. No particularly dust-sensitive ecological receptor is identified within the Project area.

Screening criteria, provided in **Appendix A** are reviewed and applied to the Project infrastructure (WTGs, SSs and BESSs) in **Table 6**, which concludes that further assessment is not required.

Table 6 IAQM Screening Criteria Review

Type of receptor	Screening Criteria	Receptor Prescence Identified
Human	250 m of the boundary of the site or 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).	No
Sensitive Ecological	50 m of the boundary of the site or 50 m of the route(s) used by construction vehicles on public roads, up to 250 m from the site entrance.	No

The IAQM methodology considers the sensitivity of the area of single high-sensitivity receptors to dust soiling, such as residences, that are beyond 50 m of construction activities, to be low (refer **Appendix A**, **Table A2**). Additionally, as the Project area is likely to have an annual mean PM_{10} concentrations of less than 28 µg/m^3 (refer **Section 6.2.1**), the sensitivity of the area to impacts to human health is also considered to be low (refer **Appendix A**, **Table A3**). Regardless of the scale of works, for earthworks, construction and trackout, the IAQM methodology finds that the risk of dust impacts to low sensitivity areas are low or negligible (refer **Appendix A**, **Table A6, A7** and **A8**, respectively).

In relation to the concrete batching plant/s, Victoria's "*Separation distance guideline*" (EPAV 2024) and "*Planning guidance: Assessing an application for a concrete batching plant*" (EPAV 2023) recommends a minimum separation distance of 100 m for a concrete plant processing greater than 5,000 tonnes per annum. Where the separation distance is greater than 300 m, no further assessment of amenity issues is required through referral to EPA. Final siting of the temporary concrete batching plant/s will ensure a minimum separation distance to any sensitive receptor of at least 300 m.

Based on the above, the risk of any dust-related impacts at any sensitive receptor is concluded to be negligible and can be readily addressed through good-practice dust management measures, as typically adopted for construction projects, refer **Section 8.0**.

7.1.2 Other Emissions to Air

Emissions of air pollutants associated with the combustion of diesel fuel from heavy equipment, trucks and light vehicles include $PM_{2.5}$, CO, NO_X, SO_2 and VOCs. All construction vehicles and plant would be serviced and maintained in accordance with manufacturers specifications to maximise operational efficiency and to minimise engine exhaust emissions.

Large, long-term construction sites that would generate large heavy vehicle traffic flows, e.g., greater than 200 movements per day in the same place over a period of a year or more may warrant an air quality assessment (EPUK 2010). However, vehicle and plant emissions associated with the Project construction will be distributed across the Project area and are unlikely to compromise air quality at the closest receptors due to the scale of the emissions and the distances to receptors, such that further assessment is not warranted.

There is also unlikely to be large areas of significantly contaminated odorous soils encountered during earthworks, therefore the potential for odours emissions and the associated risk of adverse amenity impacts is negligible.

7.2 Operation

Emissions to air associated with the operation of the Project are expect to be limited to engine exhaust emissions and wheel-generated dust associated with any Project-related vehicle movements and are expected to be minimal in scale and short in duration such that air quality at the closest receptors is unlikely to be compromised, therefore no further assessment is warranted.

7.3 Decommissioning

The Project design life is up to 35 years. While it is expected that fugitive dust emissions from these activities will require impact assessment and management, due to the uncertainty in the details of those activities at this time, e.g., equipment, scheduling etc., the potential air quality impacts of the decommissioning phase would be best considered when these details have been finalised. It is likely, however, that due to the envisaged (comparatively) reduced intensity of closure and decommissioning activities including vehicular traffic, perhaps with some infrastructure remaining in-situ, the dust impacts associated with this phase are likely to be lower than those associated with construction. A Dust Management Plan (DMP) specific to decommissioning would be developed and implemented to avoid and minimise dust impacts, therefore it is anticipated that there will be minor to negligible residual impacts to air quality during decommissioning.

8.0 Mitigation Measures

A DMP for the construction of the Project will be developed including the mitigation measures provided in **Table 7**.

Table 7 Recommended Mitigation Measures

ID	Measure / Requirement	Implementation Phase
General		
AQ1	Training will be provided to all Project personnel, including relevant sub-contractors on sound air quality control practices and the requirements of the DMP through inductions, toolboxes and targeted training.	Pre-construction / Construction
AQ2	Air quality control measures will be included in relevant Environmental Work Method Statements and/or Erosion and Sediment Control Plans.	Pre-construction / Construction
AQ3	Vegetation clearing will be staged where possible to minimise the area and time that surfaces are exposed.	Construction
AQ4	Exposed surfaces with no scheduled work for medium to long terms will be treated to minimise dust generation. Exposed surfaces will be stabilised progressively using the most practicable site-specific methods, including watering and geo-fabrics for short term exposure and emulation spray, spray grass, soil compaction and revegetation for longer term exposed areas or final finishes.	Construction
AQ5	Construction activities will be modified, reduced or controlled during high or unfavourable wind conditions or high background levels, if they have a potential to increase dust generation that may impact sensitive receptors.	Construction
AQ6	Control measures including water carts, sprinklers, sprays, dust screens or the application of geo-binding agents will be utilised, where applicable, to mitigate dust emissions that may otherwise impact sensitive receptors. The frequency of use will be modified to accommodate prevailing conditions.	Construction
AQ7	Erosion control structures will be checked regularly for build-up of silt and other materials to ensure deposits do not become a dust source.	Construction
AQ8	Stockpiles will be located as far from sensitive receptors as possible. A suitable cover crop or provision of other covering over topsoil stockpiles will be established where stockpiles prone to wind erosion are in place for the medium and long term.	Construction
AQ9	There will be no burning off of waste on site.	Construction
AQ10	Stormwater, recycled water or other water sources shall be used, where feasible and reasonable, in preference to potable water for construction activities, including concrete mixing and dust control.	Construction
AQ11	Maintain dust control equipment on the concrete batching plant/s to ensure its operability.	Construction
AQ12	The application of pesticides for the purposes of the Project will be modified, reduced or controlled during high or unfavourable wind conditions where wind can carry pesticides outside of the defined treatment area.	Construction / Operations
AQ13	Temporary concrete batching plants are to be located greater than 300 m from sensitive receptors.	Construction

ID	Measure / Requirement	Implementation Phase
AQ14	Construction of WTGs are to be located greater than 50 m from Ramsar wetland	Construction
Vehicle Movement and Material Stockpiling		
AQ15	Areas of disturbed material and access roads will be stabilised where possible by methods such as compaction.	Construction
AQ16	Measures will be implemented to minimise dust, soil or mud from being deposited from vehicles on public roads. This will be achieved by implementing mitigation measures such as rumble grids and large aggregate at entry/exit points. Manual cleaning will also be carried out where appropriate. In the event of any spillage or tracking onto public roads, the spilt material will be removed immediately or when known.	Construction
AQ17	Vehicle movement will be confined to designated haul roads and areas. These roads will have speed limits in place to reduce dust generation. Further reduced speed limits may need to be implemented where dust generation persists.	Construction
AQ18	Water carts will be used to supress dust on haul roads as required.	Construction
Plant and Equipment		
AQ19	Construction plant, vehicles and machinery will be maintained in accordance with manufacturer's specifications to ensure that emissions are not excessive. Periodic visual checks will be undertaken to ensure ongoing compliance, typically weekly. If visible smoke emissions are detected from plant and equipment, the plant and equipment will be tagged out of service until such time as it has been inspected by a mechanic and either repaired, maintained, or shown to be compliant with manufacturer specifications.	Construction

9.0 Closing

Provided a DMP incorporating industry standard construction management and mitigation measures is developed for the Project, harm from emissions to air during construction will be eliminated or minimised so far as reasonably practicable in accordance with the Project's GED.

Emissions to air generated during the operation and maintenance of the Project are likely to be negligible.

10.0 References

Ecology and Heritage Partners. 2024. *Letter of Advice regarding preliminary native vegetation assessmenf for Macorna Wind Farm.* Letter of Advice, Ecology and Heritage Partners Pty Ltd.

EPAV. 2023. *Civil construction, building and demolition guide.* Melbourne: Environment Protection Authority Victoria.

EPAV. 2018. *Publication 1749: Air monitoring report 2018 – Compliance with the National Environment Protection (Ambient Air) Measure.* Melbourne, Victoria: Environment Protection Authority Victoria.

EPAV. 2020. *Publication 1875: Air Monitoring Report 2019 - Compliance with the National Environmental Protection (Ambient Air Quality) Measure.* Victoria: Environment Protection Authority Victoria.

EPAV. 2024. *Publication 1949 Separation distance guideline.* Environment Protection Authority Victoria.

EPAV. 2021. *Publication 1958: Air Monitoring Report 2020 - Compliance with the National Environmental Protection (Ambient Air Quality) Measure.* Environment Protection Authority Victoria.

EPAV. 2025. *Publication 1961.2 Guideline for assessing and minimising air pollution in Victoria.* Melbourne: Environmental Protection Authority Victoria.

EPAV. 2022. *Publication 2052: Air Monitoring Report 2021 - Compliance with the National Environmental Protection (Ambient Air Quality) Measure.* Environment Protection Authority Victoria.

EPAV. 2023. *Publication 3001: Planning guidance: Assessing an application for a concrete batching plant.* Melbourne: Environment Protection Authority Victoria.

EPUK. 2010. *Planning for Air Quality.* London: Environmental Protection UK.

Farmer, A. M. 1993. “The effects of dust on vegetation - a review.” *Environmental Pollution* (Environmental Pollition) 63-75.

Gilbert, N L, S Woodhouse, D M Stieb, and J R Brook. 2003. “Ambient nitrogen dioxide and distance from a major highway.” *Science of the Total Environment* 312(1–3):43–46.

Highways England. 2019. *Design Manual for Roads and Bridges : Vol. 11 : Environmental Assessment, Section 3 : Environmental Assessment Techniques, Part 11.*

Hitchens, J, L Morawska, R Wolff, and D Gilbert. 2000. “Concentrations of submicrometre particles from vehicle emissions near a major road.” *Atmospheric Environment* 34(1):51–59.

IAQM. 2024. *Guidance on the assessment of dust from demolition and construction, Version 2.2.* London: Institute of Air Quality Management .

NEPC. 2021. *National Environment Protection (Ambient Air Quality) Measure.* National Environment Protection Council.

Roorda-Nape, M C, N A.H Janssen, J J De Hartog, P H Van Vliet, H Harssema, and B Brunekreef. 1998. “Air pollution from traffic in city districts near major motorways.” *Atmospheric Environment* 32(11):1921–1930.

Victoria Government. 2022. “Environment Reference Standard.” *Environment Protection Act 2017.* Victoria, March.

Victoria State Government. 2017. “Environment Protection Amendment Act 2017.” Melbourne, Victoria.

Zhu, Y, W Hinds, S Kim, S Shen, and C Sioutas. 2000. “Study of ultrafine particles near a major highway with heavy-duty diesel traffic.” *Atmospheric Environment* 36(27):4323–4335.

Appendix A IAQM Assessment Methodology

Air Quality Assessment

Macorna Wind Farm

Atmos MWV Pty Ltd

SLR Project No.: 640.031876.00002

15 April 2026

A.1 Introduction

A qualitative assessment of potential construction dust associated with the Project is conducted based on the IAQM "*Guidance on the Assessment of Dust from Demolition and Construction*" developed in the United Kingdom by the Institute of Air Quality Management (IAQM 2024).

The approach identifies the appropriate mitigation measures based on the likely level of impact during each phase of the construction works and is considered to be a more appropriate methodology than quantitative modelling given the temporary and highly variable nature of construction activities.

The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- **Step 1:** Screening based on distance to the nearest sensitive receptor whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2:** Assess potential impact of dust effects from activities based on:
    - the scale and nature of the works, which determines the potential dust emission magnitude; and
    - the sensitivity of the area surrounding dust-generating activities.

  This follows the description of consequence of a potential impact and includes typical management measures expected by relevant regulations, policy, guidance and standards that would typically be incorporated into the delivery of infrastructure projects of similar type, scale and complexity.

  Step 1 and 2 inform the potential plausible impact pathways from the Project based on a cause and effect.
- **Step 3:** Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4:** Assess significance of remaining activities after management measures have been considered.

A.2 Assessment Methodology

A.2.1 Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM Guidance (IAQM 2024) suggests an assessment may be required where:

- A 'human receptor' is located within:
    - 250 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on public roads, up to 250 m from the site entrance.
- An 'ecological receptor' is located within:
    - 50 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on public roads, up to 250 m from the site entrance.

This step is noted as having deliberately been chosen to be conservative and will require assessments for most projects. A planning authority may require dust assessment despite the proposed site falling outside the distances above for specific (high risk) projects.

A.2.2 Step 2a – Assessment of Scale and Nature of the Works

Step 2a of the assessment provides “dust emissions magnitudes” for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles). The magnitudes are: Large; Medium; or Small, with suggested definitions for each category. The definitions given in the IAQM guidance for demolition, earthworks, construction activities and track-out, are as follows:

- Demolition *(Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time)*:
  - **Large**: Total building volume greater than 75,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities higher than 12 m above ground level.
  - **Medium**: Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material, demolition activities 6-12 m above ground level.
  - **Small**: Total building volume less than12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities less than 6 m above ground, demolition during wetter months.
- Earthworks *(Covers the processes of soil-stripping, ground-levelling, excavation and landscaping)*:
  - **Large**: Total site area greater than 110,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 6 m in height.
  - **Medium**: Total site area 18,000 m^2 to 110,000 m^2, moderately dusty soil type (e.g. silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 3 m to 6 m in height.
  - **Small**: Total site area less than 18,000 m^2, soil type with large grain size (e.g. sand), less than 5 heavy earth moving vehicles active at any one time, formation of bunds less than 3 m in height.
- Construction (*Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc.)*:
  - **Large**: Total building volume greater than 75,000 m^3, on site concrete batching; sandblasting.
  - **Medium**: Total building volume 12,000 m^3 to 75,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.
  - **Small**: Total building volume less than 12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).
- Track-out *(The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network)*:

- **Large**: More than 50 heavy vehicle (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), greater than 100 m of unpaved road length.
- **Medium**: Between 20 and 50 heavy vehicle (>3.5 t) outward movements in any one day, moderately dusty surface materials (e.g. high clay content), between 50 m and 100 m of unpaved road length.
- **Small**: Less than 20 heavy vehicle (>3.5 t) outward movements in any one day, surface materials with a low potential for dust release, less than 50 m of unpaved road length.

To provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

A.2.3 Step 2b – Assessment of the Sensitivity of the Area

Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:

- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts
- The proximity and number of those receptors
- In the case of PM_{10}, the local background concentration
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce wind-blown dust.

Individual human receptors are classified as having high, medium or low sensitivity to either dust deposition or human health impacts. The IAQM method provides guidance on the sensitivity of different human receptor types to dust soiling and health effects as summarised in **Table A1**. The definitions and examples given in the IAQM Guidance for ecological receptors have been modified in **Table A1** to be relevant to the Australian context based on advice from SLR's ecological specialist team.

It is noted in the IAQM Guidance that people's expectations of amenity levels (dust soiling) is also dependent on existing deposition levels.

Table A1 IAQM - Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	• Users can reasonably expect a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • The appearance, aesthetics or value of their property could be diminished by soiling; or	• The enjoyment of amenity would not reasonably be expected; or • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • There is transient exposure, where the

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
	extended periods as part of the normal pattern of use of the land.	• The people or property would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: Dwellings, museums other culturally important collections, medium and long term car parks and car showrooms.	*Examples: Parks and places of work.*	*Examples: Playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	• Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}.*	*Examples: Public footpaths, playing fields, parks and shopping streets.*
Ecological	• Locations that support International or National (Environment Protection and Biodiversity Conservation; EPBC) level species or ecological communities of conservation significance that may be affected by dust soiling; or • Locations that are protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), that will require approval from the Commonwealth	• Locations that support National or State level species or ecological communities of conservation significance, where its dust sensitivity is uncertain or unknown; or • Locations that are protected under the EPBC Act or State legislation (e.g. Biodiversity Conservation Act), that will require approval from the Commonwealth or State Government Minister for	• Locations that support State or Local Government level species of conservational significance where the features may be affected by dust deposition. • Locations that are protected under State legislation (e.g. Biodiversity Conservation Act) or Local Government Environmental Management Plans, that will require approval from the

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
	Government Minister for the Environment (the minister) if the action has, will have, or is likely to have, a significant impact on Matters of National Environmental Significance (MNES).	the Environment (the minister) if the action has, will have, or is likely to have, a significant impact on MNES or State listed conservation significant species or communities.	State Government Minister for the Environment (the minister) if the action has, will have, or is likely to have, a significant impact on State listed conservation significant species or communities.
	Examples: Threatened avifauna that are impacted from air pollution through the ingestion of fine dust particles into the liver and lungs due to their high metabolic rate and special respiratory systems.	*Examples: Threatened or Priority Ecological Communities that are sensitive to dust by inhibiting photosynthesis and respiration of species.*	*Examples: a local Nature Reserve with dust sensitive vegetation communities.*

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- Any history of dust generating activities in the area.
- The likelihood of concurrent dust generating activity on nearby sites.
- Any pre-existing screening between the source and the receptors.
- Any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant.
- The season during which the works will take place.
- Any conclusions drawn from local topography.
- The duration of the potential impact (as a receptor may become more sensitive over time).
- Any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in **Table A2**. The sensitivity of the area should be derived for each of activity relevant to the Project (i.e. construction and earthworks).

Table A2 IAQM - Categorising the Sensitivity of an Area to Dust Soiling Impacts

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<250
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low
Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors < 20m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors < 50 m is 102. The sensitivity of the area in this case would be high.					

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table A3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (i.e. an annual average of 25 µg/m^3 for PM_{10}) the IAQM method has been modified slightly.

This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:

- Any history of dust generating activities in the area
- The likelihood of concurrent dust generating activity on nearby sites
- Any pre-existing screening between the source and the receptors
- Any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place
- Any conclusions drawn from local topography
- Duration of the potential impact
- Any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

Table A3 IAQM - Categorising the Sensitivity of an Area to Dust Health Impacts

Receptor sensitivity	Annual Mean PM_{10}	Number of receptors [a,b]	Distance from the source (m)			
			<20	<50	<100	<250
High	>25 µg/m3	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	21-25 µg/m3	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	17-21 µg/m3	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<17 µg/m3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>25 µg/m3	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	21-25 µg/m3	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	17-21 µg/m3	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<17 µg/m3	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

a Estimate the total within the stated distance (e.g. the total within 250 m and not the number between 100 and 250 m); noting that only the highest level of area sensitivity from the table needs to be considered.
b In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

The IAQM Guidance matrix used to categorise the sensitivity of the area to ecological impacts from dust is presented in **Table A4**.

Table A4 IAQM - Categorising the Sensitivity of an Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

a The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout and for each designated site.

b Only the highest level of area sensitivity from the table needs to be considered.

c For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site.

A.2.4 Step 2c – Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table A5** to **Table A8** (for demolition, earthworks, construction and track-out, respectively) to determine the potential risk category with no mitigation applied.

Table A5 Risk of Dust Impacts from Demolition Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table A6 Risk of Dust Impacts from Earthworks Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table A7 Risk of Dust Impacts from Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table A8 Risk of Dust Impacts from Track-out Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

A.2.5 Step 3 - Site-Specific Mitigation

Once the potential impact categories are determined for each of the relevant activities, general management measures and management measures for the four dust generating activities (demolition, earthworks, construction, trackout) can be identified, commensurate with those potential impacts.

A.2.6 Step 4 – Residual Risk of Impacts

After Step 3, it should then be determined whether there is a residual risk of significant impacts. For almost all construction activity, the IAQM Guidance notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation, and that experience shows that this is normally possible. Providing that the appropriate level of dust control is effectively implemented, the residual effects will normally be *negligible* or not significant.

It is noted though that all situations are assessed on a case-by-case basis as certain site restrictions may limit the ability to effectively implement mitigation measures, such as inadequate access to water for dust suppression. It is important that the specific characteristics of the site and the surrounding area are considered to ensure that the conclusion of *negligible* residual impacts is robust.

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