

Appendix I

Air Quality Assessment





Table of Contents

Executive Summary	5
1 Introduction	6
1.1 Legislative context	6
1.1.1 Environment Protection Policy (Air Quality) 2004	6
2 Site description	8
3 Air emission sources	16
4 Existing air quality and meteorology	17
4.1 Air quality	17
4.2 Meteorology	18
5 Discussion and conclusions	22
5.1 Recommendations	22

List of Figures

Figure 2-1: Aerial view of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.	10
Figure 2-2: Aerial view of the western end of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.	11
Figure 2-3: Aerial view of the central zone of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.	12
Figure 2-4: Aerial view of the eastern end of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.	13
Figure 2-5: Aerial view of the south-eastern end of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.	14
Figure 2-6: Aerial view of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds with TPS zone overlay.	15
Figure 4-1: Aerial view showing the location of the Gretna BLANKET station and the project area.	17
Figure 4-2: 2024 annual plot of 24 Hr average PM ₁₀ and PM _{2.5} concentrations at the Gretna BLANKET station.	18
Figure 4-3: Aerial view showing the location of Butlers Gorge BoM station and the project area.	19
Figure 4-4: 9 am and 3 pm wind roses for Butlers Gorge.	20
Figure 4-5: Annual and seasonal wind roses for Butlers Gorge.	21

List of tables

Table 4-1: Long term climate statistics, BoM weather station BUTLERS GORGE: 096003.	19
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References

- [1] Attalla, M. I., Day, S. J., Lange, T., Lilley, W. and Morgan, S. (2008) *NO_x emissions from blasting operations in open-cut coal mining*. Atmospheric Environment, 42: 7874 – 7883.
- [2] Australian Government, Dept of Sustainability, Environment, Water, Population and Communities (February 1999) *National Pollutant Inventory Emission Estimation Technique Manual for Concrete Batching and Concrete Product Manufacturing*.
- [3] Australian Government, Dept of Sustainability, Environment, Water, Population and Communities (January 2012) *National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 3.1*.



- [4] Australian Explosives Industry and Safety Group Inc. (AEISG) (August 2011) *Code of Practice Prevention and Management of Blast Generated NO_x Gases in Surface Blasting, Edition 2.*



Executive Summary

Tarkarri Engineering was commissioned by Entura on behalf of Hydro Tasmania to conduct an air quality assessment for the construction works associated with a proposed redevelopment of the Tarraleah Power Station as part of the Major Projects Program.

The risk of particulate air emissions from the project prejudicing environmental values is very low given the presence of a significant buffer between the project disturbance footprint and residential land uses, low existing particulate levels and relatively high rainfall and generally calm wind conditions.

Sufficient buffers exist between tunnel portal locations and any residential locations such that residential exposure to blast gases isn't a risk. Public roads pass near to some portal locations and management of exposure risk may be required.



1 Introduction

Tarkarri Engineering was commissioned by Entura on behalf of Hydro Tasmania to conduct an air quality assessment for the construction works associated with a proposed redevelopment of the Tarraleah Power Station (PS) as part of the Major Projects Program (MPP).

The redevelopment would replace end of life assets and provide a more flexible and efficient scheme to ensure a reliable and safe renewable energy source into the future. Increase the capacity Tarraleah Scheme from 90 MW to approximately 180 MW and increase its operational flexibility and efficiency through the provision of a direct pressurised connection between the scheme's headwater and a new power station. The No. 1 Canal and hillside penstocks would be decommissioned. Mossy Marsh and No. 2 ponds would transfer less water than current and water from Derwent Pumps and natural pickup would be pumped from Pond No. 2 to a surge tower. A new intake on Lake King William and an associated approx. 1 km tunnel (currently under construction) would also be utilised by the redevelopment and new a transmission line from the power station to the Liapootah to Palmerston transmission line would be constructed.

1.1 Legislative context

1.1.1 Environment Protection Policy (Air Quality) 2004

The *Environment Protection Policy (Air Quality) 2004* (Air Quality EPP), made under section 96K of the *Environmental Management and Pollution Control Act 1994*, provides a framework for the management and regulation of point and diffuse sources of emissions to air for pollutants with the potential to cause environmental harm. The policy protects environmental values, with values to be protected under this policy as follows:

- the life, health and well-being of humans at present and in the future;
- the life, health and well-being of other forms of life, including the present and future health, wellbeing and integrity of ecosystems and ecological processes;
- visual amenity; and
- the useful life and aesthetic appearance of buildings, structures, property and materials.

The Air Quality EPP outlines the following in relation to the management of diffuse air emission sources (sources of potential air emissions from the redevelopment of the Tarraleah Power Station would be diffuse in nature).

Management of diffuse sources of air pollution

16. (1) Regulatory authorities should manage and regulate diffuse sources of air pollution that have the potential to cause material or serious environmental harm or an environmental nuisance in such a manner as will protect the environmental values identified in this Policy.
(2) Diffuse sources of air pollution should be managed using best practice environmental management so as to:
 - (a) minimise emissions; and
 - (b) manage those emissions that are unavoidable in a manner that minimises impacts on health, safety or amenity.
- (3) Diffuse sources of air pollution should be managed in accordance with any relevant guidelines published, adopted or endorsed by the Board for the purposes of this clause.
- (4) Diffuse sources of air pollution must be managed in accordance with any regulations made under the Act.



Relevant criteria for air constituents of concern for this assessment with the potential to generate environmental harm / nuisance are taken from the Air Quality EPP and subsequent EPA Board Statement from January 2022, *Update to Air Pollutant Design Criteria used in the Environmental Impact Assessment Process*. Concentrations are reported for gas volumes at 25°C and 1 atmosphere. For TSP and dust deposition, criteria are taken from the NSW Environment Protection Authority (EPA).

NB: The criteria are provided here for informative purposes only with this assessment qualitative, not quantitative.

NO₂

Oxides of nitrogen are comprised mainly of nitrogen oxide (NO) and nitrogen dioxide (NO₂). Nitrogen oxide is produced by the high temperature combustion in the presence of nitrogen and oxygen. NO is converted to NO₂ in the atmosphere. Exposure to high concentrations of NO₂ can result in decreased lung function.

Averaging period	Maximum concentration
1 hour	150.5 µg/m ³
1 year	28.2 µg/m ³

Particulate matter

In the atmosphere, particles range in size from 0.1 to 50 µm. Health impacts relate to the extent to which they can penetrate the respiratory tract. Particles with an aerodynamic diameter greater than 10 µm, are generally screened out in the upper respiratory tract by adhering to mucus in the nose, mouth, pharynx and larger bronchi and are removed by either swallowing or expectorating. Very fine particles, in particular those less than 2.5 µm, can be deposited in the pulmonary region. It is these particles that are of greatest concern to health.

PM₁₀

Averaging period	Maximum concentration
1 day	50 µg/m ³
1 year	25 µg/m ³

PM_{2.5}

Averaging period	Maximum concentration
1 day	25 µg/m ³
	20 µg/m ³ *
1 year	8 µg/m ³
	7 µg/m ³ *

* 2025 goal from National Environment Protection (Ambient Air Quality) Measure.

TSP

Total Suspended Particulate Matter (TSP), NSW EPA criteria.

Averaging period	Maximum concentration
1 year	90 µg/m ³



Deposition

Deposition of insoluble solids, NSW EPA criteria

Maximum rate	Maximum increase
4 g/m ² /month	2 g/m ² /month

2 Site description

The MPP Tarraleah Redevelopment Project encompasses an area extending from the existing Tarraleah Hydroelectric Power Station west to Lake King William and east to Dee Lagoon substation / south-east to Liapootah substation. The key components of the project are:

- An approximately 4.2 km **headrace pipeline** and associated service roads connecting the Lake King William tunnel (under construction) to the headrace tunnel.
- An approximately 9.8 km low pressure **headrace tunnel**.
- An approximately 2.3 km long high pressure **power tunnel** that splits into two short penstocks before entering the power station.
- A partially underground **power station** with an installed capacity of approximately 180 MW and rated flow of 60 m³/s located adjacent to the existing Tarraleah Power Station.
- A **surge facility** consisting of a 70 m high (above ground level) surge tower and associated underground approximately 140 m high surge shaft to control water pressure in the headrace and power tunnels.
- An approximately 6 m³/s **pumping station** and approximately 0.8 km **rising main** to transfer water from the existing No. 2 Pond to the power and headrace tunnels via the surge tower.
- A **transformer yard** and **switchyard** located close to the power station connecting the power station to the proposed transmission line.
- A new 22 kV **power supply** from the existing 22 kV network to the western, mid access and Paddy's Quarry portals, pump station, surge tower and power station will provide power during construction and operation.
- A new 220 kV **transmission line**. There are currently two transmission line options being considered:
 - A 14 km double circuit line from the existing Tungatinah Switchyard to the existing Dee Lagoon substation (northern option), or
 - A 15 km double circuit line from the proposed Tarraleah Switchyard to the existing Liapootah substation (southern option)
- **Access tunnels, tunnel portals** and **access roads** to provide access to the headrace and power tunnels. Excess spoil from tunnel, power station and portal excavations will be stored in one of three **permanent spoil emplacement areas** located at the western portal, mid tunnel access portal and Paddy's Quarry portals

Construction of the Tarraleah Redevelopment Project underground works will be completed using drill and blast techniques and may be supported by a tunnel boring machine. Above ground works will be completed by conventional earth moving and mechanical excavation. To support construction the following key temporary infrastructure is proposed:

- A **construction compound** at Tarraleah Village supported by smaller construction compounds located at each of the tunnel portals and the power station. Construction



compounds will include site administration facilities and workshops, handle and store materials and equipment imported to site and concrete batching and crushing and screening plant.

- Explosives for excavation work are required to be stored in a dedicated facility. Two **explosive magazines** will be located off Butlers Gorge Road.
- To facilitate construction of the power station a **temporary bridge** will be built over the Nive River.
- A workforce accommodation village will be constructed at Tarraleah but is not included in the scope of this assessment.

Upon the completion of works, all temporary construction sites will be rehabilitated.

The works involves a disturbance footprint (within which particulate air emissions have the potential to occur) incorporating the pipeline alignment, tunnel portals and spoil dumps, a surge tower and transmission line alignment. Clearance of up to 176.8 ha of native vegetation (of which approximately 90 ha has previously been harvested for forestry) and 103.8 ha of modified vegetation communities to allow construction of above ground infrastructure including tunnel portals and associated spoil stockpiles, access tracks, a surge tower and transmission line (the proposed new Tarraleah PS would be located on the site of the existing Tarraleah PS switchyard and does not require additional vegetation clearance).

Figures 2-1 to 2-5 present aerial views of the project area with salient features marked, project infrastructure highlighted in yellow, and the disturbance footprint of the project highlighted in green. Building polygons from LISTdata are also shown on the aerial views highlighted in red.

NB: Building in and around Tarraleah PS and the southern end of Lake King William are Hydro Tasmania owned infrastructure and are not considered sensitive to air emission from the project.

Figure 2-5 presents an aerial view of the project area and surrounds with the Tasmanian Planning Scheme (TPS) zones overlay.

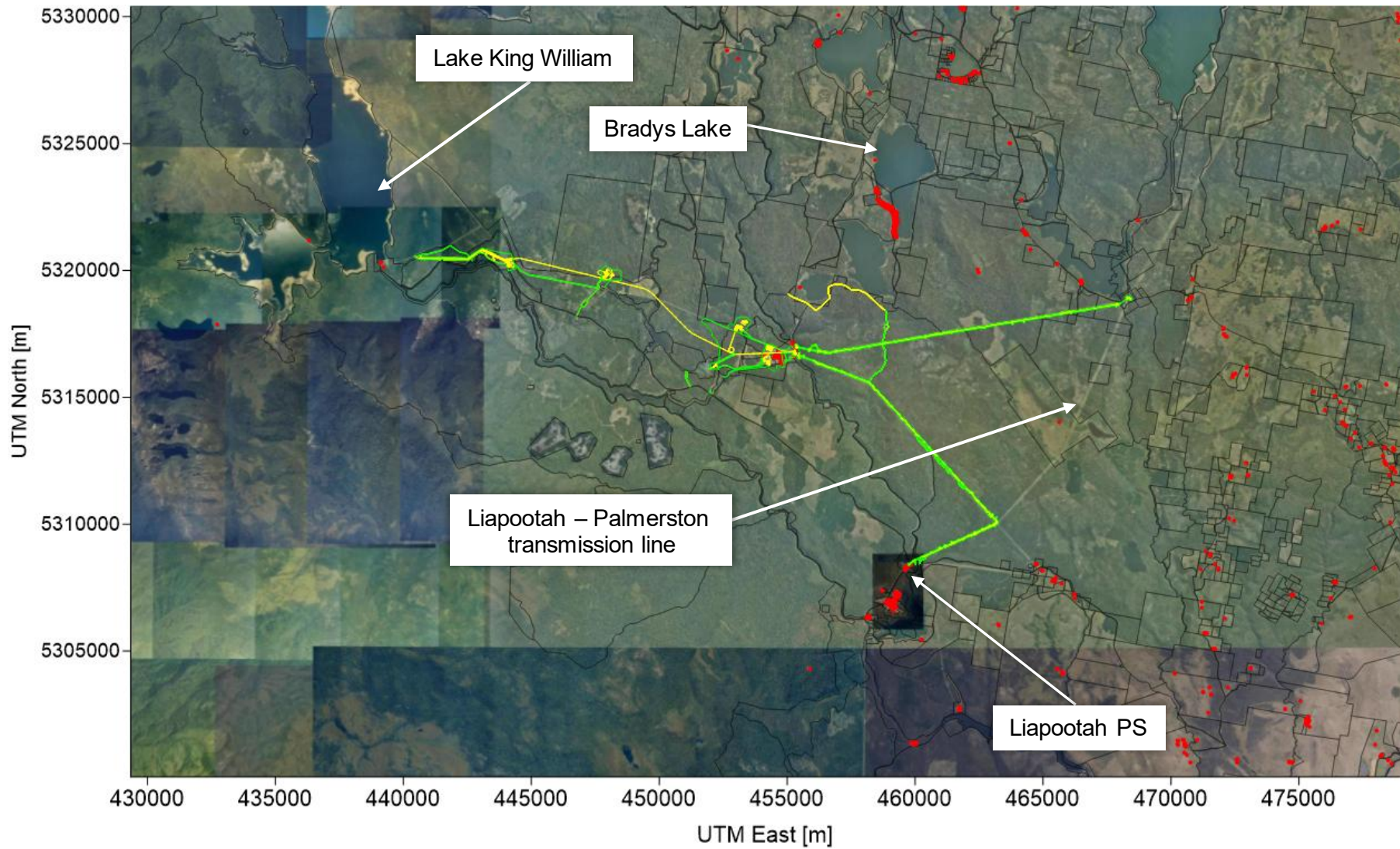


Figure 2-1: Aerial view of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.

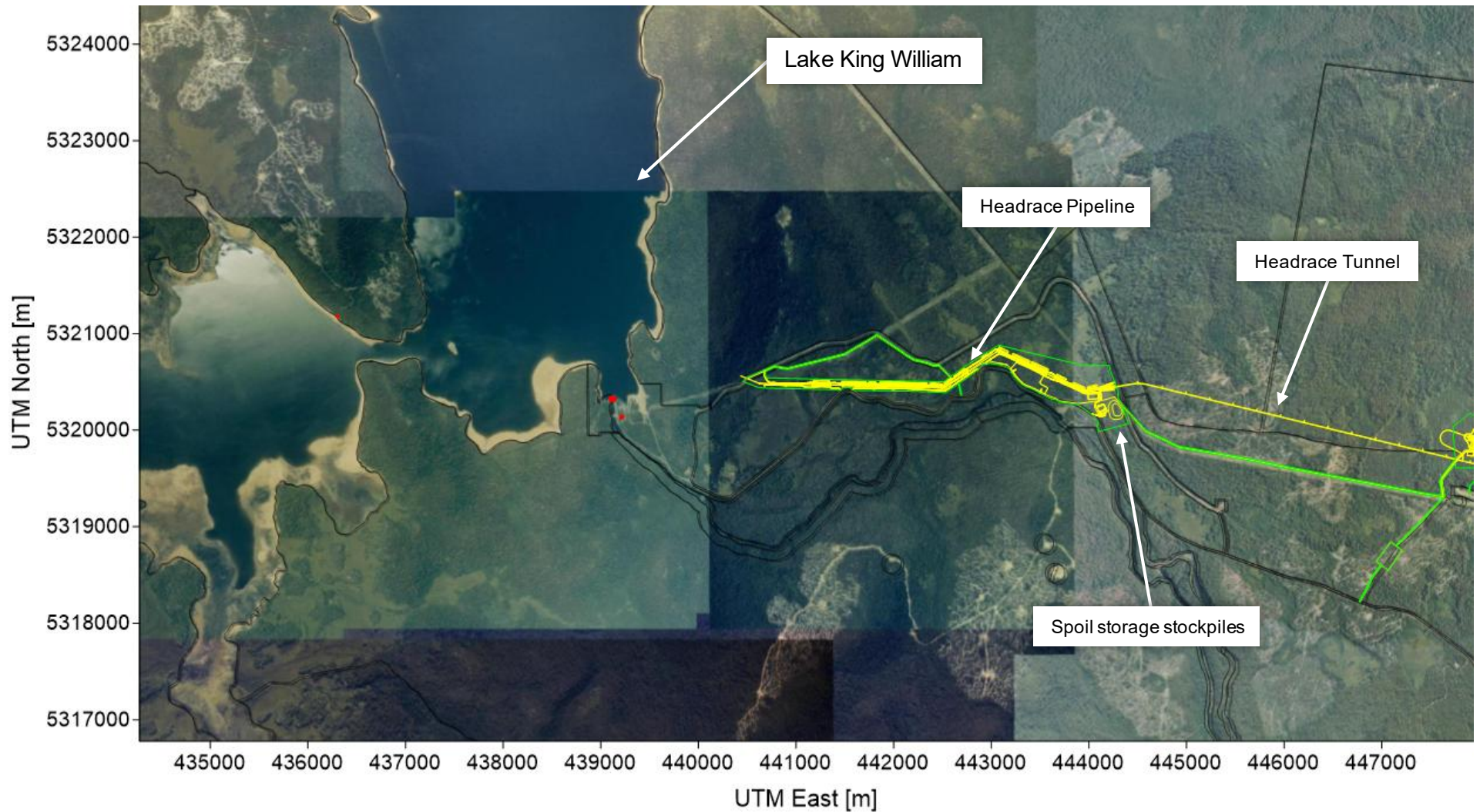


Figure 2-2: Aerial view of the western end of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.

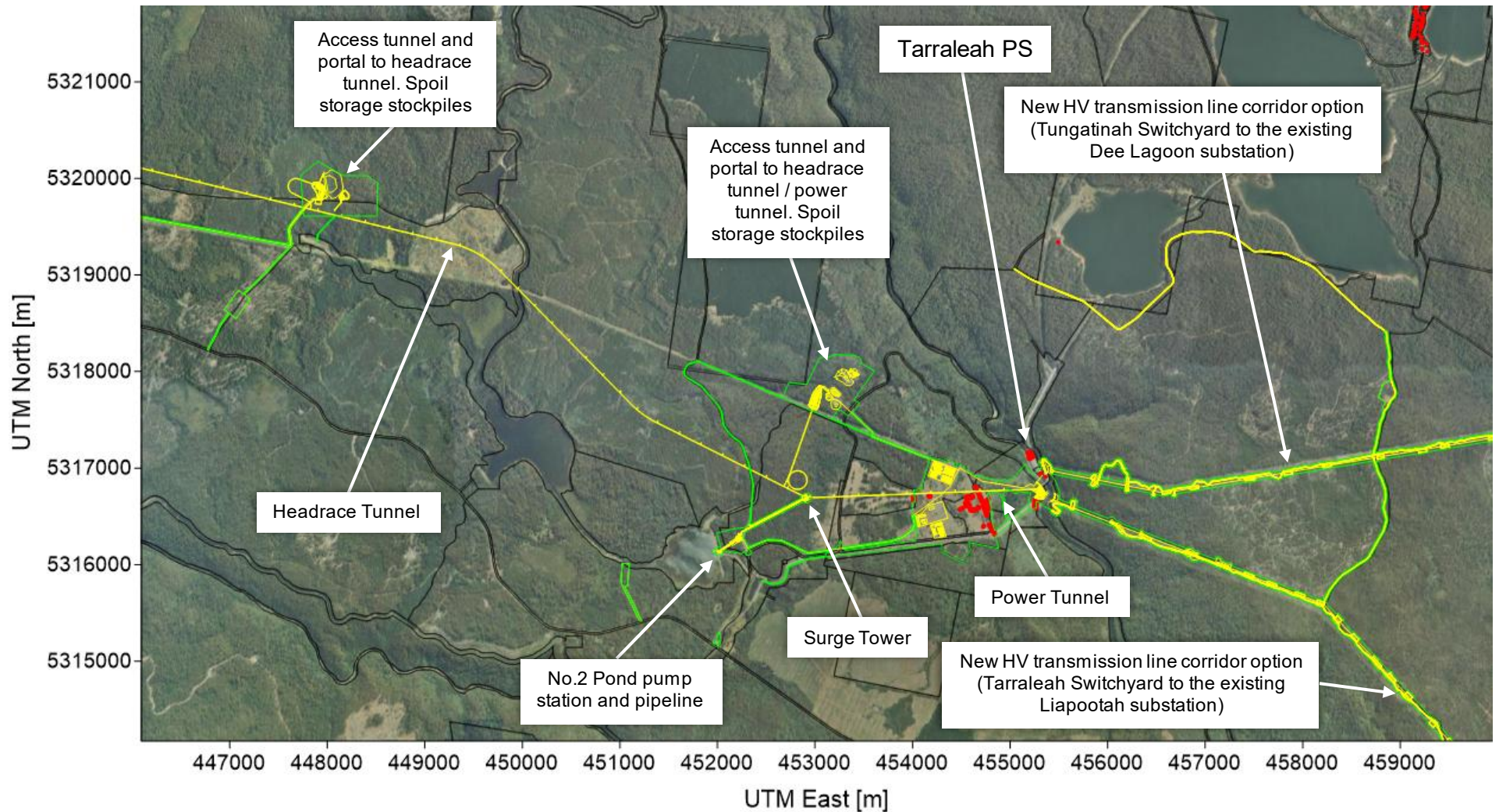


Figure 2-3: Aerial view of the central zone of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.

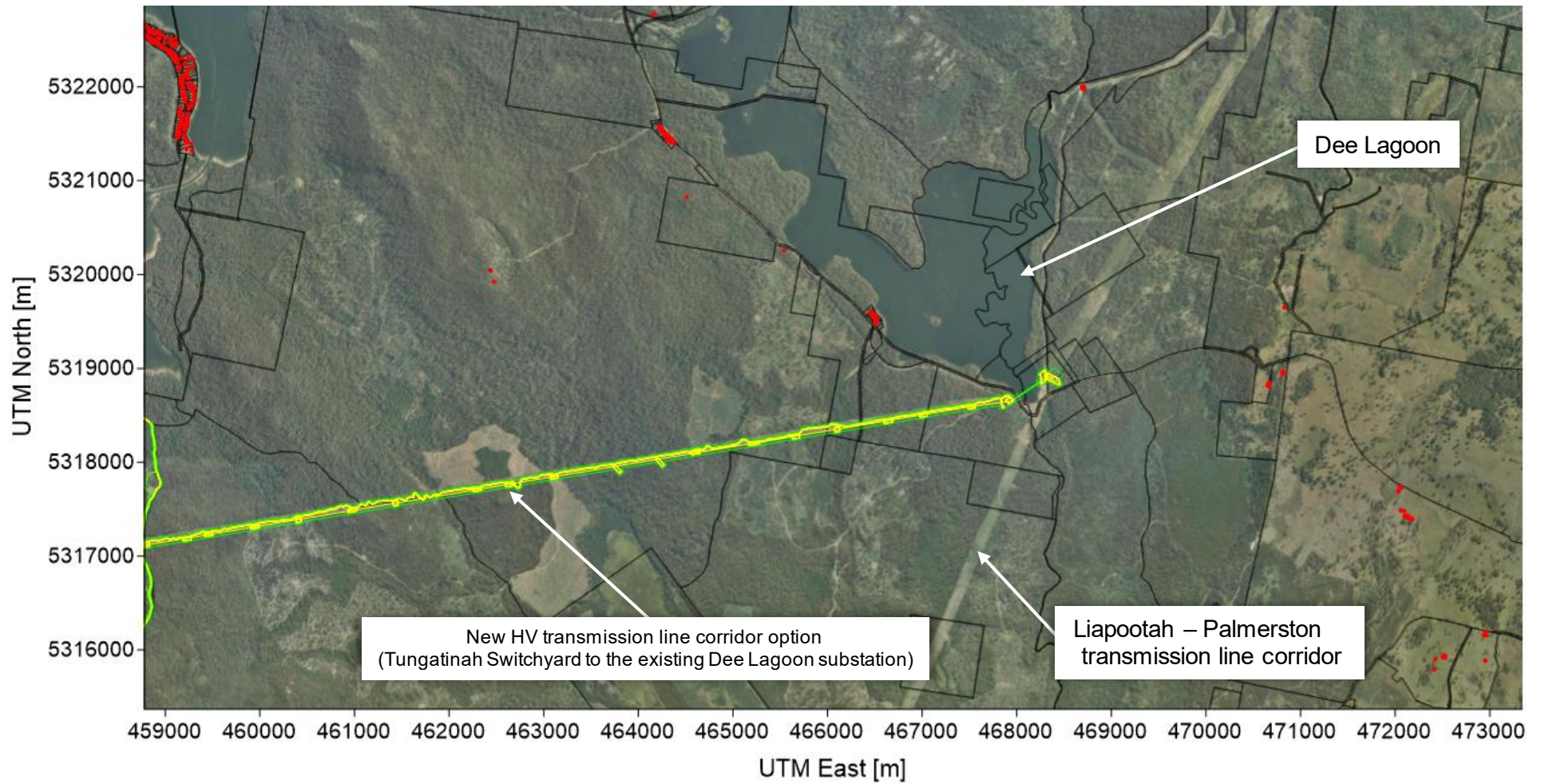


Figure 2-4: Aerial view of the eastern end of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.

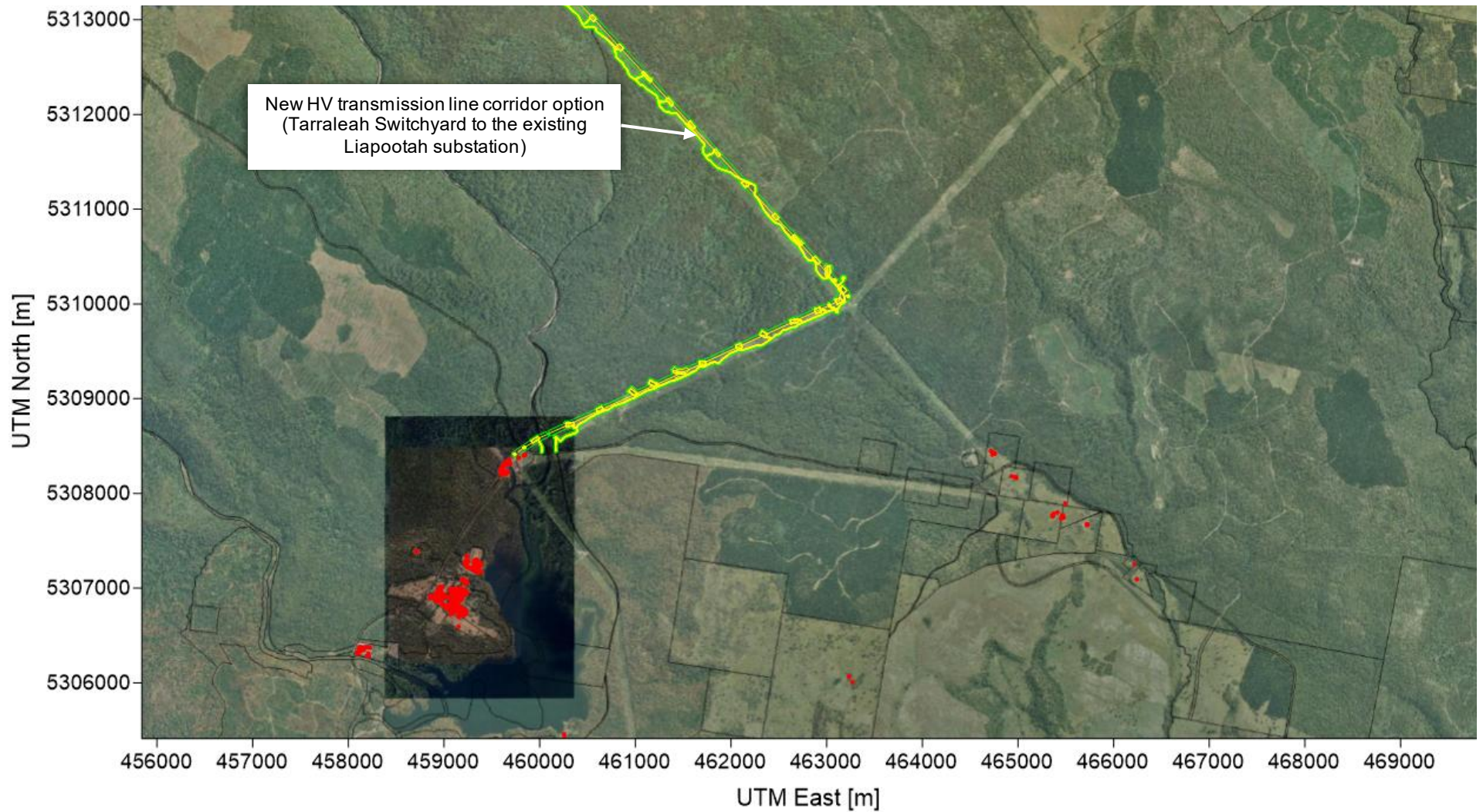


Figure 2-5: Aerial view of the south-eastern end of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds.

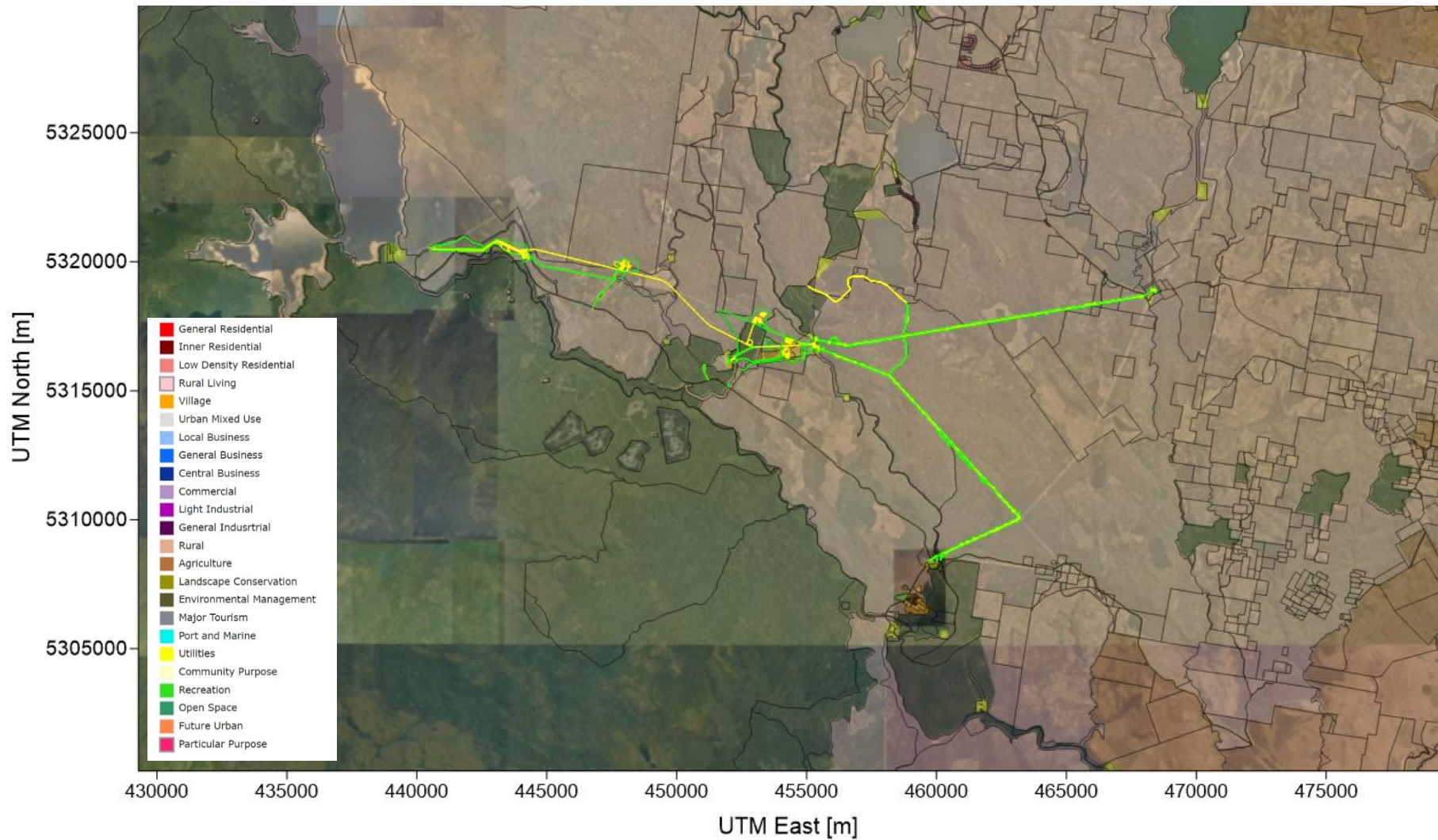


Figure 2-6: Aerial view of the project area showing project infrastructure (in yellow), disturbance area (in green) and surrounds with TPS zone overlay.



From the above:

- The western half of the project area (encompassing the headrace pipeline, headrace tunnel, surge tower, power pipeline and new power station) is well isolated from sensitive uses. The closest sensitive residential uses are located at Bradys Lake, approx. 6.5 km north-east of the Tarraleah PS.
- The new HV transmission line options are closer to sensitive uses but still have a significant buffer:
 - Approx. 3.8 km from residences at Bradys Lake.
 - Approx. 900 m from residences at Dee, on the western side of Dee Lagoon.
 - At distances greater than 1.6 km from scattered rural residences to the east of the Liapootah – Palmerston transmission line corridor.
 - Approx. 2.3 km from scattered residences south-east of the Liapootah – Palmerston transmission line corridor
 - Approx. 1.2 km to sensitive uses (i.e. caravan park) south-west of the Liapootah HV substation.
- The project area encompasses land zoned Rural (the majority), Utilities, Village (on land owned by Hydro Tasmania) and Environmental Management. Surrounding areas to the north, east and south-east are zoned Rural while to the south of the project and south of the River Derwent the land is zoned Environmental Management.

3 Air emission sources

Potential sources of particulate air emission to the atmosphere from the MPP Tarraleah Redevelopment Project are detailed below:

- Vegetation removal: This has the potential to entrain particulate materials into the atmosphere as root systems are disturbed, and surfaces are exposed.
- Wind erosion: Where significant areas of exposed surfaces are present during earthworks wind action can entrain particulates, particularly under high wind speeds.
- Vehicle movements: This has the potential to entrain particulate materials from unsealed surfaces into the atmosphere as a result of tyre / surface interaction. Uncovered loads in material transport trucks can also be a source particulate emission along with diesel vehicle engine emissions.
- Extraction and loading of materials: The action of extracting (i.e. digging) and transferring materials to transport trucks has the potential to eject particulate matter into the air.
- Blasting (for tunnel construction): Post blast a plume of particulate matter and gases from incomplete reactions, in particular NO with NO₂ formation, is emitted to the atmosphere Attalla *et al.* (2008)^[1]. This would occur from portal openings.
- Crushing and screening: This has the potential to entrain particles into the atmosphere through crusher material interactions, screen action and materials dropping from conveyors.
- Material stockpiles: There is potential for any unconsolidated material present to be entrained by wind, particularly under high wind speeds.
- Concrete batching: located at portal locations (western, mid access, and/or Paddy's Quarry portals) and the main workshop area at Tarraleah Village. Particulates from cement dust, aggregate and sand. Point sources associated dust collectors and fugitive sources include the transfer of materials, and wind erosion from sand and storage areas.



4 Existing air quality and meteorology

4.1 Air quality

The Tasmanian EPA provides indicative particle concentration data from its network of air quality monitoring stations. Known as BLANKET, the nearest stations to the project area is at Gretna approx. 50 km to the south-east.

Figure 4-1 presents an aerial view with the location of the project area and the Gretna BLANKET station marked. Figure 4-2 presents an annual plot of indicative PM₁₀ and PM_{2.5} 24-hr average concentrations for the 2024 year at the Gretna BLANKET station.

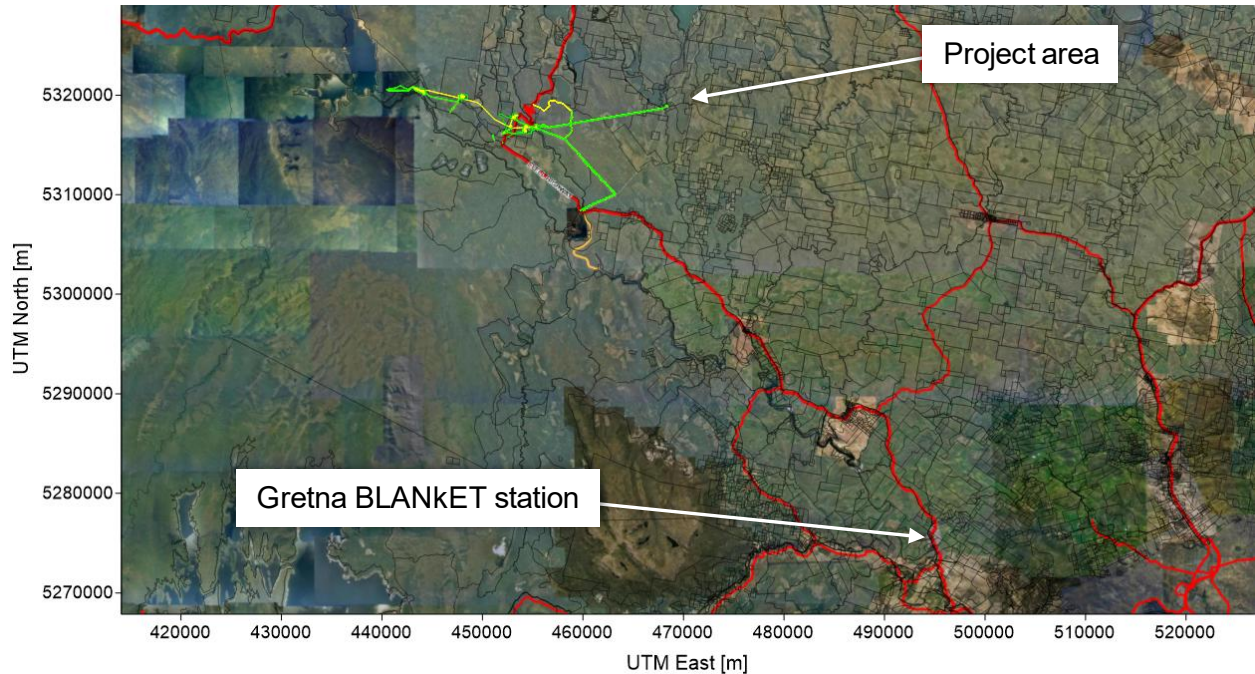


Figure 4-1: Aerial view showing the location of the Gretna BLANKET station and the project area.

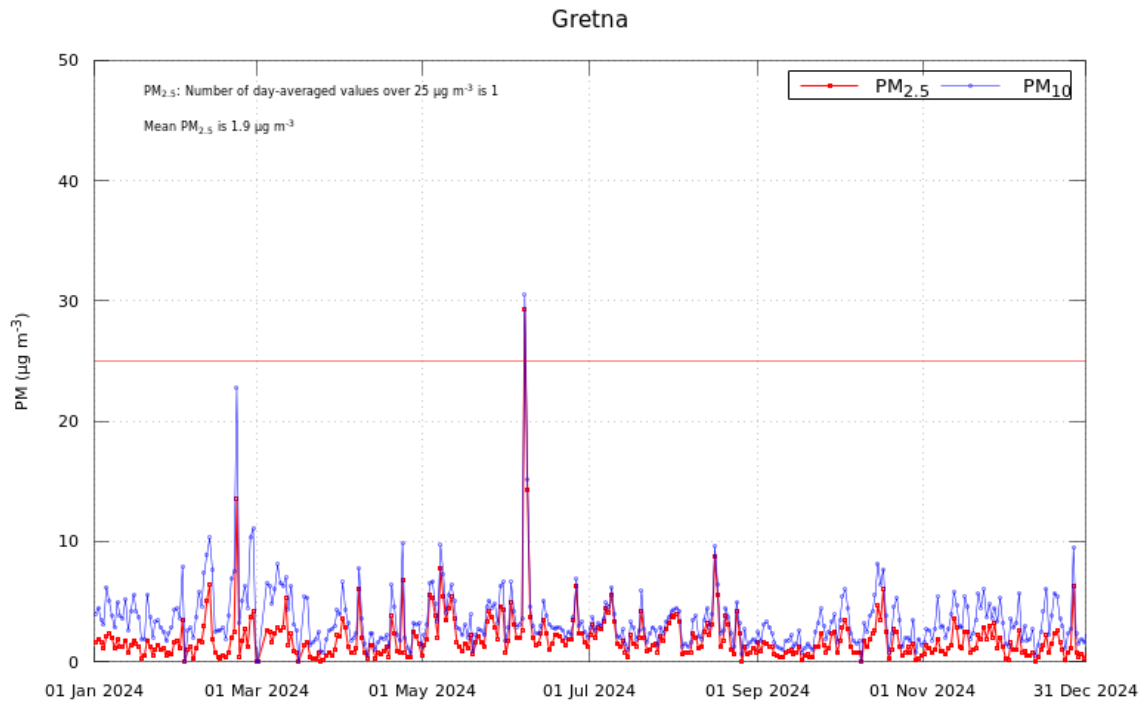


Figure 4-2: 2024 annual plot of 24 Hr average PM₁₀ and PM_{2.5} concentrations at the Gretna BLANKET station.

The indicative concentrations presented are generally low, indicating that the local air shed isn't overloaded with particulate matter. During Late Autumn and particularly in Winter elevated levels are present at times, likely the result of local wood heater usage. Care should be taken in interpreting these results as the station is located a significant distance from the MPP Tarraleah Redevelopment Project and near to a population area where wood fired heater emissions may be a more significant component of local particle concentrations than in the areas surrounding the project.

4.2 Meteorology

NB: Please note the use of letter designations for wind directions in the following subsections.

The nearest representative Bureau of Meteorology (BoM) weather station is located at Butlers Gorge (Station number 094029) at the western end of the Project Area.

Figure 4-3 provides an aerial view showing the location of the Butlers Gorge BoM station and the project area.

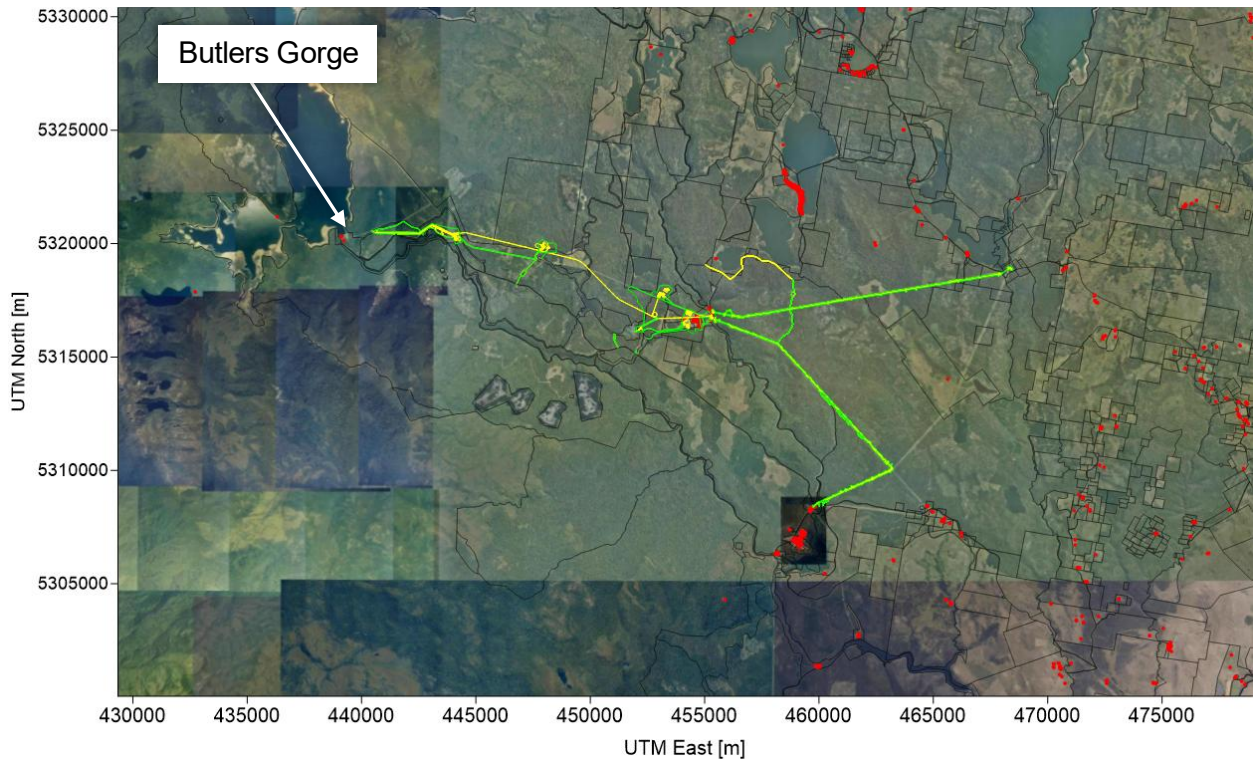


Figure 4-3: Aerial view showing the location of Butlers Gorge BoM station and the project area.

Long term weather data was obtained from the BoM weather station at Butlers Gorge (1941 – present) and presented in Table 4-1. The mean temperature range is between - 1 and 20 °C with the coldest month being July and the hottest months being January and February. The rainfall is generally high in the region, highest in Winter and lowest in late Summer. The mean annual rainfall is approx. 1671 mm.

Climate stats – BUTLERS GORGE									
Month	Mean temp (°C)		Rainfall (mm)	9 a.m. conditions			3 p.m. conditions		
	Max.	Min.		Temp (°C)	RH (%)	Wind speed (km/h)	Temp (°C)	RH (%)	Wind speed (km/h)
Jan	19.1	6.5	92.1	10.4	-	9.3	16.9	56	14.6
Feb	18.9	6.2	79.5	10.0	-	7.4	17.5	62	13.1
Mar	16.6	5.2	100.5	8.8	-	7.7	15.3	64	13.5
Apr	13.1	3.5	138.3	6.9	-	8.2	11.8	69	12.5
May	10.0	1.8	161.1	4.6	-	7.7	8.9	77	10.6
Jun	7.8	0.3	150.7	2.6	-	6.9	6.8	80	9.7
Jul	7.2	-0.3	176.5	2.0	-	6.3	5.9	80	10.0
Aug	8.0	0.1	185.1	2.7	-	6.9	6.9	75	11.6
Sep	10.2	1.1	168.5	4.6	-	8.8	8.6	67	12.7
Oct	12.6	2.4	159.0	6.8	-	10.0	11.2	66	14.8
Nov	14.8	4.0	135.3	8.0	-	10.1	13.1	63	15.2
Dec	16.9	5.5	123.3	9.5	-	9.5	14.9	59	13.8
Annual	12.9	3.0	1670.5	6.4	-	8.2	11.5	68	12.7

Table 4-1: Long term climate statistics, BoM weather station BUTLERS GORGE: 096003.



Figure 4-4 presents average 9 am and 3 pm wind roses for Butlers Gorge from the BoM weather station.

The 9 am BoM wind rose shows strong W and NW wind signals and a significant percentage of calm winds.

The 3 pm BoM wind rose shows generally stronger 3 pm winds than those at 9 am. Again the W and NW signals are significant while calm winds are rare.

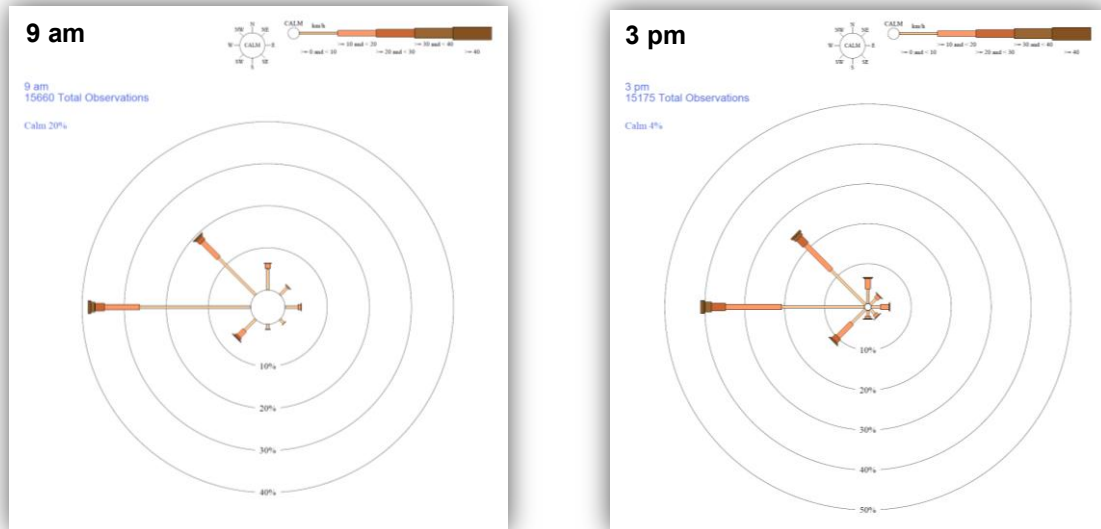


Figure 4-4: 9 am and 3 pm wind roses for Butlers Gorge.

Figure 4-5 presents annual and seasonal wind roses for the Butlers Gorge BoM station from data obtained through American National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Database.

The NW and W wind signals are evident in the plots along with a significant SW component. The significance of these wind sectors is lessened in the winter when wind speeds are generally lower while calm wind conditions makeup approx. 15 - 20 % of recorded winds in all seasonal periods.

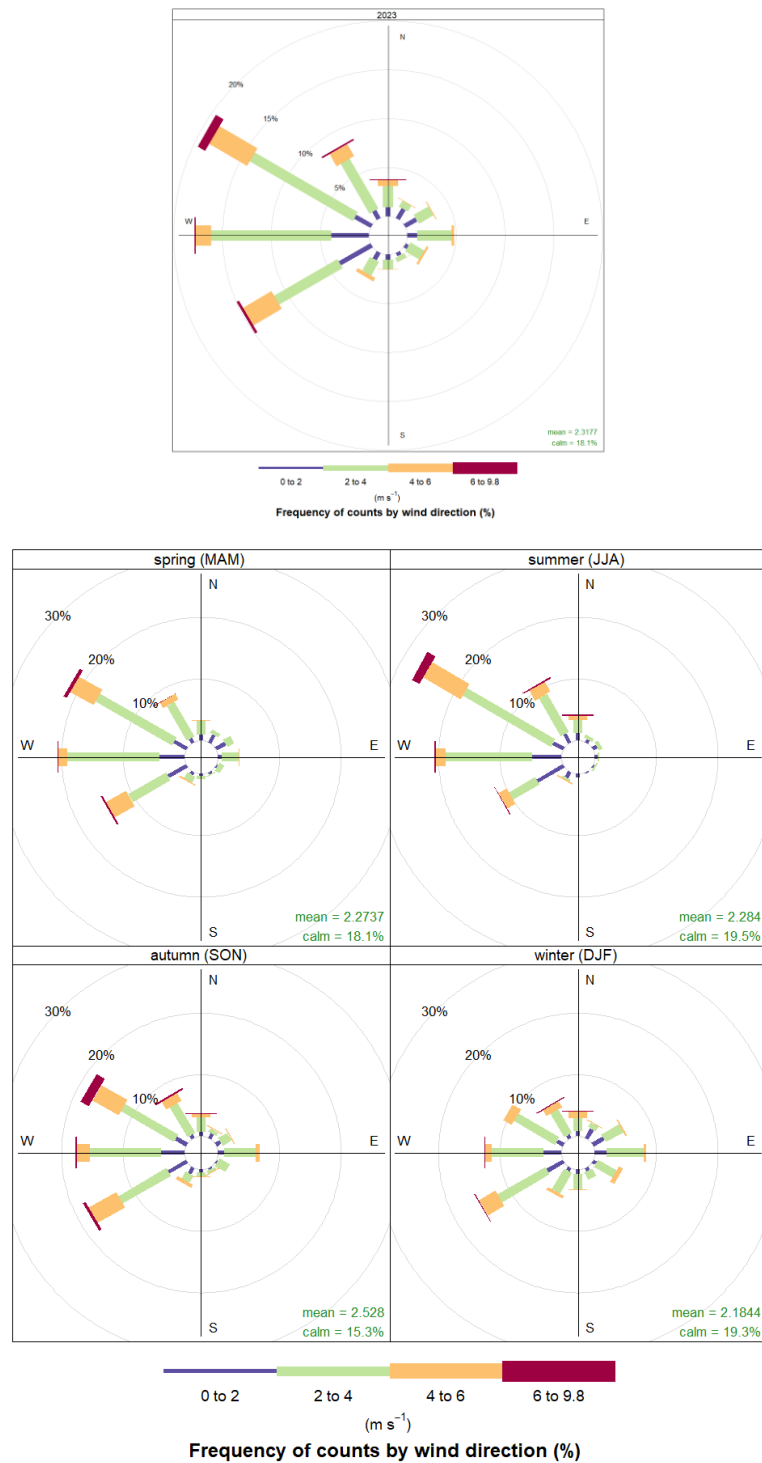


Figure 4-5: Annual and seasonal wind roses for Butlers Gorge.

The above indicates that the Summer months under higher temperatures and lower rainfall are the highest risk with regard to particulate emission generation (noting that rainfall is high across the year relative to low land areas further east) while afternoon winds are typically stronger.



5 Discussion and conclusions

From the information provided above the risk of particulate air emissions from the MPP Tarraleah Redevelopment Project prejudicing environmental values is very low given the following:

Location

- A significant buffer of Rural zoned land exists between the project disturbance footprint and residential land uses. Works associated with the new HV line transmission line are the highest risk (relative to other working areas of the project) with this area of the project closest to residences.

NO₂ emissions from blasting would likely dissipate to ambient concentrations within 5 km of any blasting (Attalla *et al.* 2008) and sufficient buffer exists between tunnel portal locations and any residential locations. Public roads, including the Lyell Highway, pass near to some portal locations and some risk of exposure to post blast gas plumes exists. As such management of exposure risk may be required.

Batching plant locations are sufficiently isolated from residential locations such that particulate emissions wouldn't impact residences. It is expected that batching plant emission concentration would be at or below ambient levels within 3 km of plant locations (based on screening predictions with emission estimation from NPI data^[3]).

Ambient conditions

- Existing particulate levels in the area are generally low but can be elevated during winter due to wood heater use (in and around residential locations). Generally these elevated periods would occur under stable low wind conditions when particulate emissions are unlikely to be significant from the Project.

Meteorology

- Rainfall in the area is relatively high and calm wind conditions are not uncommon. The highest risk is during the Summer (relative to the other seasons) when temperatures are highest, winds, particularly in the afternoon, are strongest and rainfall is lowest.

5.1 Recommendations

A dust management plan should be prepared prior to the commencement of the project. This should set out detailed dust management measures, responsibilities, key personnel, adaptive management and community engagement. Management measures that could be considered include the following:

- Minimise exposed surfaces through construction planning and progressive rehabilitation (e.g. hydromulching or surface matting to bind surfaces and subsequent revegetation).
- Watering of haul routes at a minimum rate of National Pollution Inventory (NPI) Level 1 (2 litres/m²/h)^[2] under hot, dry, windy conditions through Summer.
- Locating stockpiles in wind protected areas and either covering or using water sprays to control dust generation.
- Provision of water sprays on crushing and screening equipment
- Provision of adequate water supply to maintain watering rates and provide water for spray systems.
- Minimise surface blasting under hot, dry, windy conditions.
- Covering of all haul loads.



Development of any blast management plan should incorporate the risk-based management approaches outlined in AEISG (2011)^[4] to manage the risk of NO₂ exposure from blast gases.