APPENDIX G

Air Quality Report

Prepared by:

MWA Engineers

AIR QUALITY ASSESSMENT

PROPOSED CHILDCARE CENTRE DEVELOPMENT

153-161 BEENLEIGH REDLAND BAY ROAD

CORNUBIA

Prepared for:
Development Holdings Pty Ltd
C/- Property Projects Australia

Prepared by:
MWA Environmental

4 April 2023

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Job Name: Cornubia

Job No: 23016
Original Date of Issue: 4 April 2023

DOCUMENT DETAILS

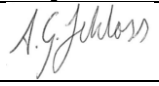
Title: Air Quality Assessment – Proposed Childcare Centre Development – 153-161 Beenleigh Redland Bay Road Cornubia

Principal Author: Mr Alex Schloss

Client: Development Holdings Pty Ltd
C/- Property Projects Australia

Client Contact: Mr Oliver Allbutt

REVISION/CHECKING HISTORY

Version Number	Date	Issued By		Checked By	
1 Report	29/03/2023	AS		BH	
2					
3					
4					
5					
6					

DISTRIBUTION RECORD

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Client (electronic)	1								
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1.0 INTRODUCTION

1.1 STUDY BRIEF

MWA Environmental has been engaged by Development Holdings Pty Ltd to undertake an Air Quality Assessment for a proposed childcare centre development at 153-161 Beenleigh Redland Bay Road, Cornubia.

To determine if air quality at the subject site is suitable for a childcare centre use, a detailed air quality assessment has been undertaken considering road traffic emissions from vehicles on Beenleigh Redland Bay Road adjoining the subject site and two service stations at the locality.

The proposed childcare centre is located within 40 metres of a BP service station to the west and 71 metres from a 7-eleven service station to the northeast. An assessment of emissions from the surrounding service stations has been undertaken to assess the predicted air pollutant and odour concentrations at the proposed childcare centre.

Assessment of predicted air pollutant concentrations has included representative regional ambient air quality data with the resultant cumulative concentrations assessed against the relevant *Logan Planning Scheme 2015* air emission standards and *Environmental Protection (Air) Policy 2019 air quality objectives.*

1.2 SITE DESCRIPTION

The subject site is located at 153-161 Beenleigh Redland Bay Road, Cornubia. The subject site has a real property description of Lot 12 on SP114352.

The site is zoned *Low Density Residential* under the *Logan Planning Scheme 2015*.

Surrounding land uses are described as follows:

To the North: Beenleigh Redland Bay Road, a state-controlled road consisting of two lanes in each direction. Residential dwellings and an Aged Care facility on land zoned *Low Density Residential* are located beyond.

To the East: Signalised intersection of Beenleigh Redland Bay Road, California Creek Road and Montessa Street. Recently constructed 7-eleven service station across the intersection to the northeast of the subject site.

To the South: Donald Street, with residential dwellings on land zoned *Low Density Residential* located beyond.

To the West: Residential dwellings on land zoned *Low Density Residential,* with a BP service station located beyond.

The locations of the subject site and surrounding land uses are shown on **Figure 1** and **Figure 2**.

1.3 PROPOSED DEVELOPMENT

The proposed development is for a 112-place childcare centre with associated outdoor play areas and carparking. The development provides a total of 31 carparking spaces on the southern part of the site. Access to the childcare centre is via Donald Street. Outdoor play area areas are proposed to the east and north of the childcare building.

The development plans are included as **Attachment 1**.

The minimum setback distance from the most exposed boundary of the subject site to the nearest through lane of the Beenleigh Redland Bay Road, is approximately 11.3 metres.

Conservative assumptions have been incorporated into the air quality assessment which will ensure predicted air pollutant concentrations at the proposed childcare development are likely to be an overestimate of air pollutant concentrations, particularly for the Year 2033 design horizon.

This assessment has investigated whether educational areas of the childcare centre are suitably setback from the Beenleigh Redland Bay Road and the surrounding service stations such that the relevant Logan City Plan 2015 air emission standards and *Environmental Protection (Air) Policy 2019 air quality objectives* are satisfied.

2.0 AMBIENT AIR QUALITY

The Queensland Government operates a network of ambient air quality monitoring stations across the state.

Key air pollutant emissions associated with motor vehicle exhaust emissions are Particulate Matter (as PM_{10} and $PM_{2.5}$), and oxides of Nitrogen. Benzene, Toluene and Xylene emissions are associated with service stations. Emissions of Benzene are present in both motor vehicle exhaust emissions and emissions from service stations.

A summary of the relevant ambient air quality statistics for inclusion in the dispersion modelling assessment as ambient concentrations is presented in **Table 1**.

Table 1: Ambient Air Pollutant Concentrations Applied to Assessment

Air Pollutant	Averaging Time	Concentration (µg/m³)	Reference
Particulate Matter PM_{10}	1-hour average	13.8	1-hour average 70th percentile over 5 years from 2017 to 2021 at Springwood
	24-hour average	13.4	24-hour average 70th percentile over 5 years from 2017 to 2021 at Springwood
	Annual Average	12.8	Average over 5 years from 2017 to 2021 at Springwood
Particulate Matter $PM_{2.5}$	1-hour average	6.2	1-hour average 70th percentile over 5 years from 2017 to 2021 at Springwood
	24-hour average	6.1	24-hour average 70th percentile over 5 years from 2017 to 2021 at Springwood
	Annual Average	5.5	Average over 5 years from 2017 to 2021 at Springwood
Nitrogen Dioxide	1-hour average	14.4	1-hour average 70th percentile over 5 years from 2017 to 2021 at Springwood
	Annual Average	11.5	Average over 5 years from 2017 to 2021 at Springwood
Benzene[1]	1-hour average	4.2	1-hour average 70th percentile over 5 years from 2016 to 2020 at Springwood
	Annual Average	3.6	Average over 5 years from 2016 to 2020 at Springwood
Toluene[1]	1-hour average	10.7	1-hour average 70th percentile over 5 years from 2016 to 2020 at Springwood
	24-hour average	10.5	24-hour average 70th percentile over 5 years from 2016 to 2020 at Springwood
	Annual Average	10.0	Average over 5 years from 2016 to 2020 at Springwood
Xylenes[1]	1-hour average	2.60	1-hour average 70th percentile over 5 years from 2016 to 2020 at Springwood
	24-hour average	2.56	24-hour average 70th percentile over 5 years from 2016 to 2020 at Springwood
	Annual Average	2.4	Average over 5 years from 2016 to 2020 at Springwood

[1] Benzene, Toluene and Xylene are no longer monitored at Springwood, therefore reference has been made to the previous 5-year period of monitoring data.

3.0 AIR QUALITY ASSESSMENT

3.1 ROAD TRAFFIC EMISSIONS ASSESSMENT

The subject site is located to the south of the state-controlled Beenleigh Redland Bay Road. The childcare centre development includes internal and outdoor educational spaces. A detailed air quality assessment has been undertaken to assess the potential for the proposed childcare centre to be exposed to air pollutant emissions associated with road traffic and the service station.

Detailed road traffic pollutant modelling has been undertaken using the CALPUFF dispersion model.

Emission factors have been referenced from the Brisbane City Council 'Composite Vehicle Emission Factors for Brisbane' dataset which is consider appropriate for this assessment. Emission factors have been derived for vehicles on the Beenleigh Redland Bay Road for the following selection of key pollutants:

- Nitrogen Oxides
- PM_{10}
- $PM_{2.5}$
- Benzene
- Benzo(a)pyrene

Existing and 10-year design horizon traffic volumes have been input to the road traffic dispersion model, with an assessment of predicted concentrations made against the relevant air emission standards at the most exposed internal and external education areas of the subject site.

3.1.1 TRAFFIC VOLUME DATA

Beenleigh Redland Bay Road is a four-lane state-controlled road with traffic travelling two lanes in each direction to the north of the subject site.

A Queensland Government operated Traffic Analysis and Reporting System (TARS) permanent vehicle count station is located approximately 300m to the northwest of the subject site on Beenleigh Redland Bay Road. The station (136337) records bi-directional hourly traffic volumes on the Beenleigh Redland Bay Road.

Traffic data has been sourced from traffic census accessible from http://data.qld.gov.au for the Years 2018 to 2021 with supplementary traffic census was also provided in email correspondence by TMR Traffic Engineering for a limited survey period in Year 2022.

Review of the AADTs and growth rates identifies some variability in traffic volumes in recent years with minor decrease in traffic volumes in the Year 2020 volumes and slightly higher volumes in Year 2021.

For the purposes of estimating 10-year design horizon traffic volumes, the long term growth rate from Year 2018 to Year 2022 has been considered, which is equivalent to a 2% per annum growth rate. Due to the recent variability in traffic volumes past the subject site, conservatively a 3% growth rate per annum has been applied.

Provided in **Table 2** is a summary of the AADT and projected traffic volumes past the subject site.

Table 2: Estimated Traffic Volumes

Year	Calendar Year	AADT Volumes	Source
-	2018	40,616	TMR Census
-	2019	40,517	TMR Census
-	2020	38,118	TMR Census
-	2021	44,412	TMR Census
-	2022	45,744	Projected
Current	**2023**	47,117	Projected
Year 1	2024	48,530	Projected
Year 2	2025	49,986	Projected
Year 3	2026	51,486	Projected
Year 4	2027	53,030	Projected
Year 5	2028	54,621	Projected
Year 6	2029	56,260	Projected
Year 7	2030	57,948	Projected
Year 8	2031	59,686	Projected
Year 9	2032	61,477	Projected
Year 10	**2033**	63,321	Projected

The 10-year design horizon traffic volume for the Year 2033 has been assessed at 63,321 vehicles per day.

Review of the supplied traffic data has identified commercial vehicles consisting of approximately 9% of traffic volumes in the locality, which has been applied to the emissions inventory.

Reference has been made to the data source “qld-traffic-data-average-by-hour-by-day-2021.csv” accessible from http://data.qld.gov.au to derive the distribution of hourly traffic volumes on Beenleigh Redland Bay Road past the subject site.

The modelled traffic volumes for the Beenleigh Redland Bay Road are summarised in **Table 3**.

Table 3: **Existing and Design Horizon Traffic Volumes Used for Assessment**

Road Segment	Existing and Ultimate Traffic	
	Year 2023	Year 2033
Against Gazettal	22,996	30,904
Gazettal	24,121	32,417
Combined Volumes	**47,117**	**63,321**

The hourly traffic volumes profiles over the day for the Beenleigh Redland Bay Road are summarised in **Attachment 2**.

3.1.2 EMISSION FACTORS

To provide assessment of resultant air quality at the subject site we have prepared an emissions inventory for key air pollutants based upon the 2016 Brisbane City Council 'Composite Vehicle Emission Factors for Brisbane' dataset with the following assumptions:

- Assessment of emissions for Year 2023 traffic volumes with interpolated Year 2023 vehicle fleet emission factors based upon the inventory data for Year 2010 and Year 2025;
- Assessment of emissions from Year 2033 traffic volumes with Year 2025 vehicle fleet emission factors, which is conservative as fleet emission factors reduce over time;
- Seasonally varying emissions factors input to the assessment; and
- Assumption of the 'Congested' category traffic conditions for periods of congestion from 7am to 9am Against Gazettal (Westbound) and 3pm to 6pm Gazettal (Eastbound).
- Assumption of 'Urban' category traffic conditions for remaining periods of the day.

3.2 SERVICE STATION EMISSIONS ASSESSMENT

The proposed childcare centre is also located within 40 metres of a BP service station to the west and 71 metres from a 7-eleven service station to the northeast. AO2 of the Childcare Centre Code provides the following Acceptable Outcome:

> **AO2**
> *A Childcare centre is not located within 50 metres of an existing or approved Service station.*

As the Acceptable Outcome cannot be achieved, assessment against the following Performance Outcome PO2 has been undertaken:

> **PO2**
> *A Childcare centre is located and designed to ensure occupants are not exposed to amenity or safety impact from a nearby Service station.*

A detailed air quality assessment has been undertaken to assess the potential for the proposed childcare centre to be exposed to air pollutant emissions associated with the nearby service stations.

An inspection of the service stations surrounding the subject site was undertaken in February 2023 to determine the location of emission sources and controls present.

BP Service Station

- 4 x Double sided Bowsers
- Stage 1 Vapour Recovery Controls present
- Underground storage tank vent pipes located near the centre of the northern boundary

7-Eleven Service Station

- 4 x Double sided Bowsers
- Stage 1 Vapour Recovery Controls present
- Stage 2 Vapour Recovery Controls present on motor spirit (no diesel) nozzles
- Underground storage tank vent pipes located near the southwest corner

The above information has been considered when estimating emissions for each of the service stations.

A conservative estimate of annual fuel sales volume has been undertaken for the purposes of this assessment. Fuel sales for each service station have been conservatively assessed at 10 million litres per annum of total ‘motor spirit’ sales.

‘Motor spirit’ fuels, including unleaded and ethanol blends, have a significantly higher vapour pressure and lower boiling point than diesel, with ‘motor spirit’ fuels more readily evaporating from a liquid state to gaseous state. Emissions associated with diesel are minor in comparison to motor spirit related emissions.

3.2.1 DESCRIPTION OF SERVICE STATION EMISSIONS

Air pollutant emissions from service stations are predominantly Volatile Organic Compounds (VOCs) released during the following processes:

- Fuel Delivery **Loading** of Underground Tanks
- Underground Storage Tank **Breathing**
- Fugitive Emissions from **Refuelling** of vehicles
- Fugitive Emissions from **Spillages**

For the purposes of estimating representative air pollutant and odour emission rates reference has been made to:

(a) **Published emission factors** in the NPI Manual[2], for the estimation of Total VOC and speciated individual contaminant emissions, and

(b) **Mass balance analysis**, for the estimation of odour emissions based upon NPI Manual Total VOC emission factors with reference to the unleaded fuel odour detection threshold[3]

Air pollutant emission rates of individual contaminants have been determined from the NPI Manual Total VOC emission factors (Table 2) with speciation based upon typical unleaded composition (Table 3).

'Whoosh' emissions released by vehicles prior to refuelling, have been estimated based upon California Air Pollution Control Officers Association (CAPCOA) – Air Toxics "Hot Spots" Program - Gasoline Service Station Industrywide Risk Assessment Guidelines.

Calculated odour emissions are based upon predicted Total VOC concentrations and an odour detection threshold of 1,888 µg Total VOC/m^3 as determined from an investigation commissioned by MWA Environmental in April 2015.

MWA commissioned Air Noise Environment to take duplicate samples of fugitive emissions from an unleaded petrol can in April 2015. The samples were analysed for Total VOC concentration and for odour (by olfactometry) by The Odour Unit. The results of the analysis allow for calculation of the odour detection threshold and thus correlation between predicted Total VOC concentrations and Odour Units. As a conservative assumption, the lower measured odour detection threshold of 1,888 µg/m^3 Total VOC has been applied for the purposes of assessing odour concentrations from Total VOC modelling results.

[2] *Emissions Estimation Techniques Manual for Aggregated Emissions from Service Stations* (Environment Australia, 1999)

[3] Based upon Air Noise Environment and The Odour Unit testing commissioned by MWA Environmental in April 2015

The following assumptions have been made for the purpose of estimating air pollutant emissions from the nearby service stations:

- 24-hour operation of the service stations
- Delivery of fuel to underground storage tanks conservatively undertaken by 54,500 litre tankers.
- Several bulk tanker fuel deliveries per week[4] as required which may occur at any time of day as triggered by automated tank level monitors but more typically during the daytime and evening periods.
- Bulk refuelling conservatively represented as occurring for 1 hour of every day of the year with delivery hour delayed by one hour each day (i.e. 1 January bulk refuelling from Midnight to 1am, 2 January bulk refuelling from 1am to 2am, 3 January bulk refuelling from 2am to 3am, etc.). This methodology provides a representation of bulk refuelling events and also considers the different periods of the day when these events may occur.
- Conservative estimate of 10 million litres per annum 'motor spirit' sales from each service station.
- Estimated peak daily 'motor spirit' sales of 21,370 litres which relates to 30 percent higher than the average daily fuel sales.
- Hourly emissions distributed based upon a daily sales profile as distributed per Brisbane City Council guidance[5] for the assessment of service station developments.
- Stage 1 ("VR1") vapour recovery system for each service station.
- Stage 2 ("VR2") vapour recovery system applied to the newer 7-Eleven service station.
- 'Whoosh' emissions based upon the 'upper limit' emission factor specified by CAPCOA.

The emission rate calculations have considered the maximum 1% volume national Benzene regulation that came into effect on 1 January 2006. The previous Queensland regulation was for a maximum of 3.5% Benzene in petrol. Thus, the current national regulation has resulted in a significant reduction in Benzene emissions from service stations in Queensland.

Detailed emission estimation calculations are included as **Attachment 3**.

[4] Fewer than one per day based upon tanker capacity and estimated annual fuel sales
[5] Applied in lieu of specific guidance from Logan City Council

3.3 RELEVANT AIR QUALITY OBJECTIVES

Presented in **Table 4** are the key air emission standards and air quality objectives relevant to the assessment of potential air pollutant impacts from vehicle exhaust and service station emissions.

Table 4: Adopted Air Quality Objectives

Pollutant	Averaging Period	Air Quality Objective (µg/m^3)	Environmental Value	Reference	Relevant to Emission Source Type
Benzene	3-minute	53	Design ground level concentrations at and beyond the premises boundary	Logan Planning Scheme 2015	Road traffic & service station emissions
	Annual	5.4	Health and wellbeing	EPP (Air) 2019	
Benzo(a)pyrene	Annual	0.0003	Health and wellbeing	EPP (Air) 2019	Road traffic emissions
Nitrogen Dioxide	1-hour	190	Design ground level concentrations at and beyond the premises boundary	Logan Planning Scheme 2015	Road traffic emissions
	Annual	62	Health and wellbeing	EPP (Air) 2019	
PM_{10}	1-hour	80	Design ground level concentrations at and beyond the premises boundary	Logan Planning Scheme 2015	Road traffic emissions
	24-hour	50	Health and wellbeing	LPS 2015 & EPP (Air) 2019	
	Annual	25	Health and wellbeing	EPP (Air) 2019	
$PM_{2.5}$	1-hour	50	Design ground level concentrations at and beyond the premises boundary	Logan Planning Scheme 2015	Road traffic emissions
	24-hour	25	Health and wellbeing	LPS 2015 & EPP (Air) 2019	
	Annual	8	Health and wellbeing	EPP (Air) 2019	
Toluene	3-minute	650	Design ground level concentrations at and beyond the premises boundary	Logan Planning Scheme 2015	Service station emissions
	24-hour	4,100	Health and wellbeing	EPP (Air) 2019	
	Annual	400	Health and wellbeing	EPP (Air) 2019	
Xylenes	3-minute	350	Design ground level concentrations at and beyond the premises boundary	Logan Planning Scheme 2015	Service station emissions
	24-hour	1,200	Health and wellbeing	EPP (Air) 2019	
	Annual	950	Health and wellbeing	EPP (Air) 2019	
Odour	1-hour	2.5 odour unit	Criteria for an air emission sensitive use locating in proximity to an existing use that is likely to emit odour	Logan Planning Scheme 2015	Service station emissions
Styrene	30-minute	76	Protecting aesthetic environment	Logan Planning Scheme 2015	Service station emissions
	7-day	284	Health and wellbeing	EPP(Air)	

3.4 MODELLING METHODOLOGY

Detailed road traffic pollutant modelling has been undertaken using the CALPUFF dispersion model. The CALPUFF model has been used for various air quality assessments by MWA Environmental and other consultants in recent years for modelling motor vehicle emissions from roadways across South East Queensland and is considered appropriate for this assessment.

Emission factors were adopted in accordance with the Brisbane City Council *Composite Vehicle Emission Factors for Brisbane* (August 2016) dataset[6] developed in conjunction with the Department of Science, Information Technology and Innovation based upon the COPERT Australia inventory.

The *Composite Vehicle Emission Factors for Brisbane* dataset is applicable for use in local-scale air quality impact assessment studies and includes an additional conservative margin in the specification of emission factors.

The CALPUFF View Version graphical user interface software developed by Lakes Environmental has been used to configure the CALPUFF modelling.

A site-specific meteorological data file has been configured using TAPM / CALMET predictions for the subject site. Further description of the site-specific meteorological model is provided in **Section 3.4.2**.

The assessment has considered the following two scenarios:

- Assessment of emissions from Year 2023 traffic volumes with Year 2023 vehicle fleet emission factors; and
- Assessment of emissions from design horizon traffic volumes (Year 2033) with Year 2025 (conservative) vehicle fleet emission factors.

The model layout is included in **Attachment 4**.

The road traffic emission factors used in the assessment are summarised in **Attachment 5** for the Beenleigh Redland Bay Road.

Discrete receptors have been represented in 5 metre intervals along the boundaries of the proposed development.

Receptors have been represented at heights of 0, 0.5 and 1.5 metres above ground level. Previous experience dictates the highest exposure from road traffic air pollutants will be at ground level.

The modelled discrete receptor locations are shown on the model layout included as **Figure 3**.

A mesh of gridded receptors at 3-metre spacing were generated over the model domain covering the subject site and surrounding road links for the purpose of preparing contour plots.

6 Department of Science, Information Technology and Innovation, *Composite Motor Vehicle Emission Factors for Air Quality Modelling using COPERT Australia, Version 1*, Prepared for Brisbane City Council (**BCC**), Queensland Government, Brisbane, July 2016.

The ambient concentrations from the Queensland Government monitoring data included in **Table 1** have been added to the predicted concentrations output from the model.

3.4.1 NITROGEN OXIDES CONVERSION

Potential impacts at the proposed development relate to local scale dispersion. As such, relatively low NO_2 / NO_X ratios are expected due to short transport distances and times to receptor.

The Janssen7 relationship suggests that a NO_2 / NO_X ratio of:

- less than 5% within 500 metres of the source
- approximately 2.5% within 300 metres of the source
- Less than 15% within 2 km of the source

For the purposes of this assessment a conservative NO_X ratio of 15% has been applied.

3.4.2 METEOROLOGICAL MODELLING

Following accepted methodology for detailed assessment, the TAPM software was utilised to develop a prognostic meteorological model which generated a year of representative hourly meteorological data for the region.

TAPM has been used to predict meteorological parameters specific to the region including temperature, wind speed, wind direction and stability classification. The model accesses databases of surface characteristics (terrain height, soil and vegetation) and synoptic weather analyses provided by CSIRO to carry out these analyses. TAPM is able to process the output data to produce input meteorological data files suitable for input to the CALMET / CALPUFF modelling system i.e. hourly predictions of meteorological parameters over a full year and generation of surface, upper air and geophysical data files.

Technical discussion of the model algorithms, inputs and model validation studies are provided in the *Part 1: Technical Paper* (Hurley, 2002) and *Part 2: Summary of Verification Studies* (Hurley *et al*, 2002)[8,9].

7 Based upon Janssen, L.H.M., van Wakeren, J.H.A., van Dujuren, H. and Elsholt, A.J. (1988). A Classification of NO Oxidation in Power Plant Plumes based on Atmospheric Conditions. Atmospheric Environment. Vol 21 No 1 pp 43-53, 1988.

8 Hurley, P.J. (2002) The Air Pollution Model (TAPM) Version 2: User Manual. Aspendale: CSIRO Atmospheric Research Internal Paper.

9 Hurley, P.J. (2002) The Air Pollution Model (TAPM) Version 2: Part 1: Technical Description. Aspendale: CSIRO Atmospheric Research Technical Paper.

The centre coordinates for the model grid were Latitude -27°38'30" and Longitude 153°17'. The following nested model grids were applied to the TAPM modelling:

40 x 30 km grid (total area 1200 km x 1200 km)

40 x 10 km grid (total area 400 km x 400 km)

40 x 3 km grid (total area 120 km x 120 km)

40 x 1 km grid (total area 40 km x 40 km)

Twenty-five vertical grid levels were modelled.

The TAPM model was set up to generate a site-specific meteorological data file for the locality, based upon synoptic analysis data for the representative Year 2020, as provided by CSIRO.

An analysis of wind speeds and directions measured at the Bureau of Meteorology weather station at Redland (Alexandra Hills), 14.6 km north-northeast of the subject site was undertaken for the years 2016 to 2021. The Year 2020 was assessed as statistically the most representative of the meteorological conditions for this period of available data. Included in **Attachment 6** are wind roses comparing the distribution of wind speeds and directions at the BoM Redland monitoring station for the period 2016 to 2021.

Observed wind speeds and wind directions for the monitoring station at Redland were incorporated into the TAPM model as assimilation data.

The TAPM output was processed using the CALTAPM software to produce a 3-dimensional data file suitable for input to the diagnostic CALMET model as an 'initial guess field'. The CALMET model further resolved the prognostic meteorology to a finer terrain, land use and soil type resolution of 100 metres over a 5 x 5 km area covering the subject site and surrounding region for the purpose of dispersion modelling.

Analysis of the CALMET derived meteorology for the subject site including a wind rose, wind frequency graph, monthly average temperatures graph and stability class analysis are also contained in **Attachment 7**.

4.0 RESULTS OF DISPERSION MODELLING

Detailed CALPUFF dispersion modelling has been undertaken for Year 2023 and Year 2033 traffic volumes.

Presented in **Table 5** is a summary of the highest predicted concentrations at the most exposed boundary of the proposed childcare centre from emissions associated with road traffic (refer **Figure 4**).

The predicted concentrations include the ambient concentrations presented in **Table 1**.

Table 5: Predicted concentrations from Road Traffic Pollution Modelling

Air Pollutant	Averaging Period	Maximum Predicted Concentration at Most Exposed Childcare Centre Boundary Including Ambient (µg/m³)		Air Quality Objective (µg/m³)	Complies?
		Year 2023	Year 2033		
Benzo (a) pyrene	Annual	0.000037	0.000027	0.0003	Yes
Nitrogen Dioxide	1-hour	126.5	113.0	190	Yes
	Annual	17.0	15.6	62	Yes
PM_{10}	1-hour	74.1	79.5	80	Yes
	24-hour	23.3	24.6	50	Yes
	Annual	15.5	15.7	25	Yes
$PM_{2.5}$	1-hour	46.1	44.9	50	Yes
	24-hour	12.5	12.6	25	Yes
	Annual	7.3	7.2	8	Yes

Presented in **Table 6** is a summary of the highest predicted concentrations at the most exposed boundary of the proposed childcare centre from emissions associated from the service station.

Presented in **Table 7** is the predicted cumulative Benzene concentrations at the most exposed boundary of the proposed childcare centre from emissions from the service station, road traffic and ambient concentrations.

Table 6: Predicted concentrations from Service Station Modelling

Air Pollutant	Averaging Period	Maximum Predicted Concentration at Most Exposed Childcare Centre Boundary Including Ambient (µg/m³)	Air Quality Objective (µg/m³)	Complies?
Toluene	3-minute	154.4	650	Yes
	24-hour	21.0	4,100	Yes
	Annual	12.3	400	Yes
Xylenes	3-minute	60.2	350	Yes
	24-hour	6.8	1,200	Yes
	Annual	3.3	950	Yes
Odour	1-hour	1.75	2.5 odour units	Yes
Styrene	30-minute	0.17	76	Yes
	7-day	0.02	284	Yes

Table 7: Predicted concentrations from Cumulative Service Station and Road Traffic Modelling

Air Pollutant	Averaging Period	Maximum Predicted Concentration at Most Exposed Childcare Centre Boundary Including Ambient (µg/m³)		Air Quality Objective (µg/m³)	Complies?
		Year 2023	Year 2033		
Benzene	3-minute	20.7	20.5	53	Yes
	Annual	4.6	4.5	5.4	Yes

The results of the gridded receptor modelling for a selection of key pollutants are presented in **Attachment 8** as contours of predicted concentrations over an aerial photograph base. The plotted concentrations include the ambient concentrations specified in **Table 1**.

The modelling undertaken demonstrates that the relevant air emission standards and air quality objectives for key road traffic and service station pollutants will be satisfied at the proposed childcare centre for the Year 2023 and Year 2033 traffic volume scenarios with the addition of representative regional ambient concentrations. As noted, the modelling results for the Year 2033 scenario are highly conservative as these predictions do not account for the significant reduction in vehicle fleet emission factors that will be achieved between 2025 and 2033.

In summary, the assessment has determined that air quality at the proposed childcare development will comply with the *Logan City Plan 2015 air emission standards* and *Environmental Protection (Air) Policy 2019 air quality objectives.*

5.0 CONCLUSION

MWA Environmental has been engaged by Development Holdings Pty Ltd to undertake an Air Quality Assessment for a proposed childcare centre development at 153-161 Beenleigh Redland Bay Road, Cornubia.

To determine if air quality at the subject site is suitable for a childcare centre use, a detailed air quality assessment has been undertaken considering road traffic emissions from vehicles on Beenleigh Redland Bay Road adjoining the subject site and two service stations at the locality.

This assessment has investigated whether educational areas of the childcare centre are suitably setback from the Beenleigh Redland Bay Road and the nearby service station such that the relevant *Logan City Plan 2015 air emission standards* and *Environmental Protection (Air) Policy 2019 air quality objectives* are satisfied.

Detailed road traffic and service station pollution modelling has been undertaken with the CALPUFF dispersion model. The road traffic pollution modelling considered emissions from vehicles on the Beenleigh Redland Bay Road roads for Year 2023 and Year 2033 projected traffic volumes and has utilised conservative emission factors.

The modelling undertaken demonstrates that the relevant air emission standards and air quality objectives for key road traffic and service station pollutants will be satisfied at the proposed childcare centre for the Year 2023 and Year 2033 traffic volume scenarios with the addition of representative regional ambient concentrations. The Year 2033 scenario modelling results are highly conservative as these predictions do not account for the significant reduction in vehicle fleet emission factors that will be achieved between 2025 and 2033.

In summary, the assessment has determined that air quality at the proposed childcare development will comply with the *Logan City Plan 2015 air emission standards* and *Environmental Protection (Air) Policy 2019 air quality objectives.*

MWA Environmental
4 April 2023

FIGURES

LEGEND

SITE LOCATION

DRAWING REFERENCE

CLIENT

DEVELOPMENT HOLDINGS PTY LTD
C/- PROPERTY PROJECTS AUSTRALIA

PROJECT

AIR QUALITY ASSESSMENT

PROPOSED CHILDCARE CENTRE DEVELOPMENT

153-161 BEENLEIGH REDLAND BAY ROAD CORNUBIA QLD

TITLE

SITE LOCATION AND SURROUNDING LAND USES

JOB	CORNUBIA	FIGURE 1
JOB NO.	23016	
DATE	04/04/23	DWG NUMBER
SCALE	1:2500 (A4)	23016-1
REV.		

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W www.mwaenviro.com.au
ABN 94 010 833 084

LEGEND

SITE LOCATION

LOGAN PLANNING SCHEME 2015 ZONES

- LOW DENSITY RESIDENTIAL
- RURAL RESIDENTIAL
- ENVIRONMENTAL MANAGEMENT AND CONSERVATION

DRAWING REFERENCE

LOGAN CITY COUNCIL PLANNING SCHEME 2015, INTERACTIVE MAPPING, ZONING MAP.

N

0 20 40 60 80m

CLIENT

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C/- PROPERTY PROJECTS AUSTRALIA

PROJECT

AIR QUALITY ASSESSMENT

PROPOSED CHILDCARE CENTRE DEVELOPMENT
153-161 BEENLEIGH REDLAND BAY ROAD CORNUBIA QLD

TITLE

ZONING MAP

JOB	CORNUBIA	**FIGURE 2**
JOB NO.	23016	
DATE	04/04/23	DWG NUMBER
SCALE	1:2500 (A4)	**23016-2**
REV.		

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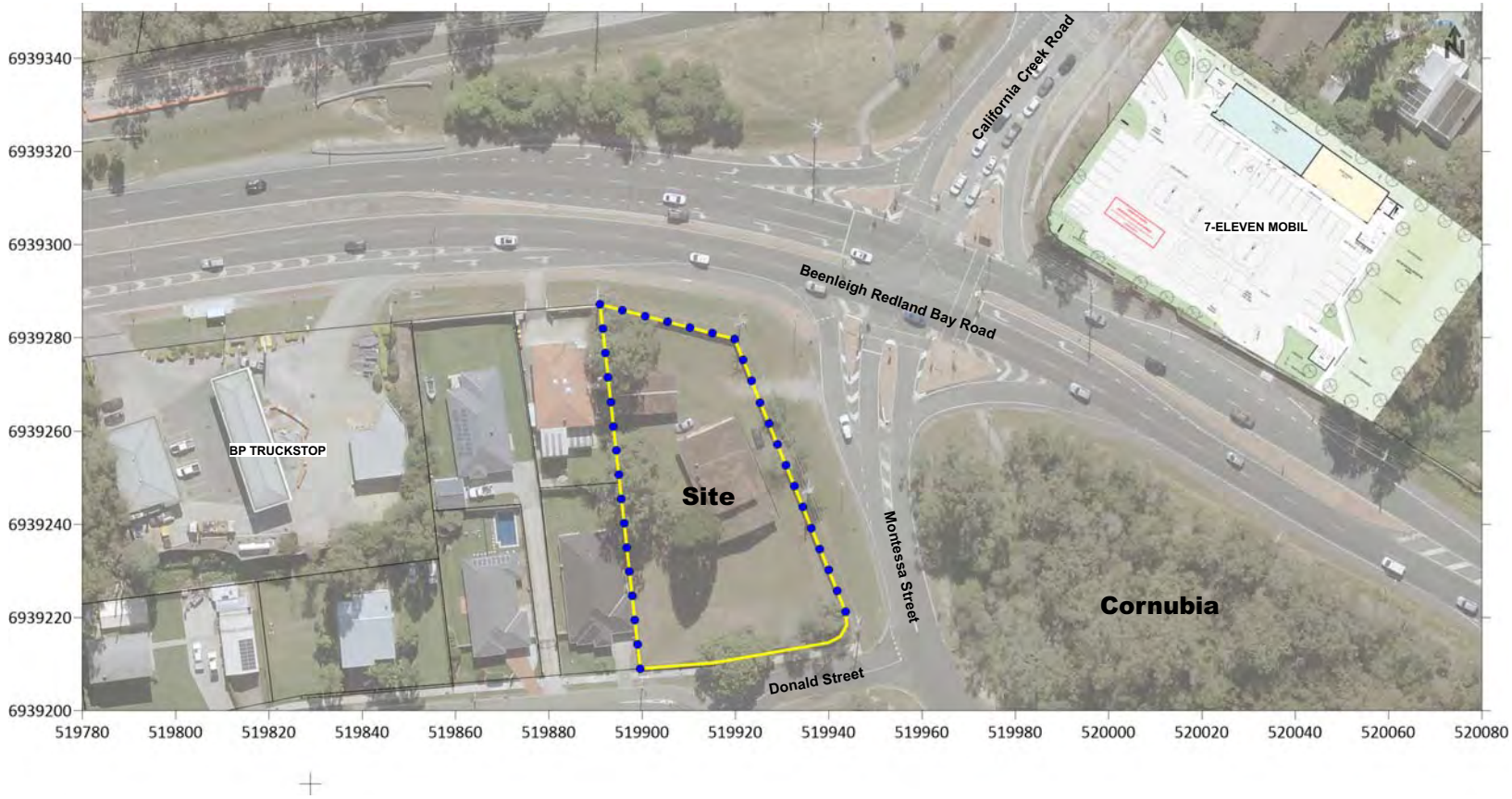

LEGEND

SITE LOCATION

DISCRETE RECEPTORS LOCATIONS

DRAWING REFERENCE

0 10 20 30 40 50m

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PROJECT

AIR QUALITY ASSESSMENT

PROPOSED CHILDCARE CENTRE DEVELOPMENT
153-161 BEENLEIGH REDLAND BAY ROAD CORNUBIA QLD

TITLE

DISCRETE RECEPTOR LOCATIONS

JOB	CORNUBIA	**FIGURE 3**
JOB NO.	23016	
DATE	04/04/23	DWG NUMBER
SCALE	1:1500 (A4)	**23016-3**
REV.		

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ATTACHMENT 1

Proposed Development Plans

DA ISSUE

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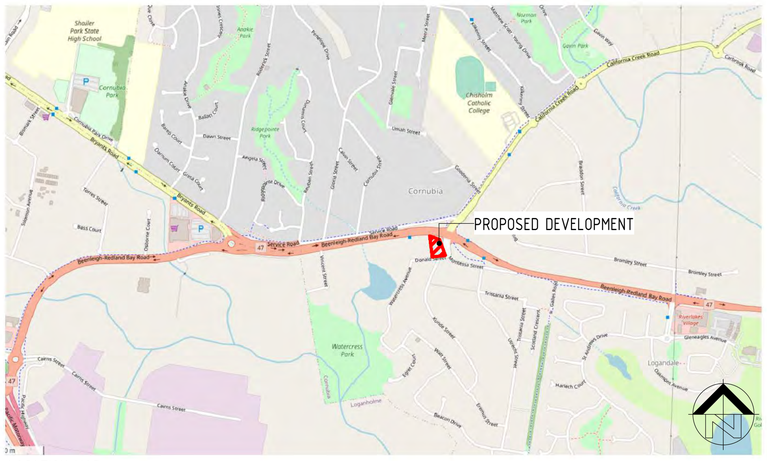
ARCHITECTURAL DA DRAWINGS

PROPOSED CHILDCARE DEVELOPMENT

153 BEENLEIGH REDLAND BAY ROAD, CORNUBIA, QLD 4130



LOCATION MAP
NTS

3D PERSPECTIVE FOR ILLUSTRATION ONLY

ARCHITECTURAL DA DRAWINGS	
DRG No.	DRAWING TITLE
DA00	COVER PAGE
DA01	EXISTING SITE PLAN
DA02	PROP. SITE PLAN
DA03	PROP. FLOOR PLAN
DA04	PROP. ROOF PLAN
DA05	BUILDING ELEVATIONS & PERSPECTIVES
DA06	BUILDING ELEVATIONS & PERSPECTIVES

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Revision and approvals

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P1	29.03.2023	TM	PRELIMINARY ISSUE FOR INFORMATION	
A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD,
CORNUBIA, QLD 4130

Drawing Title
COVER PAGE

Scale @A1

Date
MARCH 2023

Drawn
TM

Approved By
GN

Job Number - Drawing Number
23015 DA00

Revision
A

DA ISSUE

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PROPERTY DESCRIPTION

RPD: LOT 12 on SP114352
COUNCIL: LOGAN CITY COUNCIL

DEVELOPMENT ASSESSMENT

TOTAL SITE AREA	- 2,678m^2
LANDSCAPED AREA	- 2,198m^2
BUILDING SITE COVER (INCLUDES ALL ROOFED AREAS)	- 16.4%

IMPERVIOUS AREAS

PRE-DEVELOPMENT(APPROX)	- 480m^2

EXISTING BUILDING AREAS

RESIDENCE(APPROX)	- 326m^2
SHED(APPROX)	- 114m^2

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Revision and approvals

Rev	Date	Drn	Description	Appr
P1	29.03.2023	TM	PRELIMINARY ISSUE FOR INFORMATION	
A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD,
CORNUBIA, QLD 4130

Drawing Title
EXISTING SITE PLAN

Scale @A1: As indicated
Date: MARCH 2023
Drawn: TM
Approved By: GN

Job Number - Drawing Number: 23015 DA01
Revision: A

DA ISSUE

THIS DRAWING IS NOT FOR CONSTRUCTION

PROPERTY DESCRIPTION

RPD: LOT 12 on SP114352
COUNCIL: LOGAN CITY COUNCIL

DEVELOPMENT ASSESSMENT

TOTAL SITE AREA	- 2,678m²
LANDSCAPED AREA	- 815m²
BUILDING SITE COVER (INCLUDES ALL ROOFED AREAS)	- 36.5%

IMPERVIOUS AREAS

PRE-DEVELOPMENT (APPROX)	- 480m²
POST-DEVELOPMENT	- 1,799m²

BUILDING AREAS

112 PLACE CHILDCARE CENTRE

· TOTAL CHILDCARE GFA	- 757m²
· EXTERNAL PLAY SPACE REQUIRED	- 784m²
· EXTERNAL PLAYSPACE PROVIDED	- 800m²
· SITE AREA PER PLACE	- 23.9m²
· BUILDING AREA PER PLACE	- 6.7m²

EXTERNAL AREAS

REFUSE	- 9.6m²
SERVICES	- 10m²

CAR PARKING

PARKING REQUIRED 1/FTE + 1/10 CHILDREN	- 31
PARKING PROVIDED	- 31

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□ project concept to completion

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Revision and approvals

Rev	Date	Drn	Description	Appr
P1	29.03.2023	TM	PRELIMINARY ISSUE FOR INFORMATION	
A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD, CORNUBIA, QLD 4130

Drawing Title
PROP. SITE PLAN

Scale @A1: As indicated
Date: MARCH 2023
Drawn: TM
Approved By: GN

Job Number - Drawing Number: 23015 DA02
Revision: A

DA ISSUE

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Revision and approvals

Rev	Date	Drn	Description	Appr
P1	29.03.2023	TM	PRELIMINARY ISSUE FOR INFORMATION	
A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD,
CORNUBIA, QLD 4130

Drawing Title
PROP. FLOOR PLAN

Scale @A1	Date
As indicated	MARCH 2023
Drawn: TM	Approved By: GN

Job Number - Drawing Number: 23015 DA03
Revision: A

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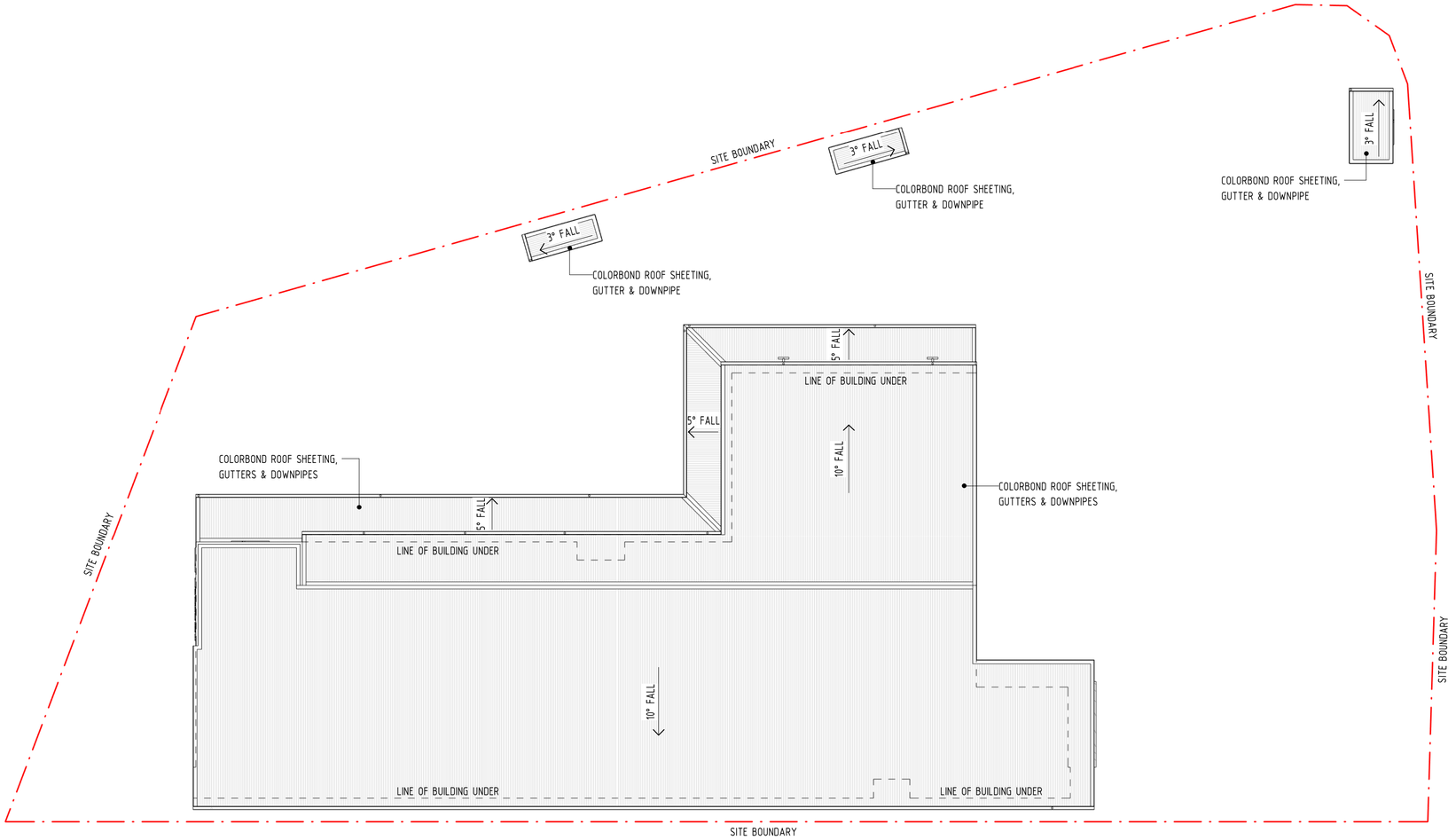

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P1	29.03.2023	TM	PRELIMINARY ISSUE FOR INFORMATION	
A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD,
CORNUBIA, QLD 4130

Scale @A1: 1 : 150
Date: MARCH 2023
Drawn: TM
Approved By: GN

Drawing Title
PROP. ROOF PLAN

Job Number - Drawing Number: 23015 DA04
Revision: A

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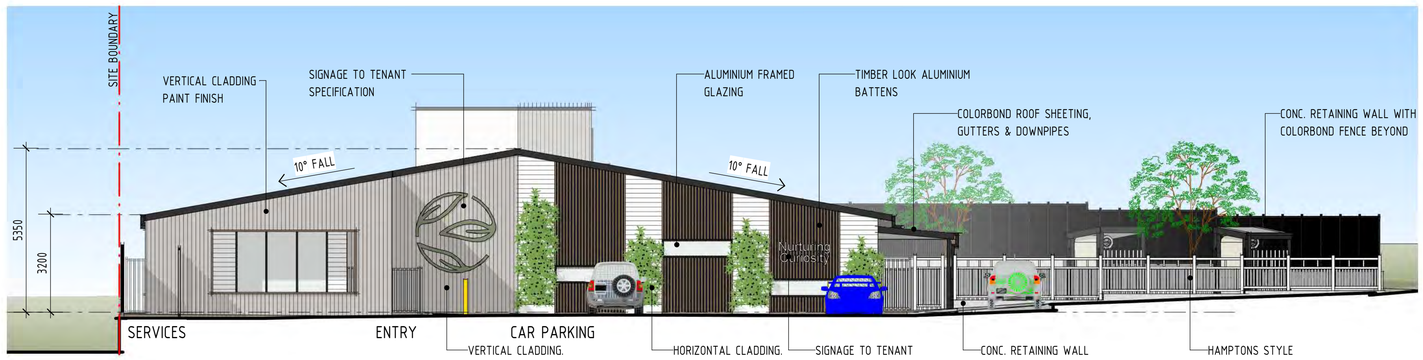
1 PERSPECTIVE A



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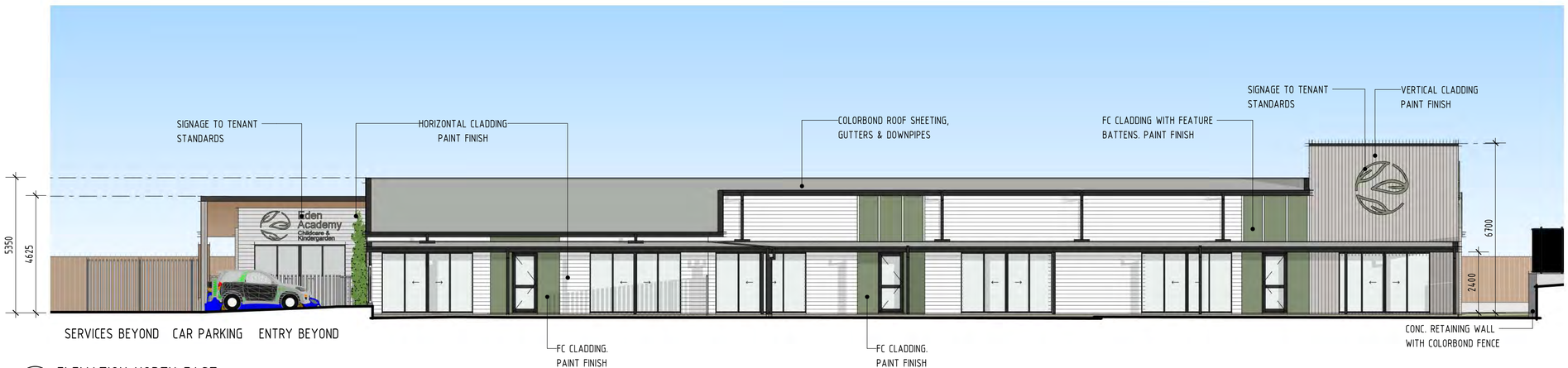


3 ELEVATION NORTH EAST
1 : 100


VERTICAL FC CLADDING PAINT FINISH


LINEA WEATHERBOARD PAINT FINISH

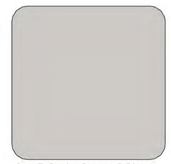

KNOTWOOD ALUMINIUM BATTENS WHITE ASH


PAINT FINISH TO MATCH COLORBOND MONUMENT


FLUSHSET FC WITH AXENT TRIMS PAINT FINISH


PAINT FINISH DULUX WHITE ON WHITE


COLORBOND CUSTOM ORB ROOF SHEETING IN SHALE GREY


PAINT FINISH DULUX DIESKAU


ALUMINIUM BATTEN FENCING


PAINT FINISH DULUX PESTO

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□ project concept to completion

Revision and approvals

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P1	27.03.2023	NG	PRELIMINARY ISSUE FOR INFORMATION ONLY	
P2	29.03.2023	TM	PRELIMINARY ISSUE FOR INFORMATION	
A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD,
CORNUBIA, QLD 4130

Scale @A1: As indicated
Date: MARCH 2023
Drawn: TM
Approved By: GN

Drawing Title
BUILDING ELEVATIONS & PERSPECTIVES

Job Number - Drawing Number: 23015 DA05
Revision: A

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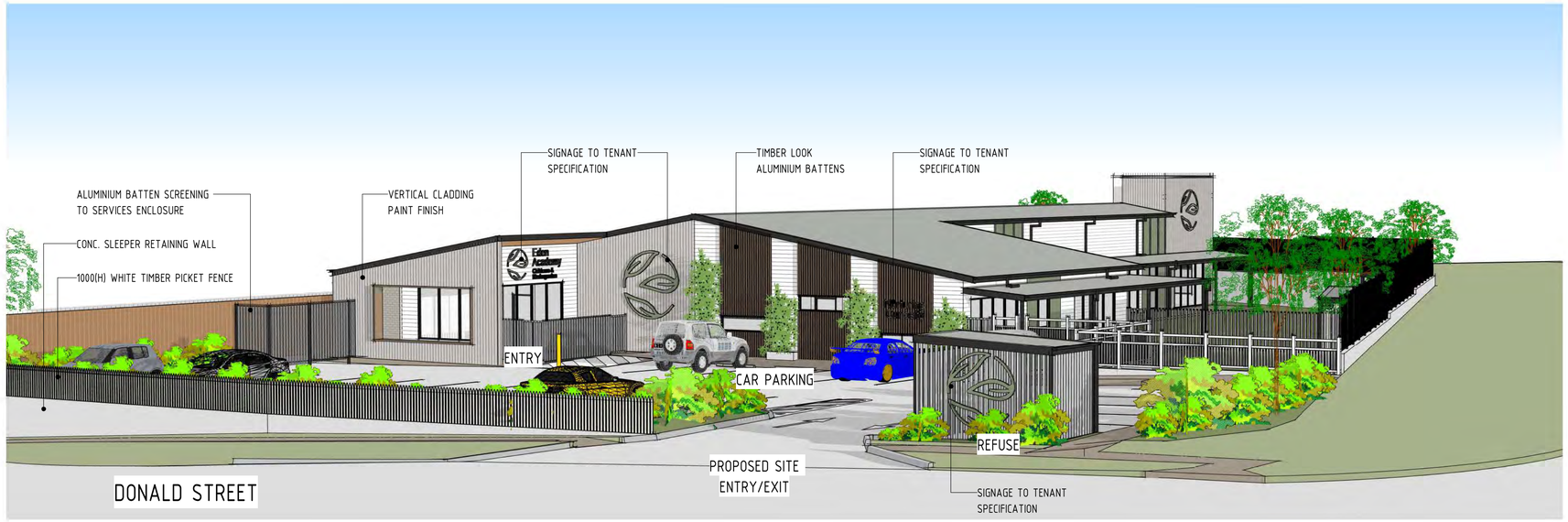
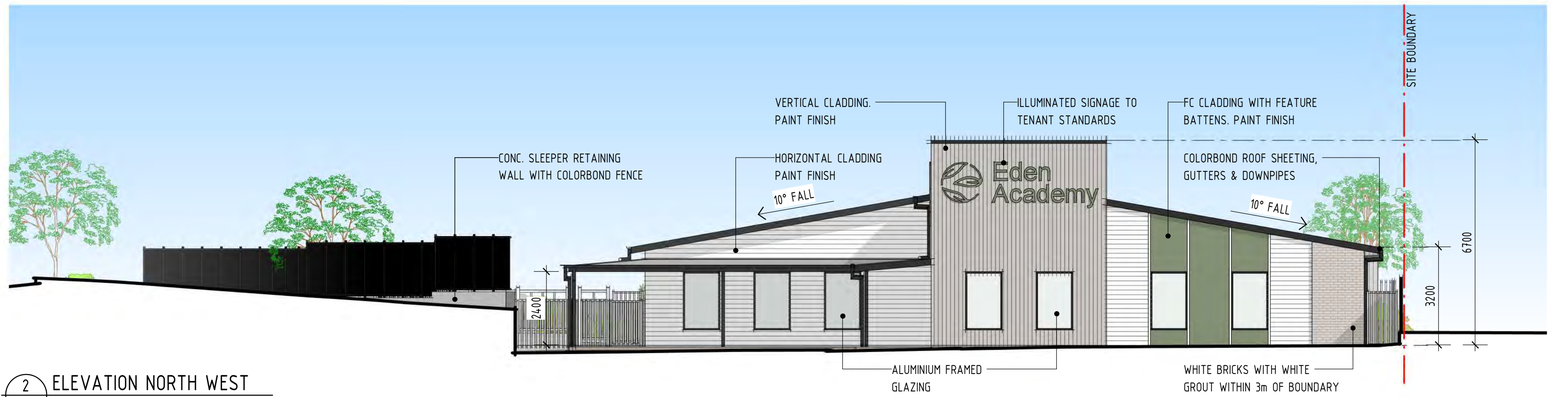
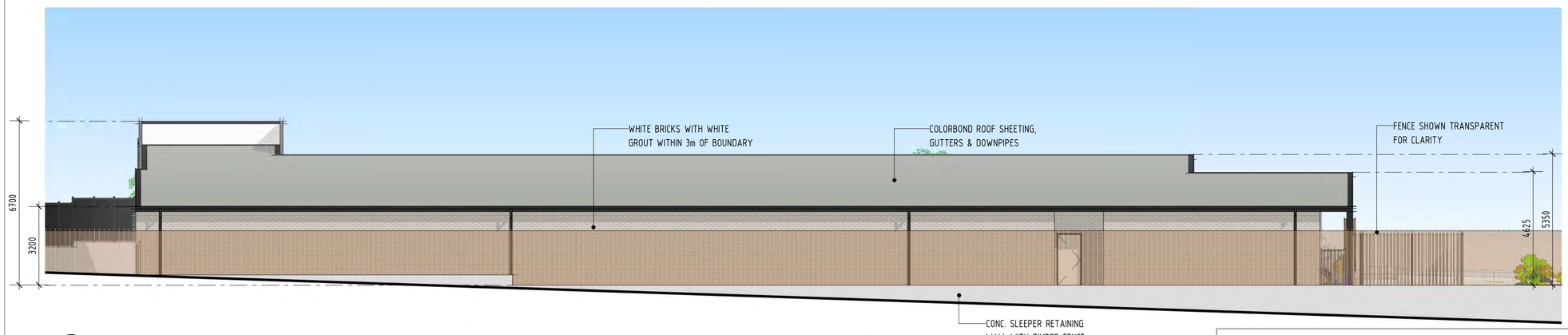


1 PERSPECTIVE B



2 ELEVATION NORTH WEST

1 : 100



3 ELEVATION SOUTH WEST

1 : 100


VERTICAL FC CLADDING PAINT FINISH


LINEA WEATHERBOARD PAINT FINISH


KNOTWOOD ALUMINIUM BATTENS WHITE ASH


PAINT FINISH TO MATCH COLORBOND MONUMENT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COLORBOND CUSTOM ORB ROOF SHEETING IN SHALE GREY


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A	31.03.2023	NG	DA ISSUE	

Project Description
PROPOSED CHILDCARE DEVELOPMENT
153 BEENLEIGH REDLAND BAY ROAD,
CORNUBIA, QLD 4130

Scale @A1: As indicated
Date: MARCH 2023
Drawn: TM
Approved By: GN

Drawing Title
BUILDING ELEVATIONS & PERSPECTIVES

Job Number - Drawing Number: 23015 DA06
Revision: A

ATTACHMENT 2

Existing and Ultimate Traffic Volumes

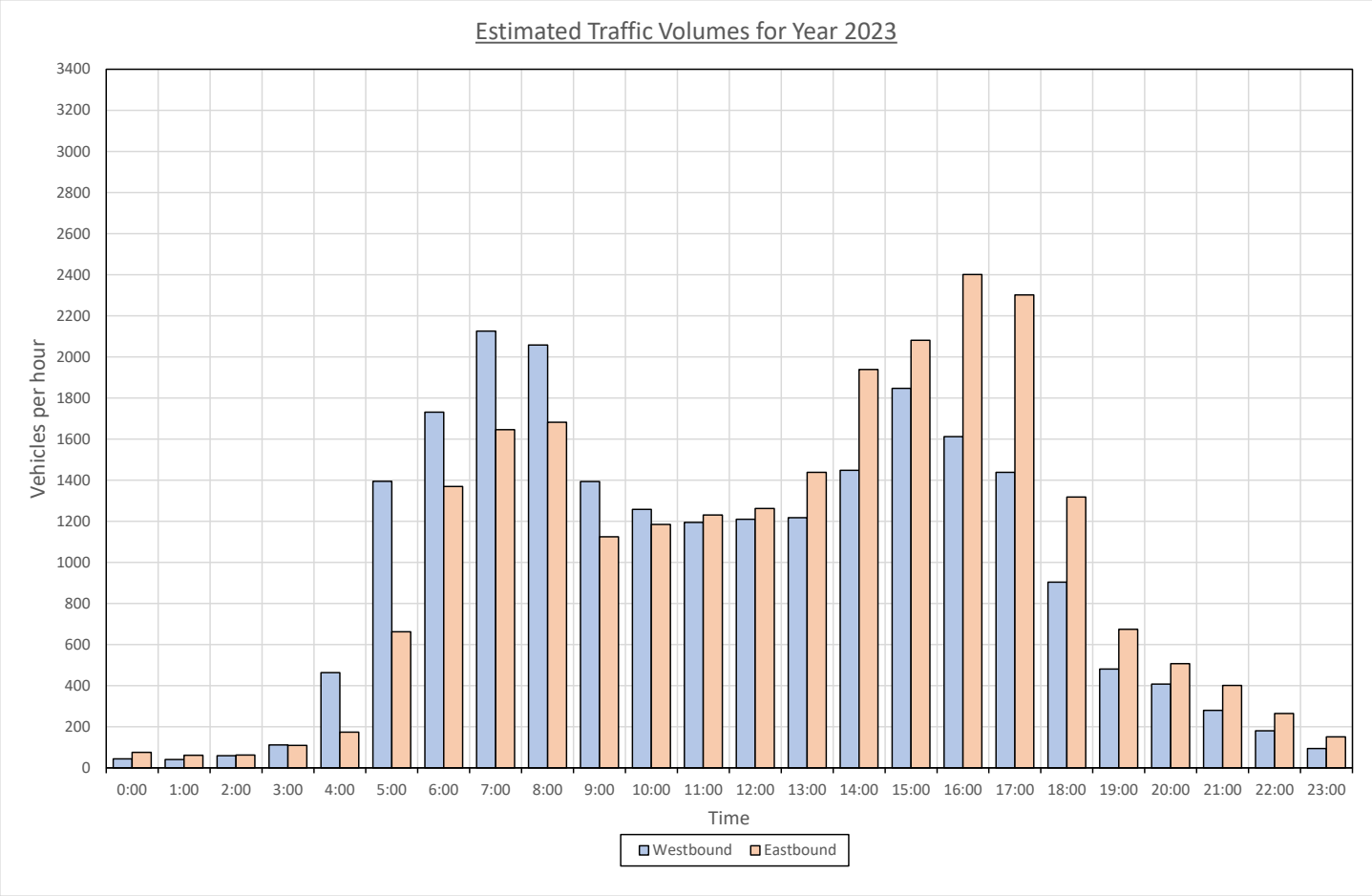


Figure A2.1: Traffic Volumes for Year 2023

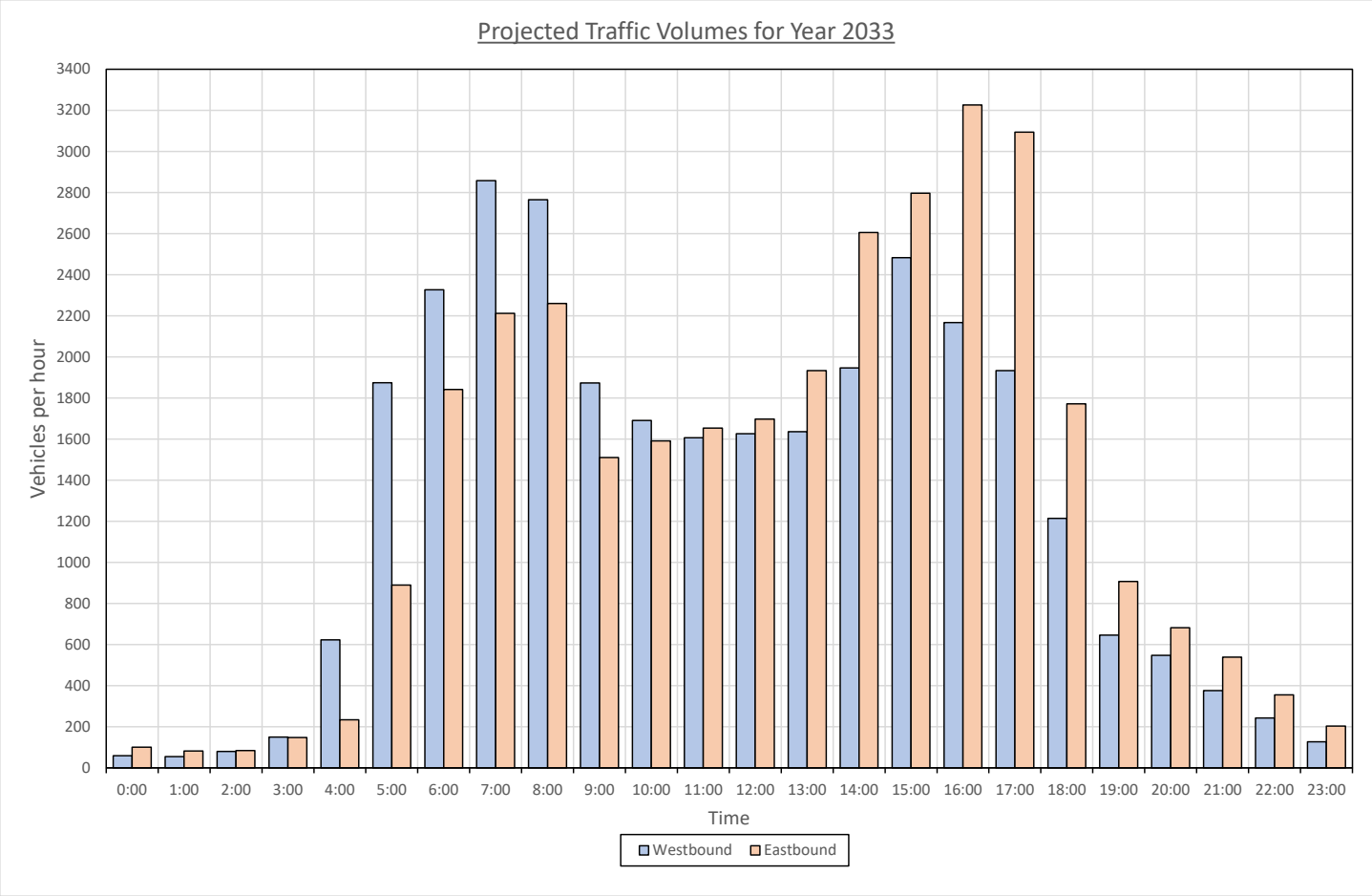


Figure A2.2: Traffic Volumes for Year 2033

ATTACHMENT 3

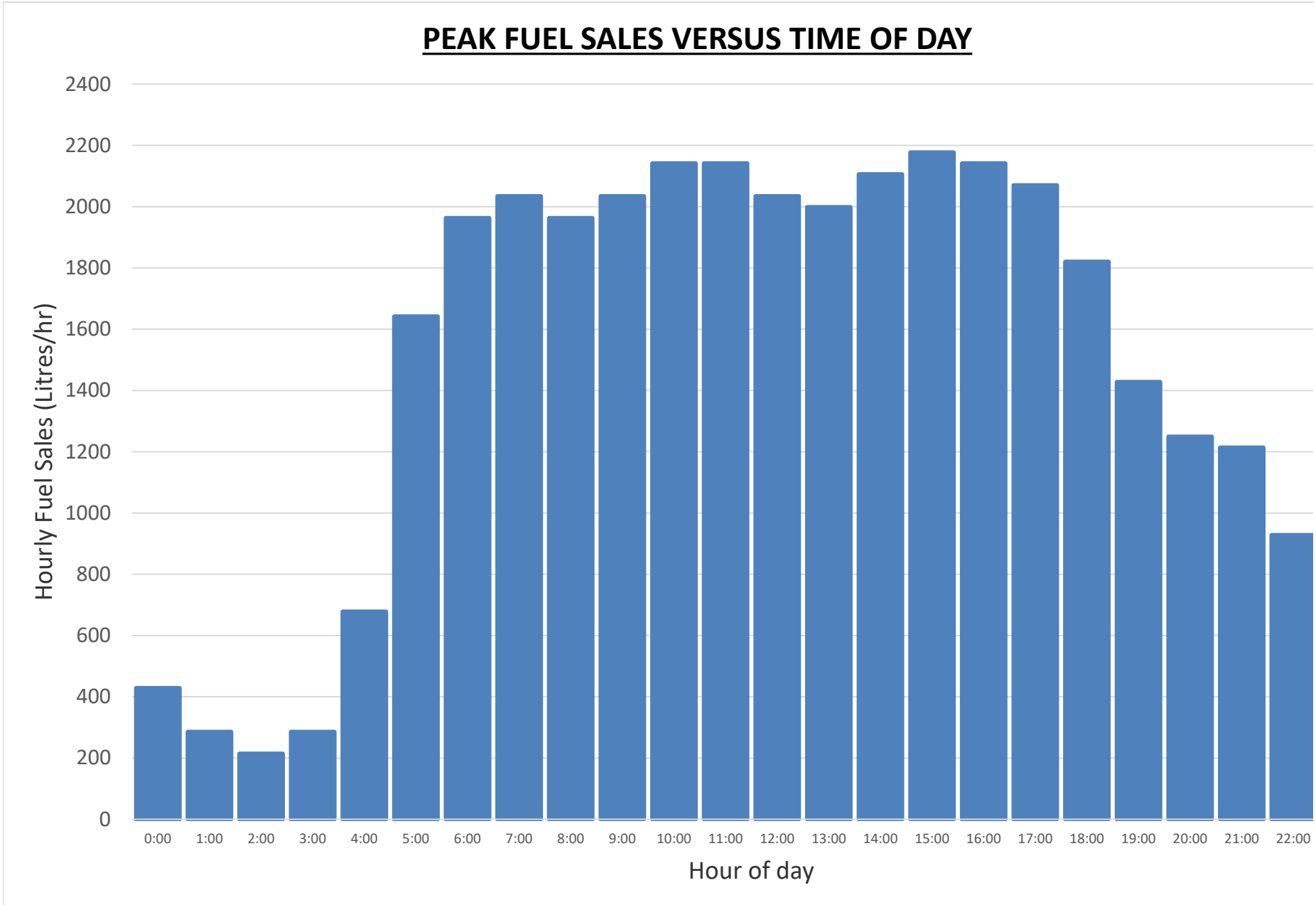
Service Station Emission Estimation

Service Station Hourly Fuel Sales Estimate

Annual Fuel Sales:	***10,000,000***	**L/annum**
Average Daily Fuel Sales:	***27,397***	**L/day**
Peak Daily Fuel Sales (+30%):	***35,616***	**L/day**

HOURLY FUEL SALES BREAKUP

HOUR BEGINNING	% WEEK DAY SALES	PEAK HOURLY FUEL SALES (l/hr)
12MN	1.2	428
1am	0.8	286
2am	0.6	214
3am	0.8	286
4am	1.9	678
5am	4.6	1642
6am	5.5	1963
7am	5.7	2034
8am	5.5	1963
9am	5.7	2034
10am	6.0	2141
11am	6.0	2141
12pm	5.7	2034
1pm	5.6	1999
2pm	5.9	2106
3pm	6.1	2177
4pm	6.0	2141
5pm	5.8	2070
6pm	5.1	1820
7pm	4.0	1428
8pm	3.5	1249
9pm	3.4	1213
10pm	2.6	928
11pm	1.8	642


PEAK FUEL SALES VERSUS TIME OF DAY
Hourly Fuel Sales (Litres/hr)
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
Hour of day

BP Service Station VOC Emission Factors

Source	Value	Units
Underground Tank Breathing	120	mg / l
Refuelling Vehicles	1320	mg / l
Spillage at Vehicles	80	mg / l
Whoosh Emissions at Vehicles	79	mg / l
Bulk Tanker Refuelling with Stage 1 Vapour Recovery	40	mg / l

Bulk Tanker Refuelling

Parameter	Value	Units
Volume of Refuelling Tanker	54500	Litres
Total VOC emissions per fill	2180	grams
Total VOC emission rate	0.61	g/s

VOC Emission Rates from Various Sources by Hour of Day

Hour Beginning	Peak Hourly Fuel Throughput (Litres)	VOC Emission Rates					Units
		Underground Tank Breathing	Refuelling Vehicles	Spillage at Vehicles	Whoosh at Vehicles	Bulk Tanker Refuelling	
12MN	428	0.0143	0.1570	0.0095	0.0094	0.61 [1]	g/s
1am	286	0.0095	0.1047	0.0063	0.0063	-	g/s
2am	214	0.0071	0.0785	0.0048	0.0047	-	g/s
3am	286	0.0095	0.1047	0.0063	0.0063	-	g/s
4am	678	0.0226	0.2486	0.0151	0.0149	-	g/s
5am	1642	0.0547	0.6019	0.0365	0.0360	-	g/s
6am	1963	0.0654	0.7197	0.0436	0.0430	-	g/s
7am	2034	0.0678	0.7459	0.0452	0.0446	-	g/s
8am	1963	0.0654	0.7197	0.0436	0.0430	-	g/s
9am	2034	0.0678	0.7459	0.0452	0.0446	-	g/s
10am	2141	0.0714	0.7851	0.0476	0.0469	-	g/s
11am	2141	0.0714	0.7851	0.0476	0.0469	-	g/s
12pm	2034	0.0678	0.7459	0.0452	0.0446	-	g/s
1pm	1999	0.0666	0.7328	0.0444	0.0438	-	g/s
2pm	2106	0.0702	0.7720	0.0468	0.0461	-	g/s
3pm	2177	0.0726	0.7982	0.0484	0.0477	-	g/s
4pm	2141	0.0714	0.7851	0.0476	0.0469	-	g/s
5pm	2070	0.0690	0.7590	0.0460	0.0453	-	g/s
6pm	1820	0.0607	0.6674	0.0404	0.0399	-	g/s
7pm	1428	0.0476	0.5234	0.0317	0.0313	-	g/s
8pm	1249	0.0416	0.4580	0.0278	0.0274	-	g/s
9pm	1213	0.0404	0.4449	0.0270	0.0266	-	g/s
10pm	928	0.0309	0.3402	0.0206	0.0203	-	g/s
11pm	642	0.0214	0.2355	0.0143	0.0141	-	g/s

[1] Conservatively assume that a full tanker is unloaded at the service station once per day, progressively rolling for each day of the year

7-eleven VOC Emission Factors

Source	Value	Units
Underground Tank Breathing	120	mg / l
Refuelling Vehicles with Stage 2 Vapour Recovery	198	mg / l
Spillage at Vehicles	80	mg / l
Whoosh Emissions at Vehicles	79	mg / l
Bulk Tanker Refuelling with Stage 1 Vapour Recovery	40	mg / l

Bulk Tanker Refuelling

Parameter	Value	Units
Volume of Refuelling Tanker	54500	Litres
Total VOC emissions per fill	2180	grams
Total VOC emission rate	0.61	g/s

VOC Emission Rates from Various Sources by Hour of Day

Hour Beginning	Peak Hourly Fuel Throughput (Litres)	VOC Emission Rates					Units
		Underground Tank Breathing	Refuelling Vehicles	Spillage at Vehicles	Whoosh at Vehicles	Bulk Tanker Refuelling	
12MN	428	0.0143	0.0236	0.0095	0.0094	0.61 [1]	g/s
1am	286	0.0095	0.0157	0.0063	0.0063	-	g/s
2am	214	0.0071	0.0118	0.0048	0.0047	-	g/s
3am	286	0.0095	0.0157	0.0063	0.0063	-	g/s
4am	678	0.0226	0.0373	0.0151	0.0149	-	g/s
5am	1642	0.0547	0.0903	0.0365	0.0360	-	g/s
6am	1963	0.0654	0.1080	0.0436	0.0430	-	g/s
7am	2034	0.0678	0.1119	0.0452	0.0446	-	g/s
8am	1963	0.0654	0.1080	0.0436	0.0430	-	g/s
9am	2034	0.0678	0.1119	0.0452	0.0446	-	g/s
10am	2141	0.0714	0.1178	0.0476	0.0469	-	g/s
11am	2141	0.0714	0.1178	0.0476	0.0469	-	g/s
12pm	2034	0.0678	0.1119	0.0452	0.0446	-	g/s
1pm	1999	0.0666	0.1099	0.0444	0.0438	-	g/s
2pm	2106	0.0702	0.1158	0.0468	0.0461	-	g/s
3pm	2177	0.0726	0.1197	0.0484	0.0477	-	g/s
4pm	2141	0.0714	0.1178	0.0476	0.0469	-	g/s
5pm	2070	0.0690	0.1138	0.0460	0.0453	-	g/s
6pm	1820	0.0607	0.1001	0.0404	0.0399	-	g/s
7pm	1428	0.0476	0.0785	0.0317	0.0313	-	g/s
8pm	1249	0.0416	0.0687	0.0278	0.0274	-	g/s
9pm	1213	0.0404	0.0667	0.0270	0.0266	-	g/s
10pm	928	0.0309	0.0510	0.0206	0.0203	-	g/s
11pm	642	0.0214	0.0353	0.0143	0.0141	-	g/s

[1] Conservatively assume that a full tanker is unloaded at the service station once per day, progressively rolling for each day of the year

ATTACHMENT 4

Road Traffic Emissions

Traffic Emission Factors

Traffic Situation	Year	Season	CO_2	NOx	PM_{10}	$PM_{2.5}$	VOCs	Benzene	Benzo(a)pyrene
			g/VKT	g/VKT	mg/VKT	mg/VKT	mg/VKT	µg/VKT	µg/VKT
Urban	2010	Summer	584.8	2.3	105.5	83.4	715.6	25.5	1.1
		Winter	583.9	2.4	130.4	108.3	876.9	31.7	1.4
		Autumn	578.0	2.3	115.2	93.1	868.8	31.4	1.4
		Spring	575.7	2.3	117.8	95.7	783.2	28.1	1.2
	2023	Summer	607.9	0.7	57.7	35.6	248.4	6.9	1.0
		Winter	591.8	0.7	63.0	40.9	322.3	9.2	1.3
		Autumn	591.5	0.7	59.8	37.7	311.0	8.9	1.3
		Spring	586.4	0.7	60.3	38.2	280.1	7.9	1.1
	2025	Summer	611.5	0.4	50.3	28.2	176.5	4.1	1.0
		Winter	593.0	0.4	52.6	30.5	237.0	5.8	1.3
		Autumn	593.6	0.4	51.2	29.1	225.2	5.4	1.3
		Spring	588.0	0.4	51.5	29.4	202.7	4.8	1.1
Congested	2010	Summer	1056.6	3.4	150.0	127.9	1228.3	42.2	2.0
		Winter	1075.7	3.5	190.7	168.6	1632.0	57.9	2.6
		Autumn	1057.8	3.4	165.9	143.8	1477.0	51.9	2.4
		Spring	1057.7	3.4	170.1	148.0	1416.8	49.5	2.3
	2023	Summer	1098.1	1.1	65.8	43.7	373.1	9.9	1.4
		Winter	1100.7	1.1	74.4	52.3	552.5	15.5	2.2
		Autumn	1089.3	1.1	69.2	47.1	476.6	13.1	1.9
		Spring	1086.1	1.1	70.1	48.0	456.8	12.5	1.8
	2025	Summer	1104.5	0.8	52.8	30.7	241.5	4.9	1.3
		Winter	1104.5	0.8	56.5	34.4	386.4	8.9	2.1
		Autumn	1094.2	0.8	54.3	32.2	322.6	7.1	1.8
		Spring	1090.5	0.8	54.7	32.6	309.1	6.8	1.7

ATTACHMENT 5

CALPUFF Model Layout

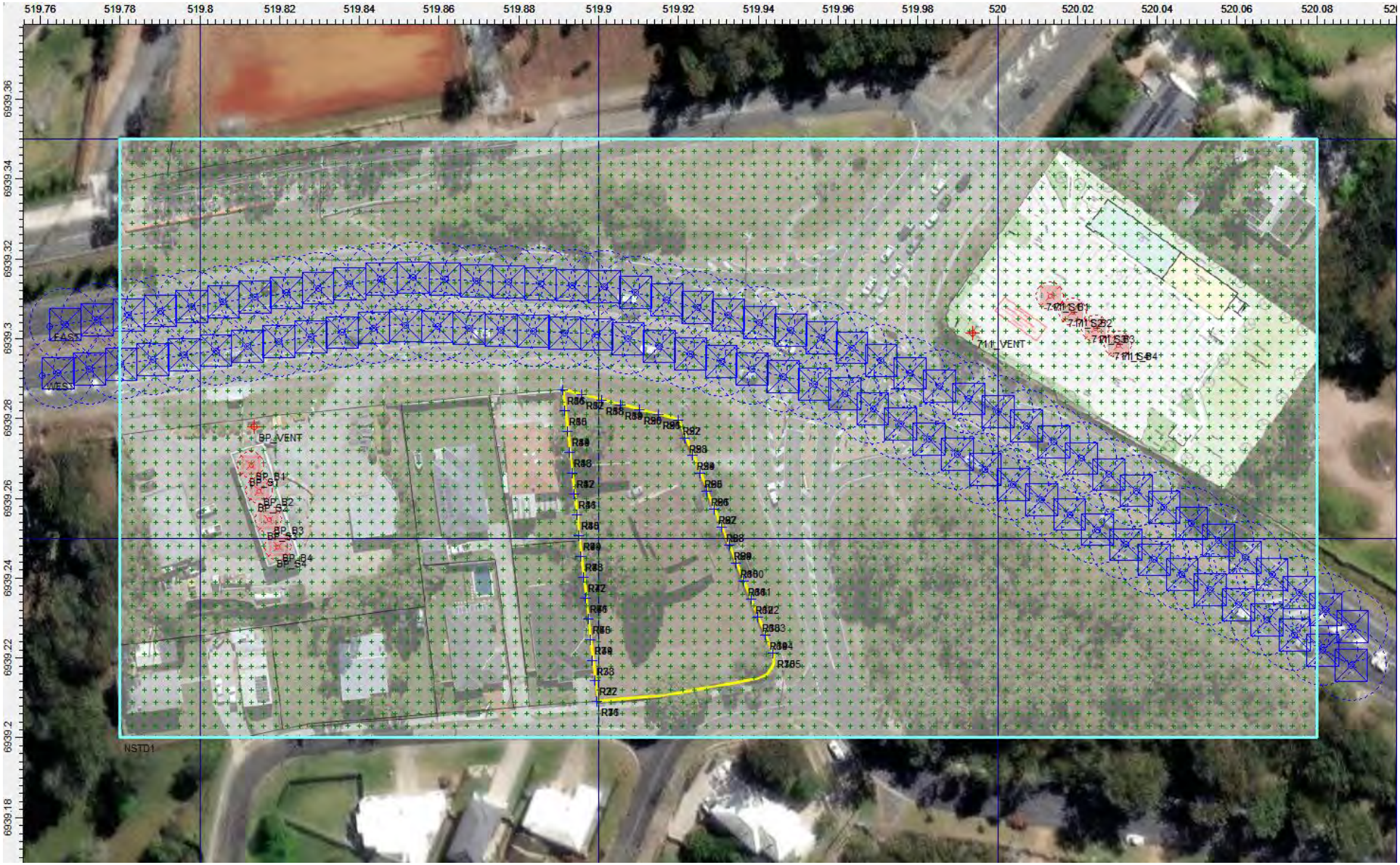


Figure A5.1: CALPUFF Model Layout with Service Station and Road Traffic Emission Sources

ATTACHMENT 6

Analysis of BoM Redland Meteorology

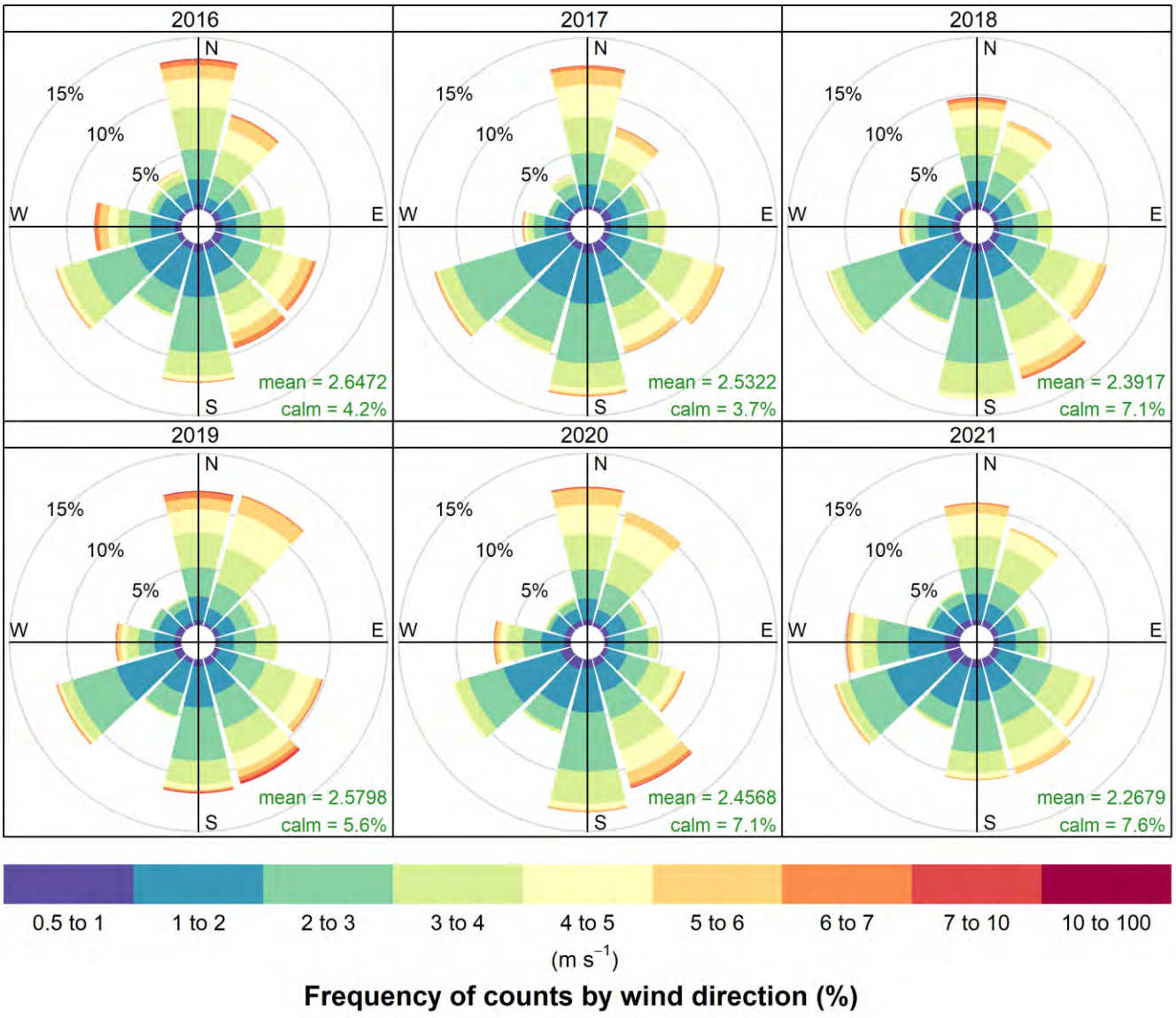


Figure A6.1 Annual wind roses for BoM Redlands

ATTACHMENT 7

Analysis of CALMET -Generated Site Meteorological Data

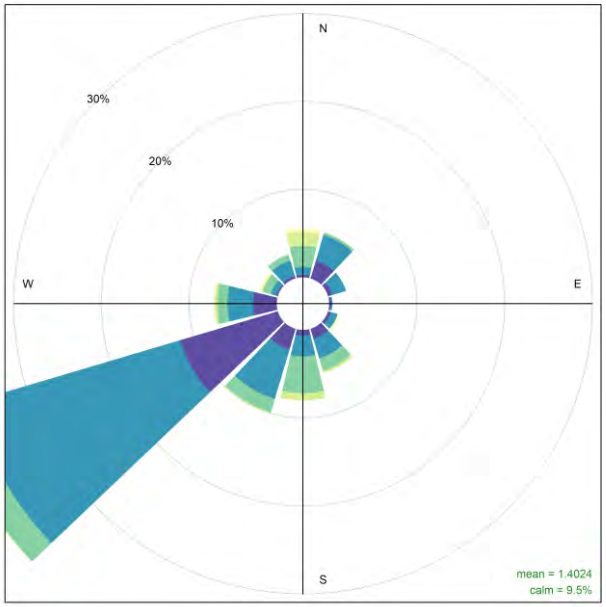
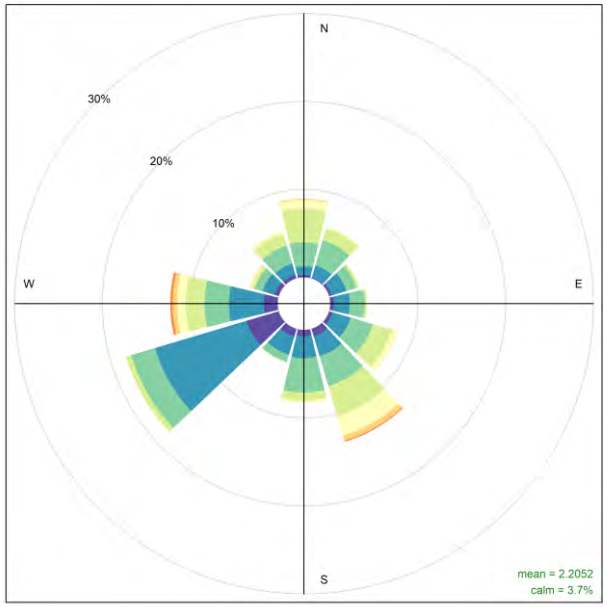
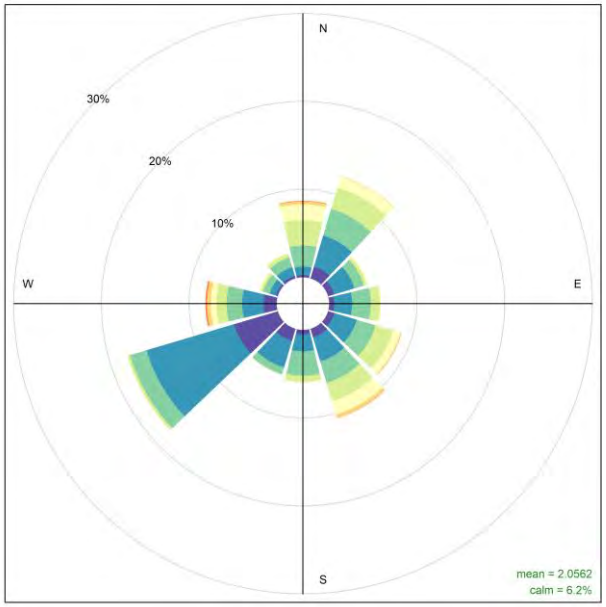
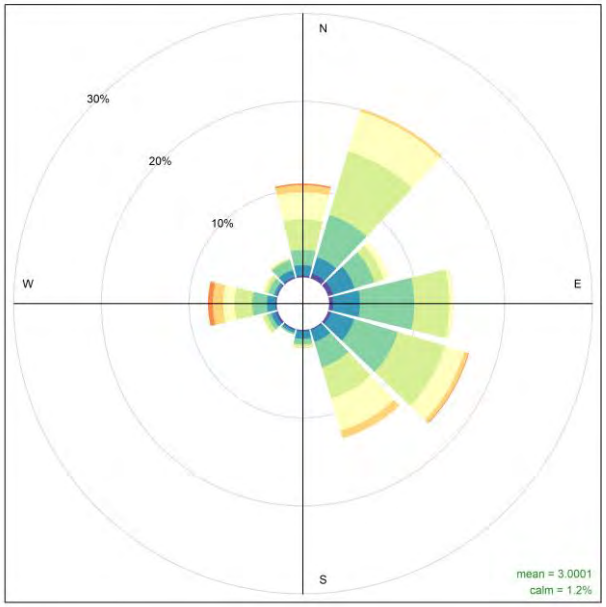
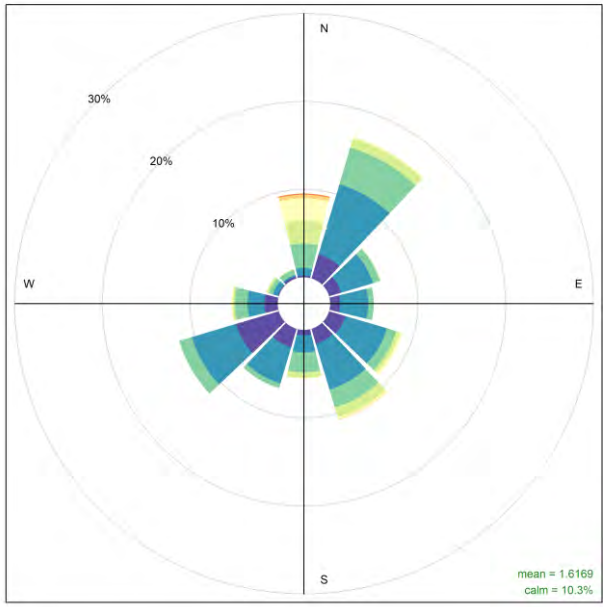
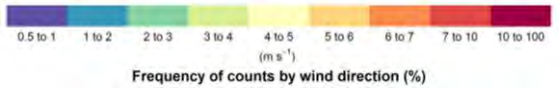
Midnight to 6am	6am to Midday	Annual
		
Midday to 6pm	**6pm to Midnight**	**Key**
		

Figure A7.1 Diurnal wind roses for Site as generated by CALMET

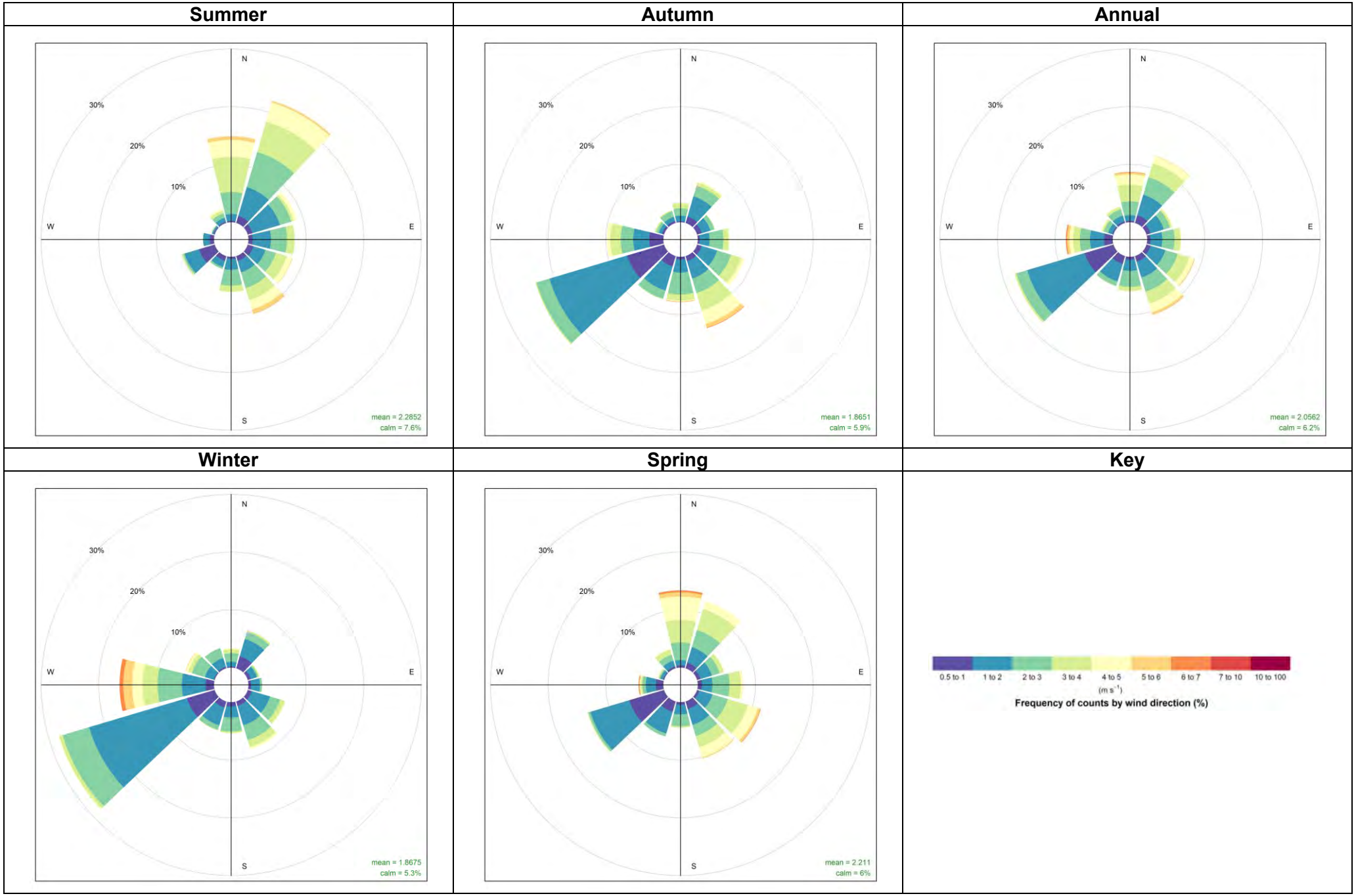


Figure A7.2 Seasonal wind roses for Site as generated by CALMET

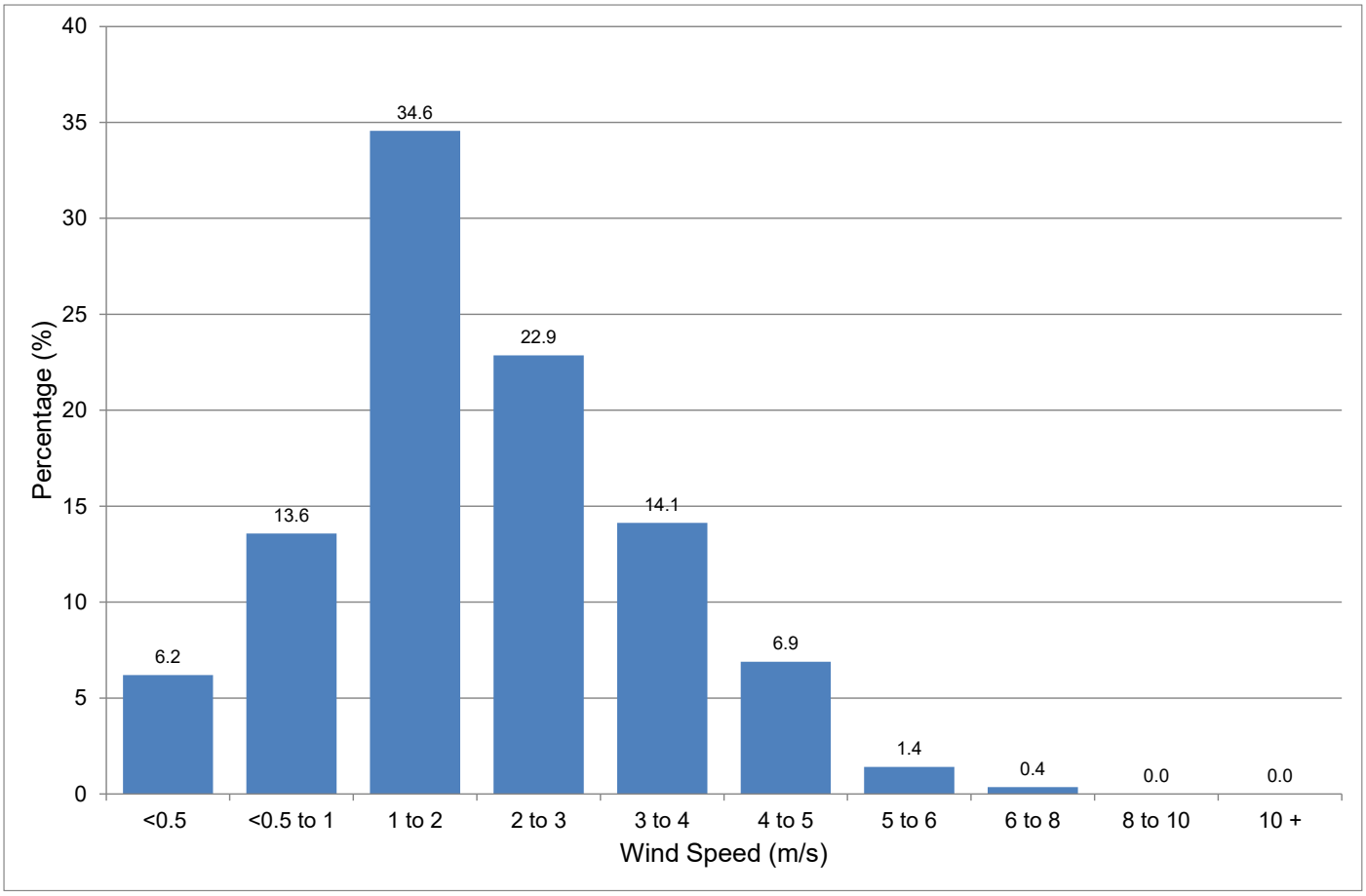


Figure A7.3 Wind frequency graph for Site as generated by CALMET

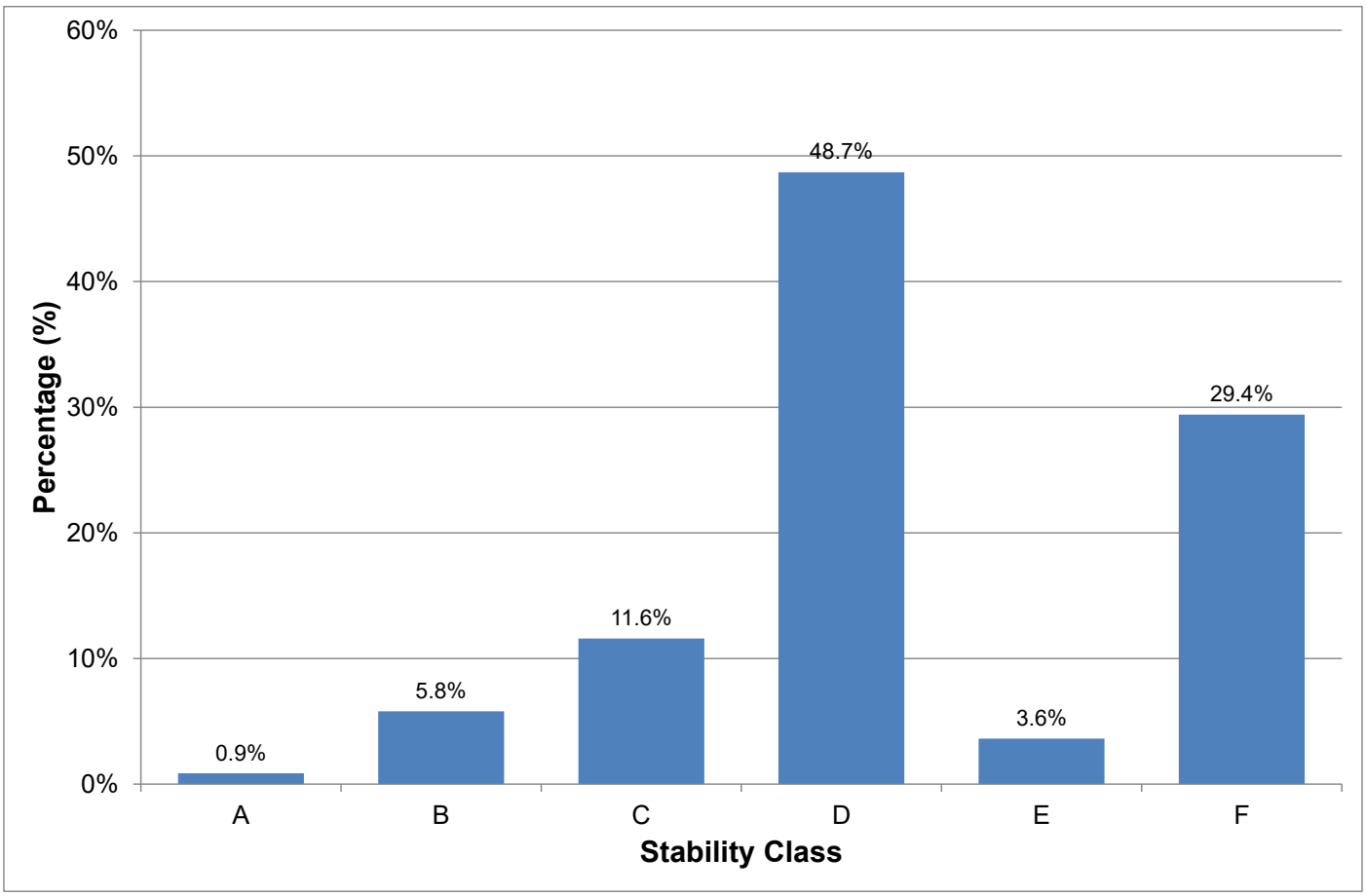


Figure A7.4 Stability Class distribution for Site as generated by CALMET

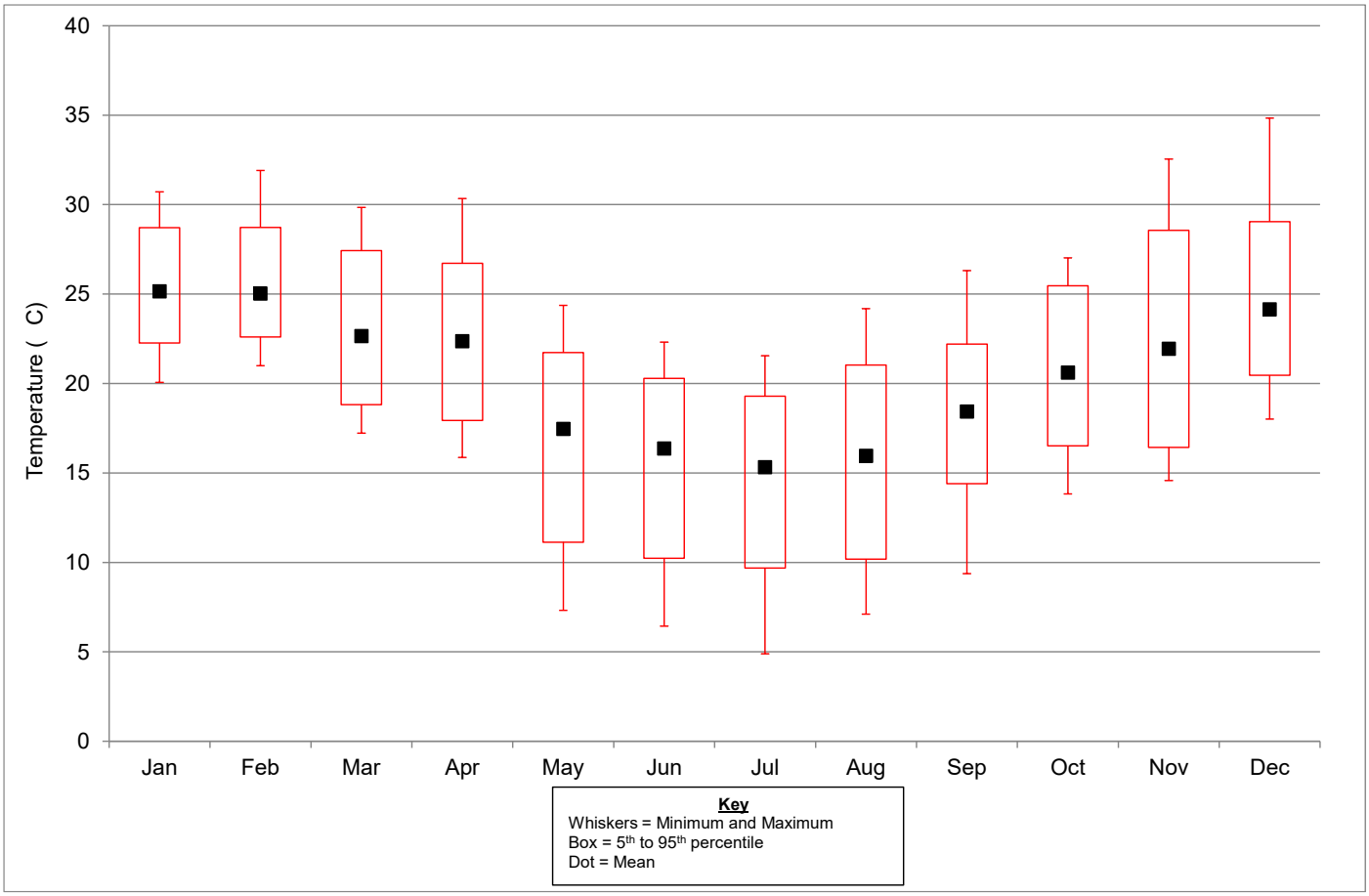


Figure A7.5 Box and Whisker plot of monthly temperature for Site as generated by CALMET

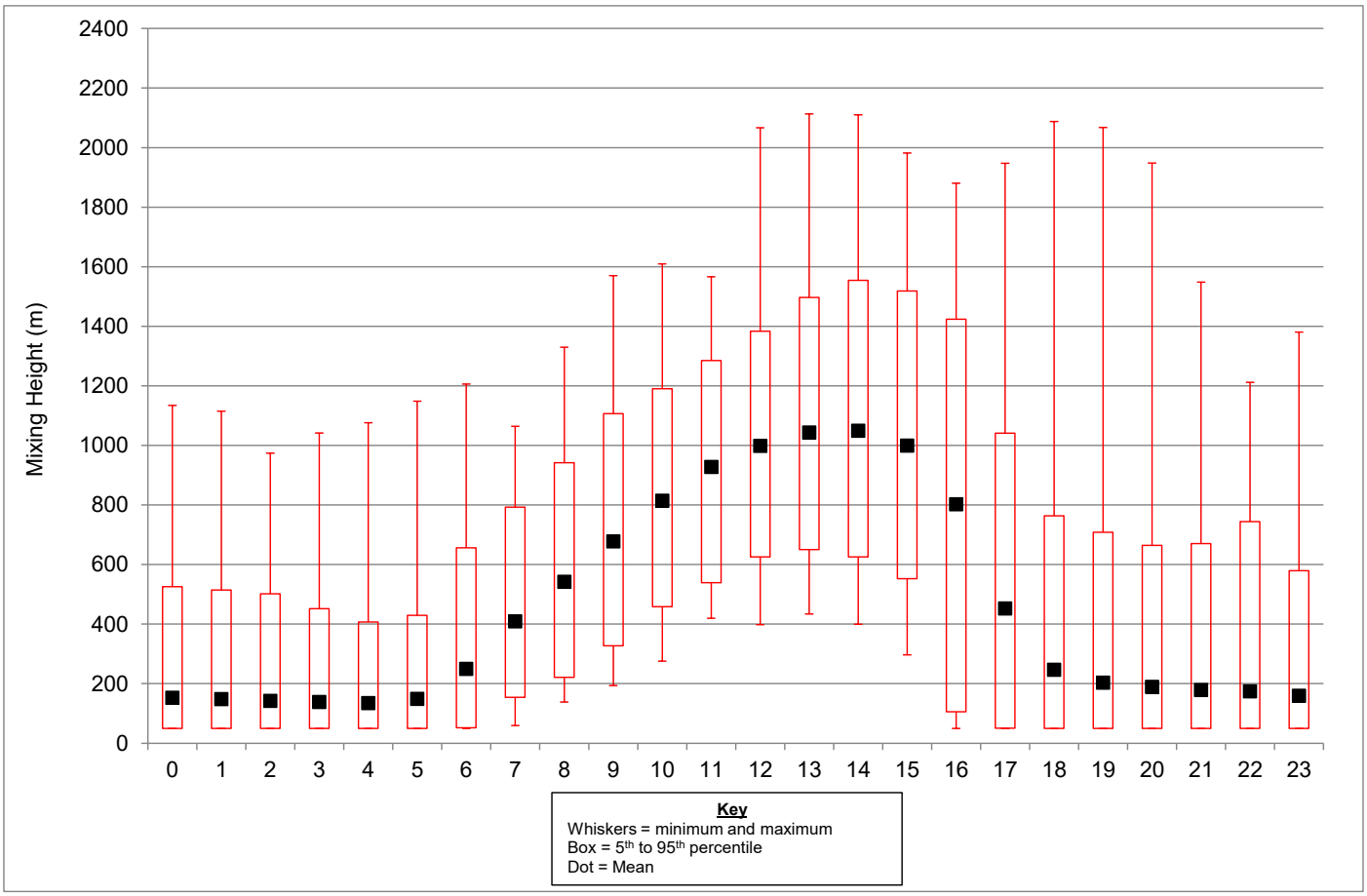
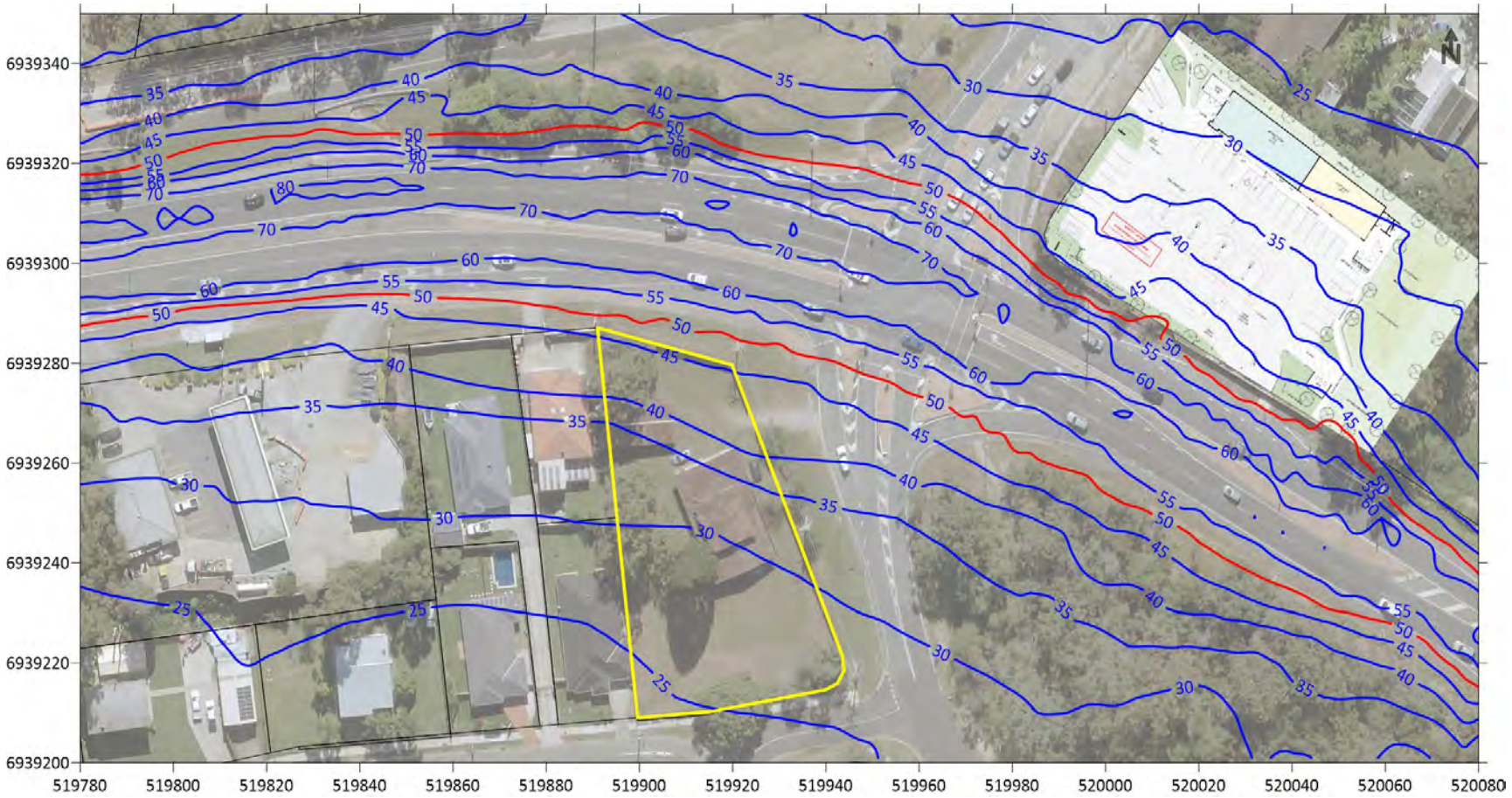


Figure A7.6 Box and Whisker plot of diurnal mixing height for Site as generated by CALMET

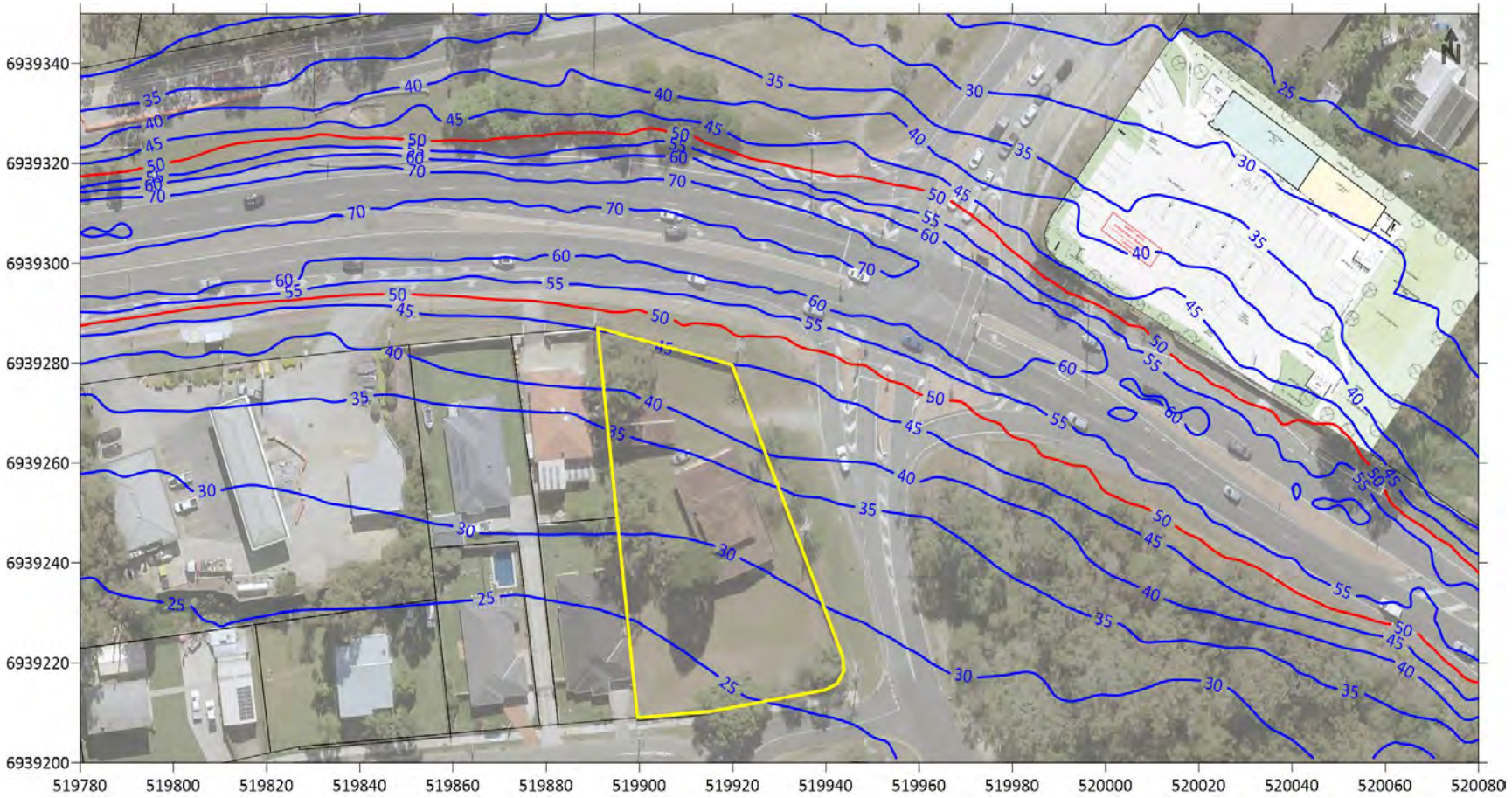
ATTACHMENT 8

Air Pollutant Contour Plots



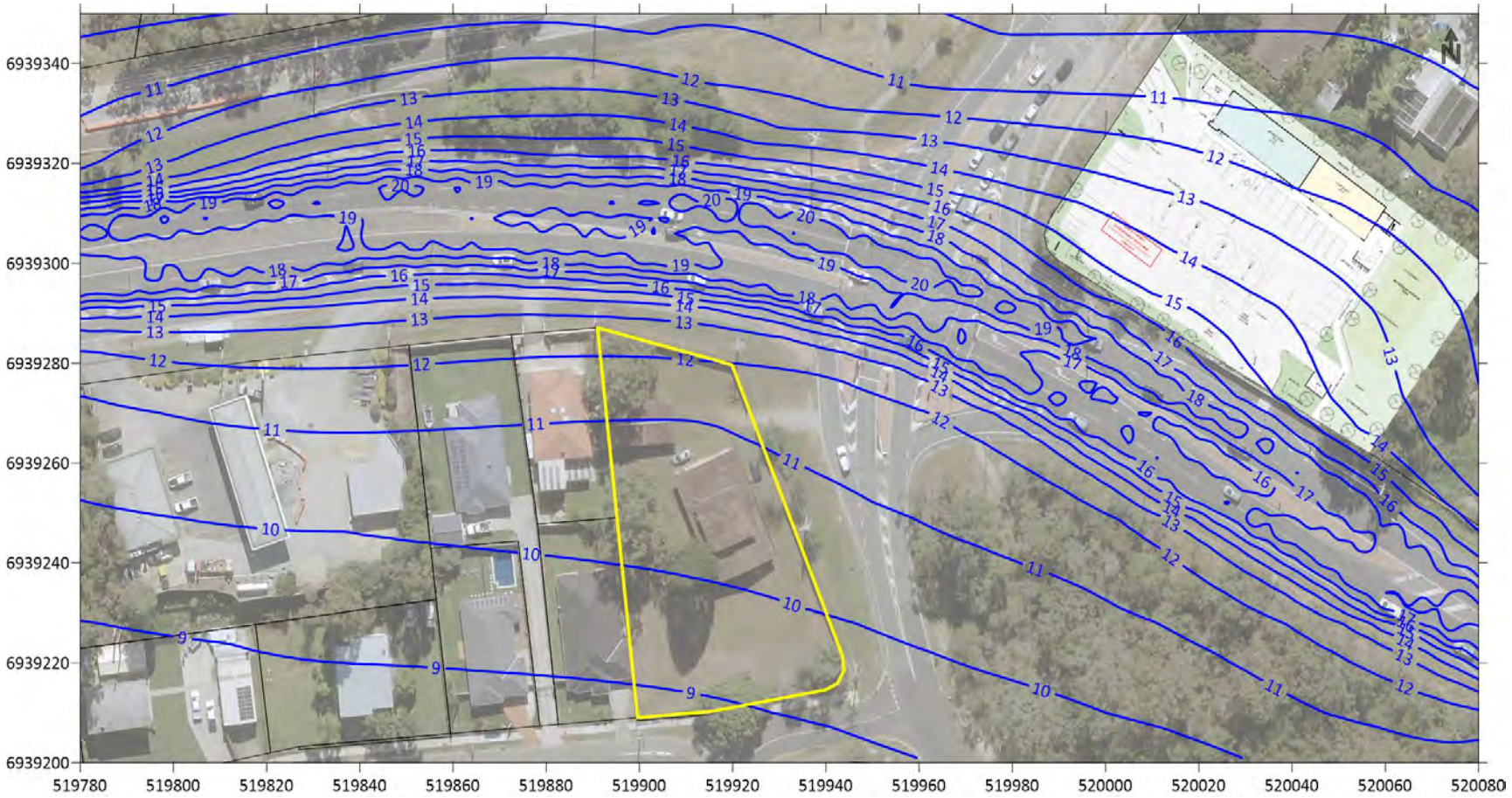
Predicted road traffic emissions for Year 2023 from Beenleigh Redland Bay Road

Figure A8.1	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	$PM_{2.5}$	1-hour average 99.9th percentile	50	µg/m³	30-Mar-2023



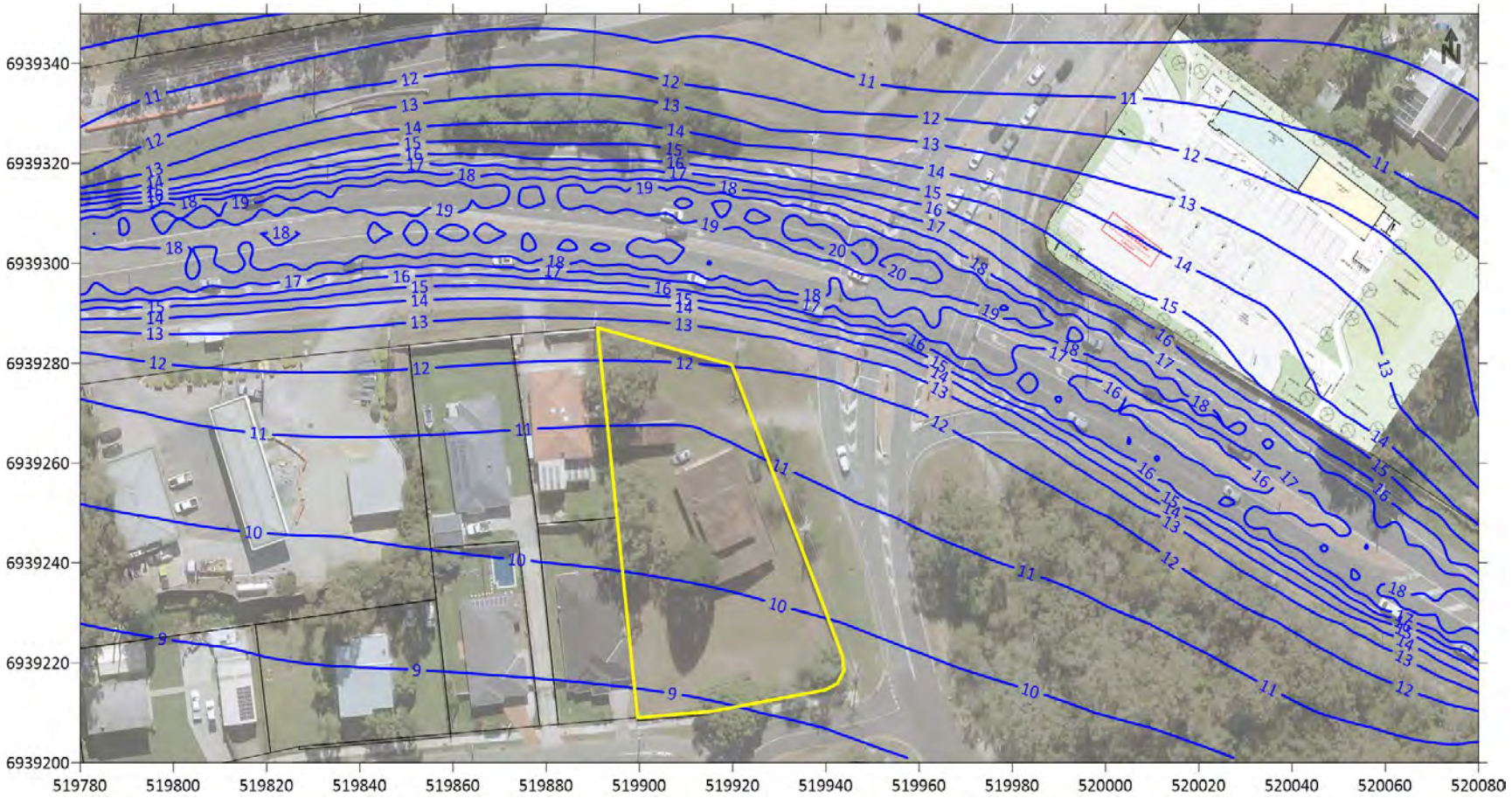
Predicted road traffic emissions for Year 2033 from Beenleigh Redland Bay Road

Figure A8.2	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	$PM_{2.5}$	1-hour average 99.9th percentile	50	µg/m³	30-Mar-2023



Predicted road traffic emissions for Year 2023 from Beenleigh Redland Bay Road

Figure A8.3	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	$PM_{2.5}$	Maximum 24-hour average	25	µg/m³	30-Mar-2023

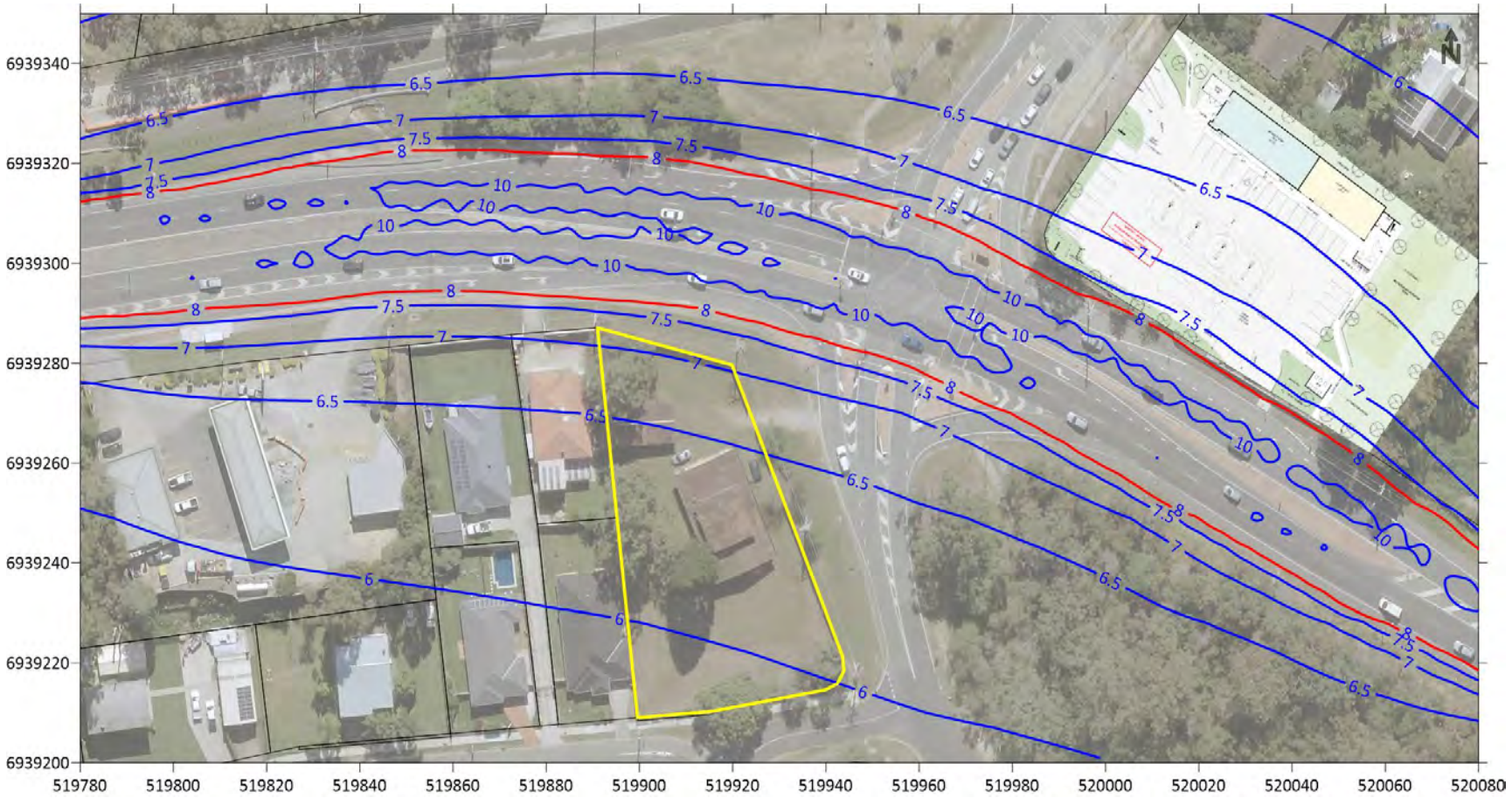


Predicted road traffic emissions for Year 2033 from Beenleigh Redland Bay Road

Figure A8.4	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	$PM_{2.5}$	Maximum 24-hour average	25	µg/m³	30-Mar-2023

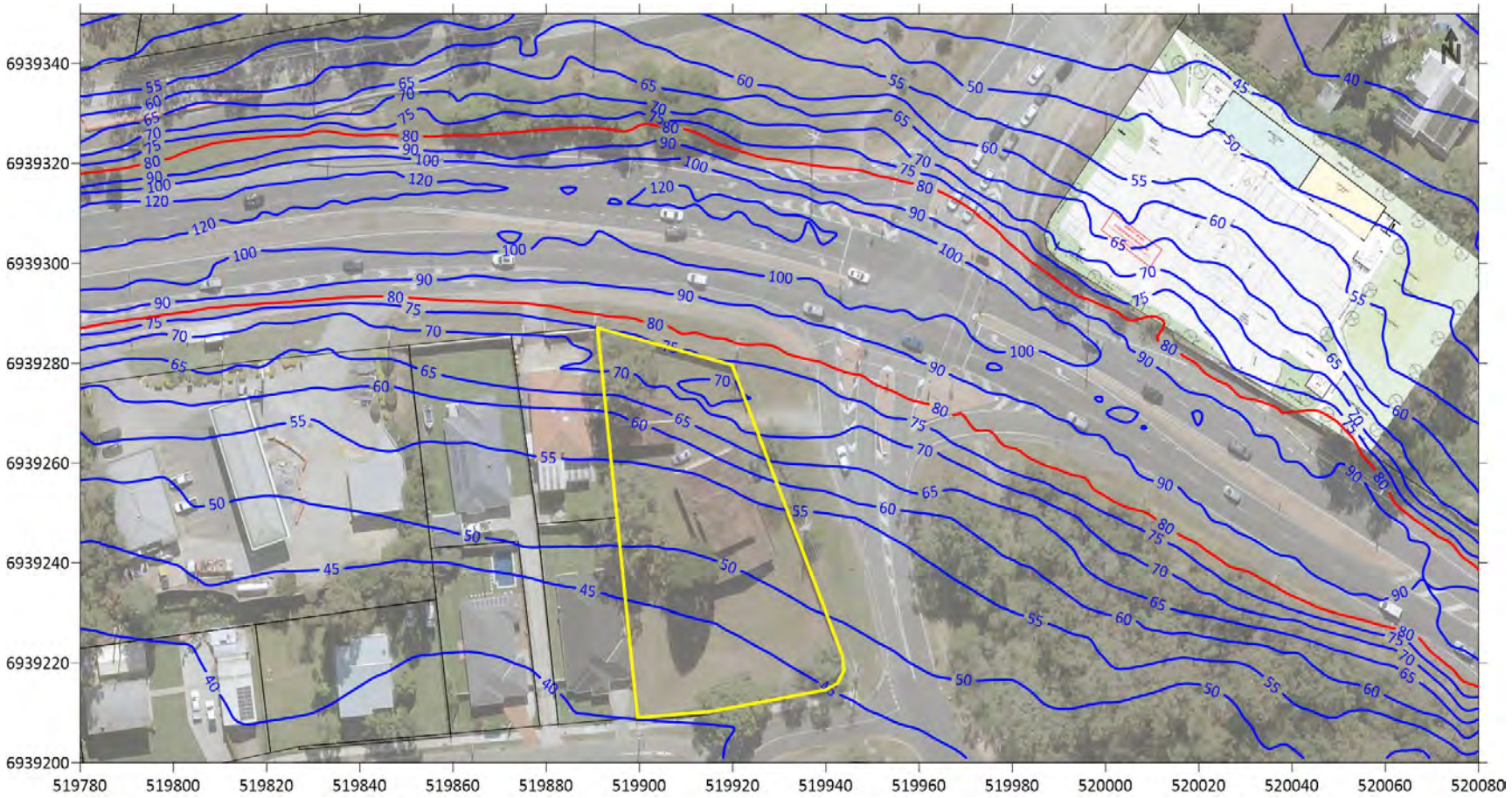
Predicted road traffic emissions for Year 2023 from Beenleigh Redland Bay Road

Figure A8.5	Source	Pollutant	Averaging Period	EPP(Air) Objective	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	$PM_{2.5}$	Annual Average	8	µg/m³	30-Mar-2023



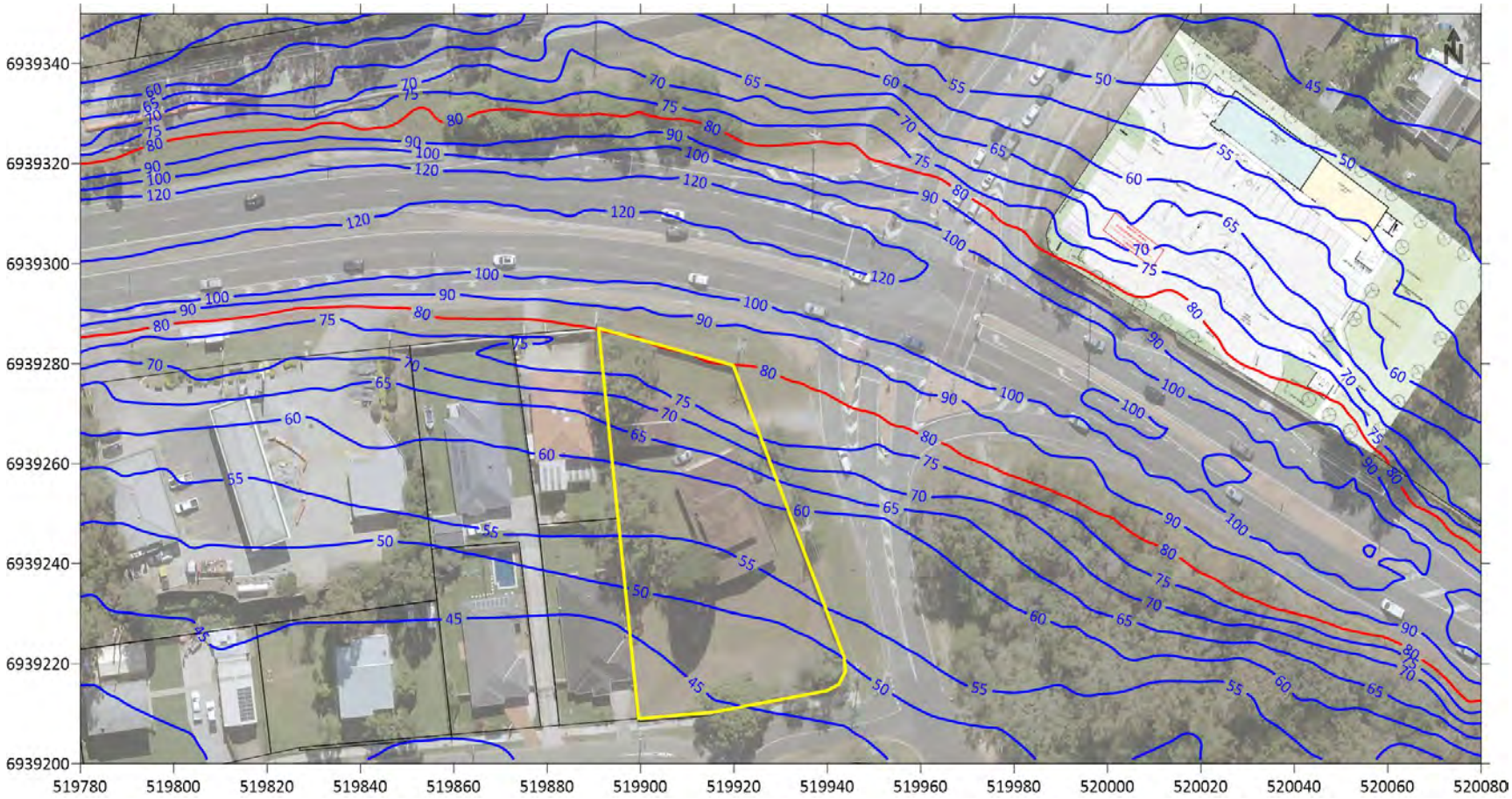
Predicted road traffic emissions for Year 2033 from Beenleigh Redland Bay Road

Figure A8.6	Source	Pollutant	Averaging Period	EPP(Air) Objective	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	$PM_{2.5}$	Annual Average	8	µg/m³	30-Mar-2023



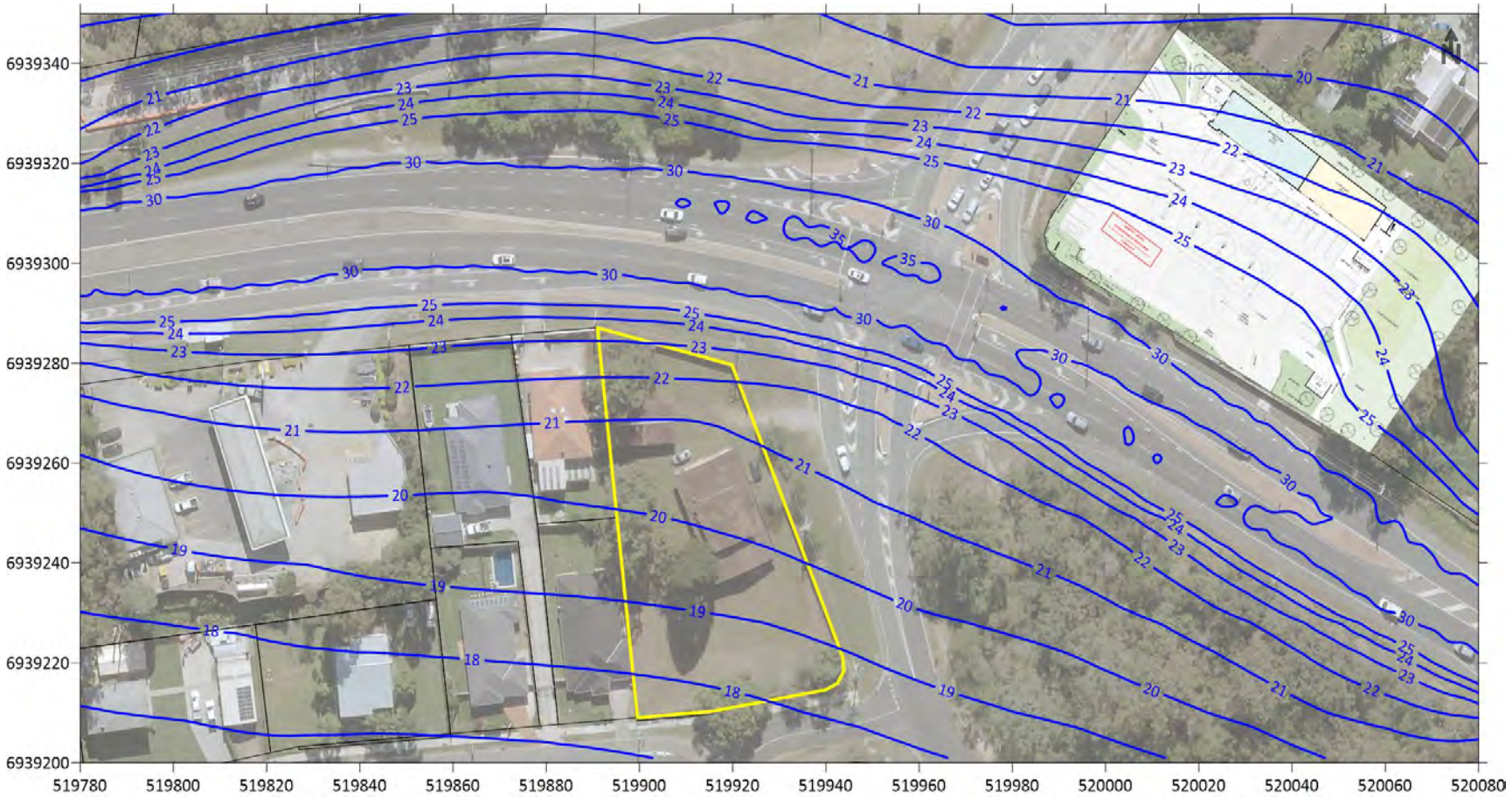
Predicted road traffic emissions for Year 2023 from Beenleigh Redland Bay Road

Figure A8.7	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	PM_{10}	1-hour average 99.9th percentile	80	µg/m³	30-Mar-2023



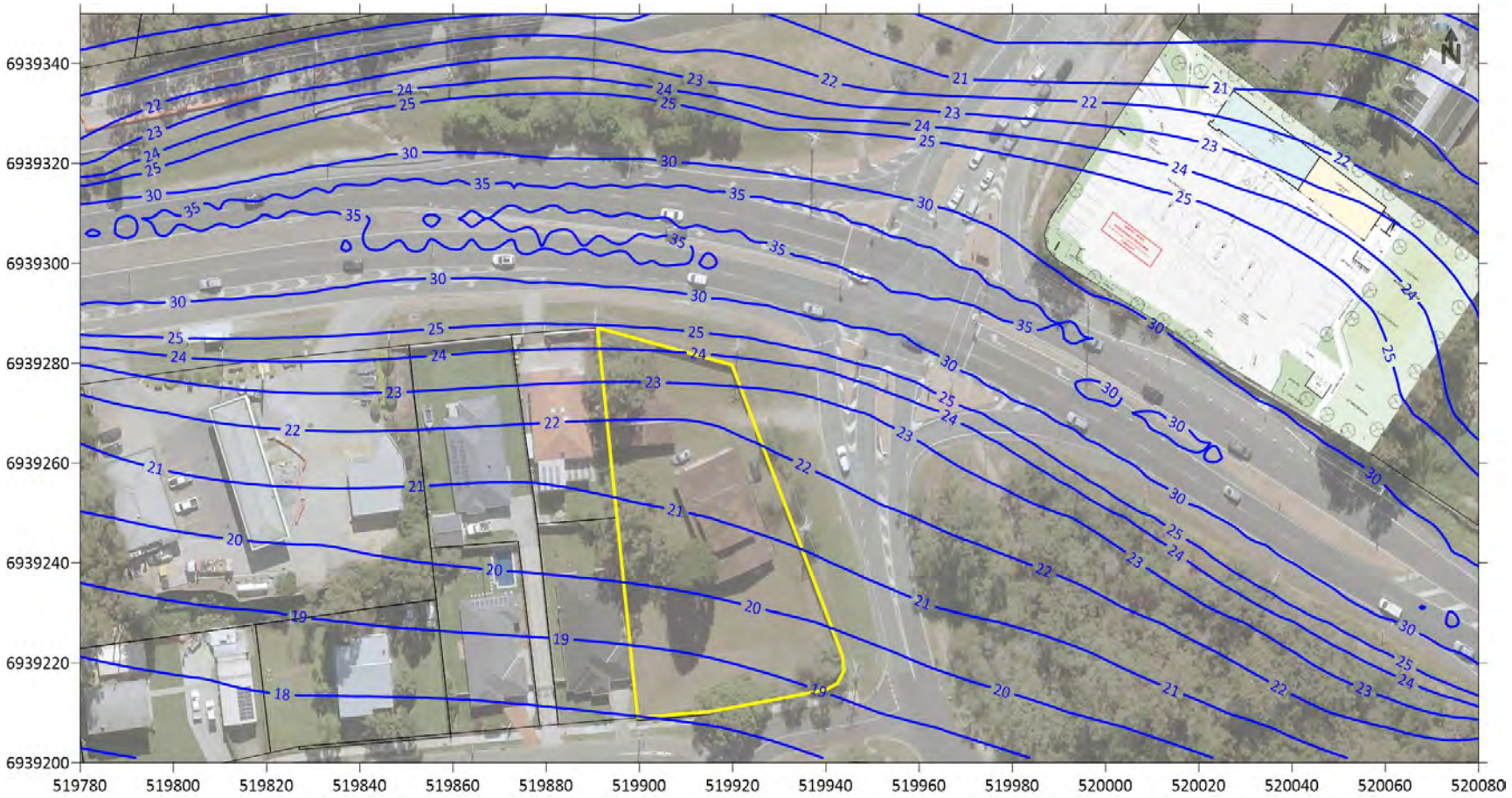
Predicted road traffic emissions for Year 2033 from Beenleigh Redland Bay Road

Figure A8.8	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	PM_{10}	1-hour average 99.9th percentile	80	µg/m³	30-Mar-2023



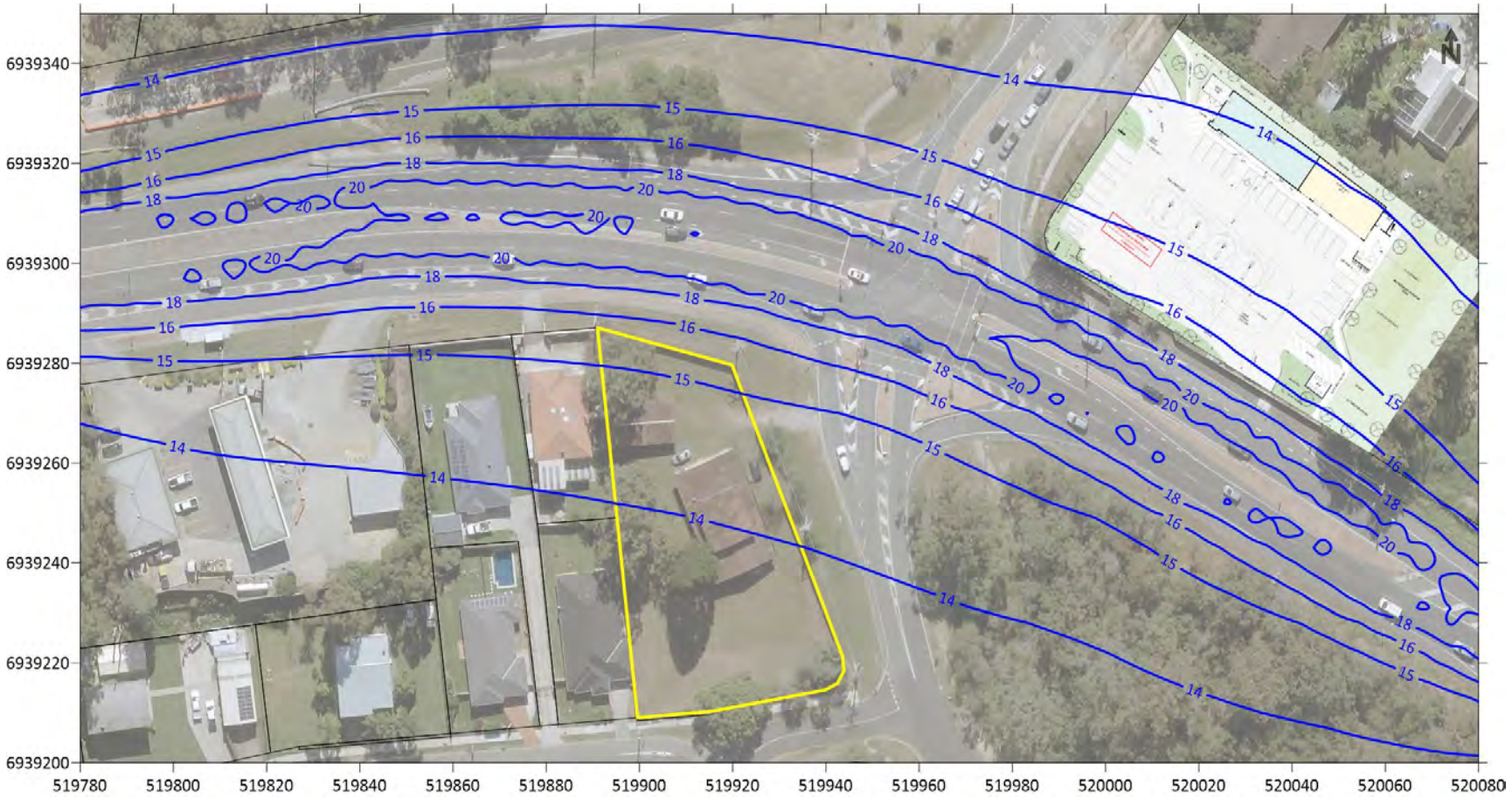
Predicted road traffic emissions for Year 2023 from Beenleigh Redland Bay Road

Figure A8.9	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	PM_{10}	Maximum 24-hour average	50	µg/m³	30-Mar-2023



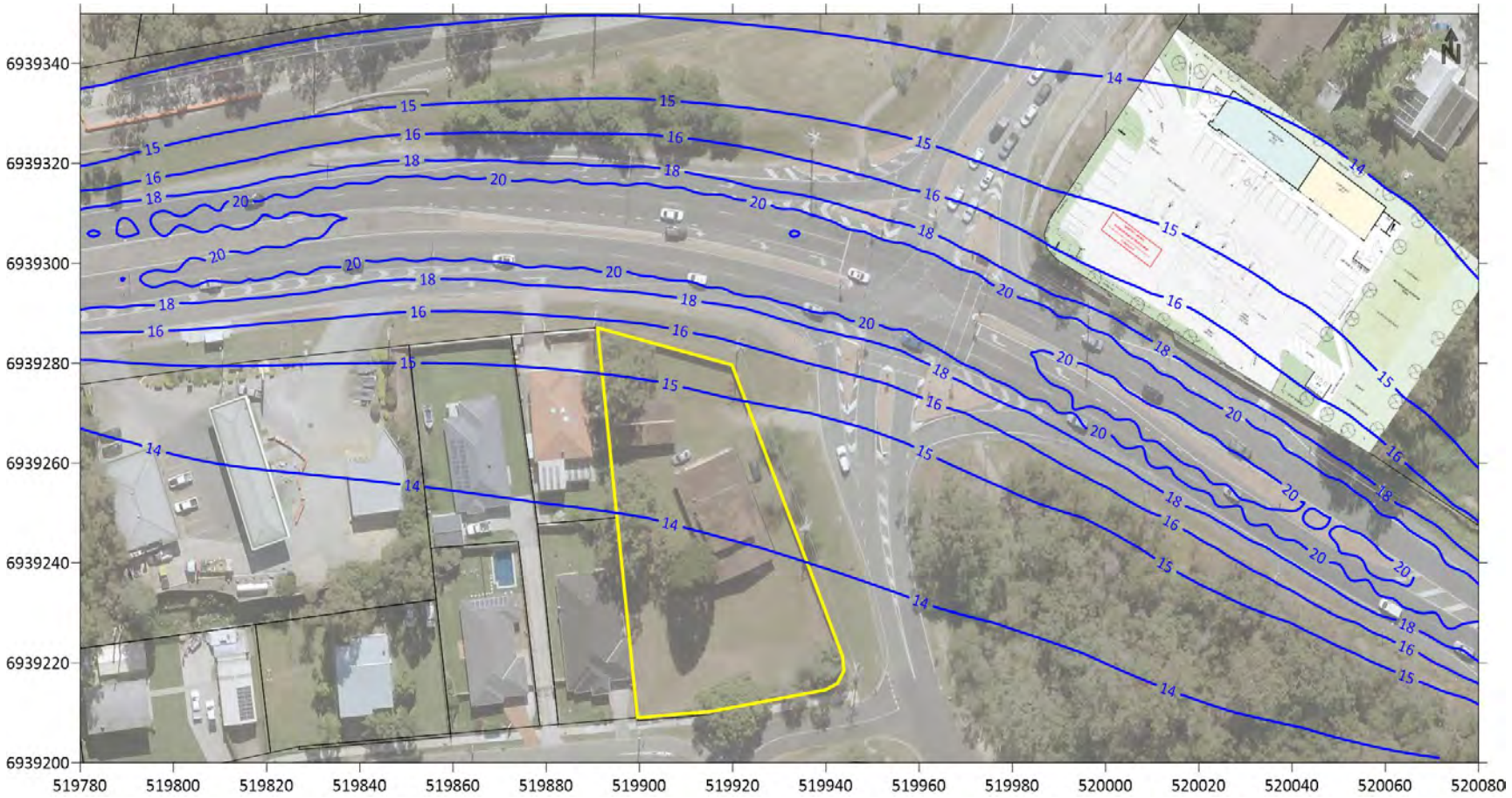
Predicted road traffic emissions for Year 2033 from Beenleigh Redland Bay Road

Figure A8.10	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	PM_{10}	Maximum 24-hour average	50	µg/m³	30-Mar-2023



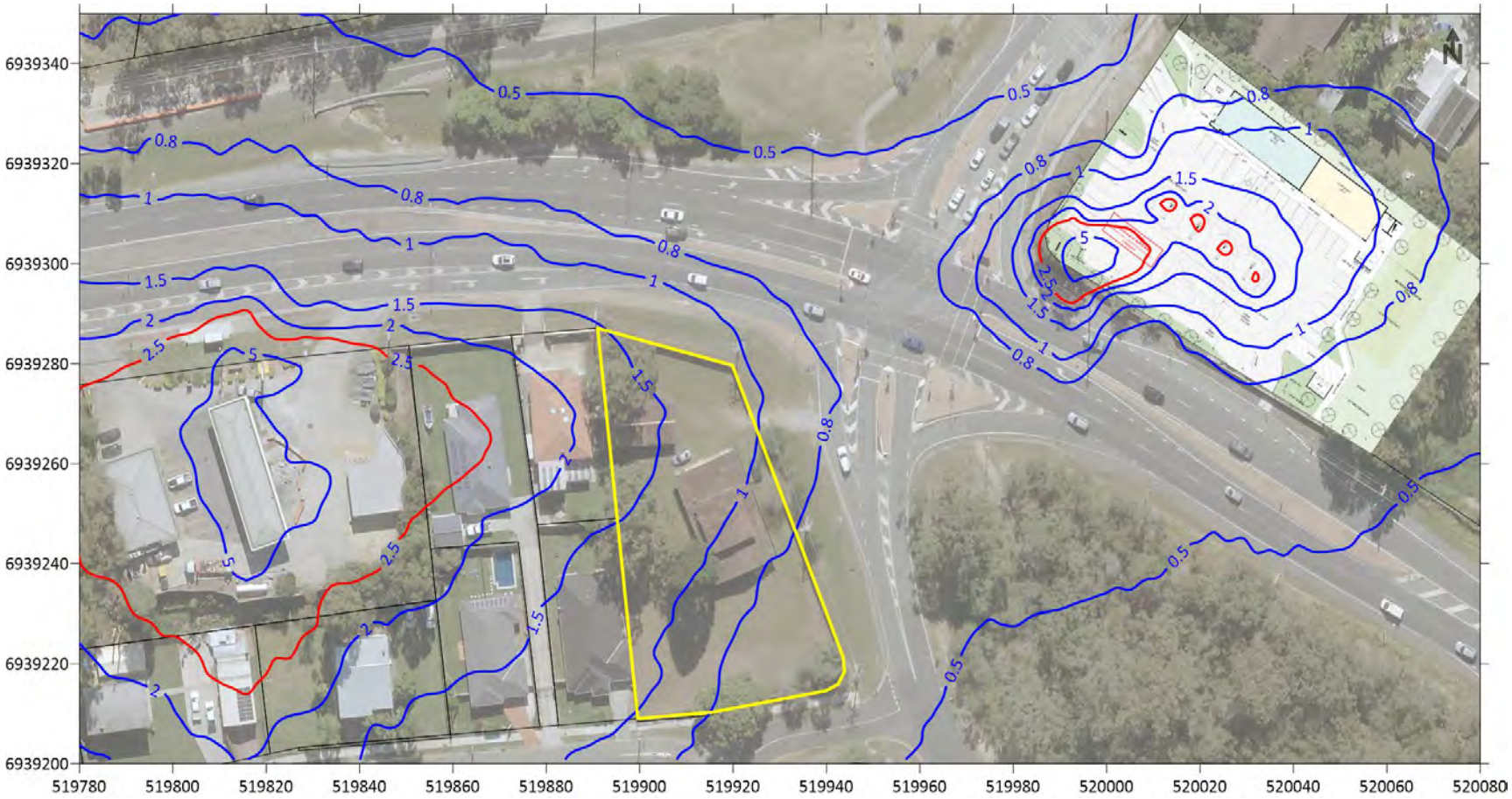
Predicted road traffic emissions for Year 2023 from Beenleigh Redland Bay Road

Figure A8.11	Source	Pollutant	Averaging Period	EPP(Air) Objective	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	PM_{10}	Annual Average	25	µg/m³	30-Mar-2023



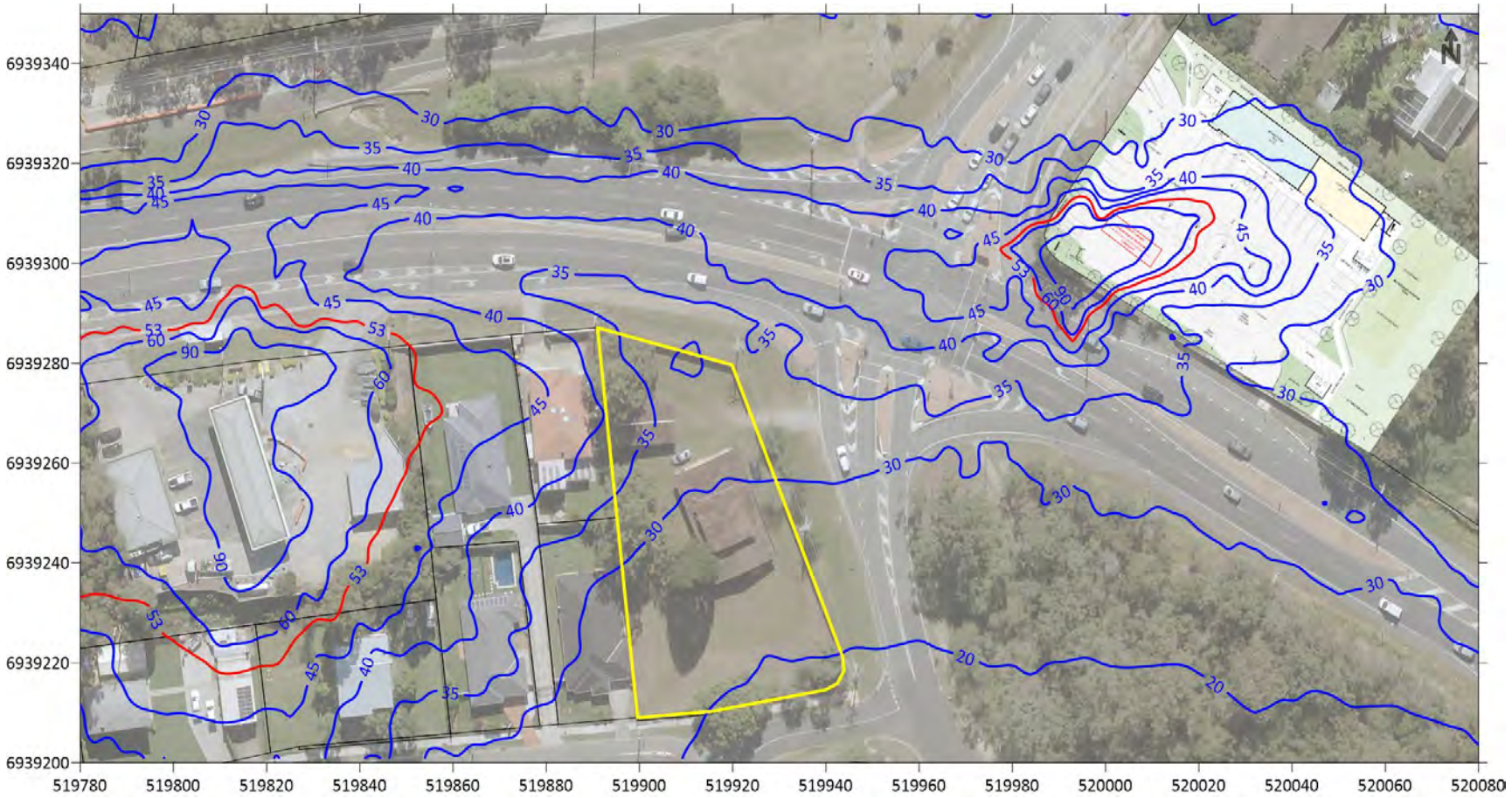
Predicted road traffic emissions for Year 2033 from Beenleigh Redland Bay Road

Figure A8.12	Source	Pollutant	Averaging Period	EPP(Air) Objective	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Ambient	PM_{10}	Annual Average	25	µg/m³	30-Mar-2023



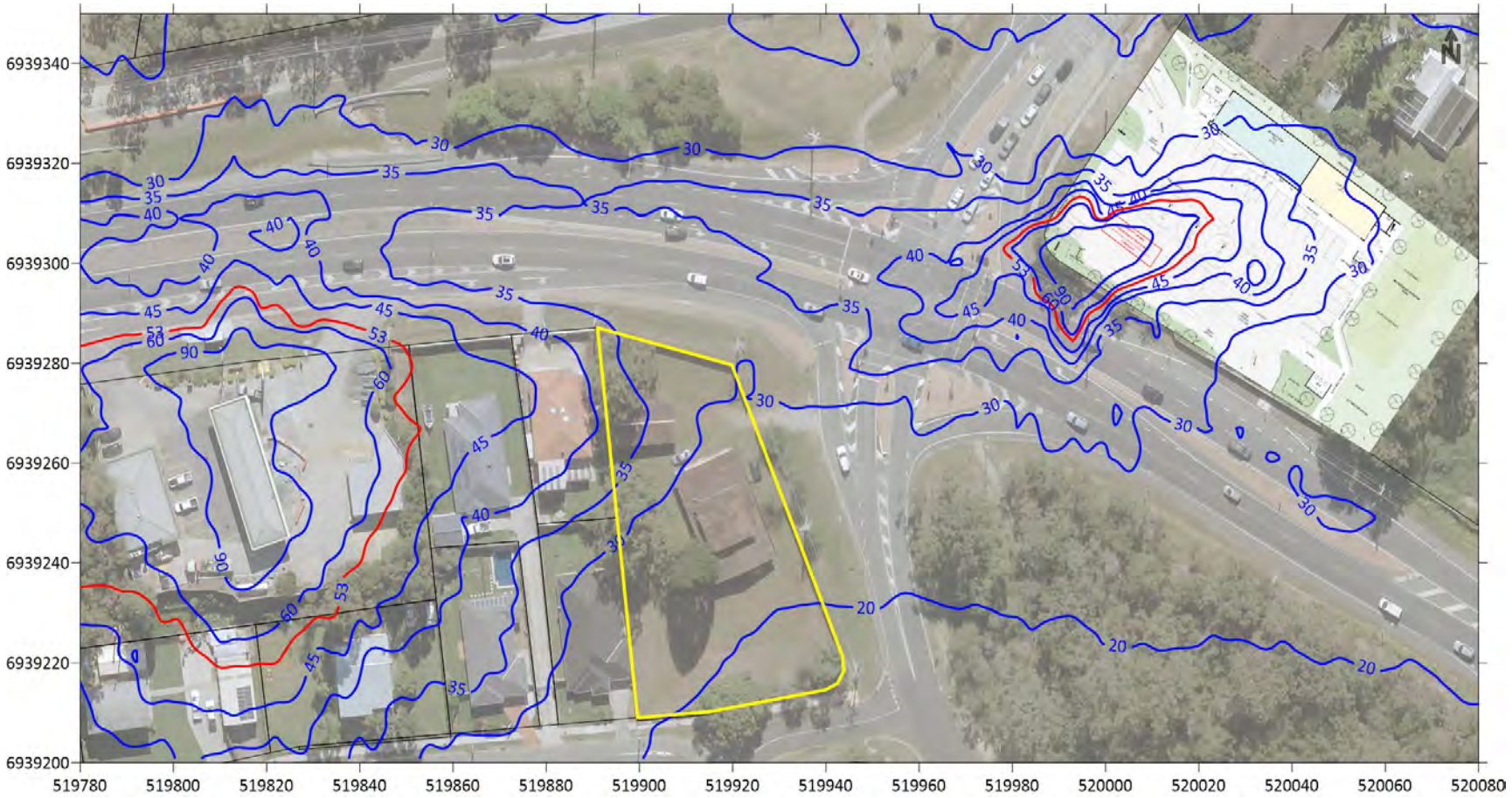
Predicted odour emissions for each service station with fuel sales at Conservatively high 10ML/annum each

Figure A8.13	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	711 Servo (east) + BP Servo (west)	Odour	1-hour average 99.5th percentile	2.5 odour unit reverse amenity	ou/m^3	30-Mar-2023



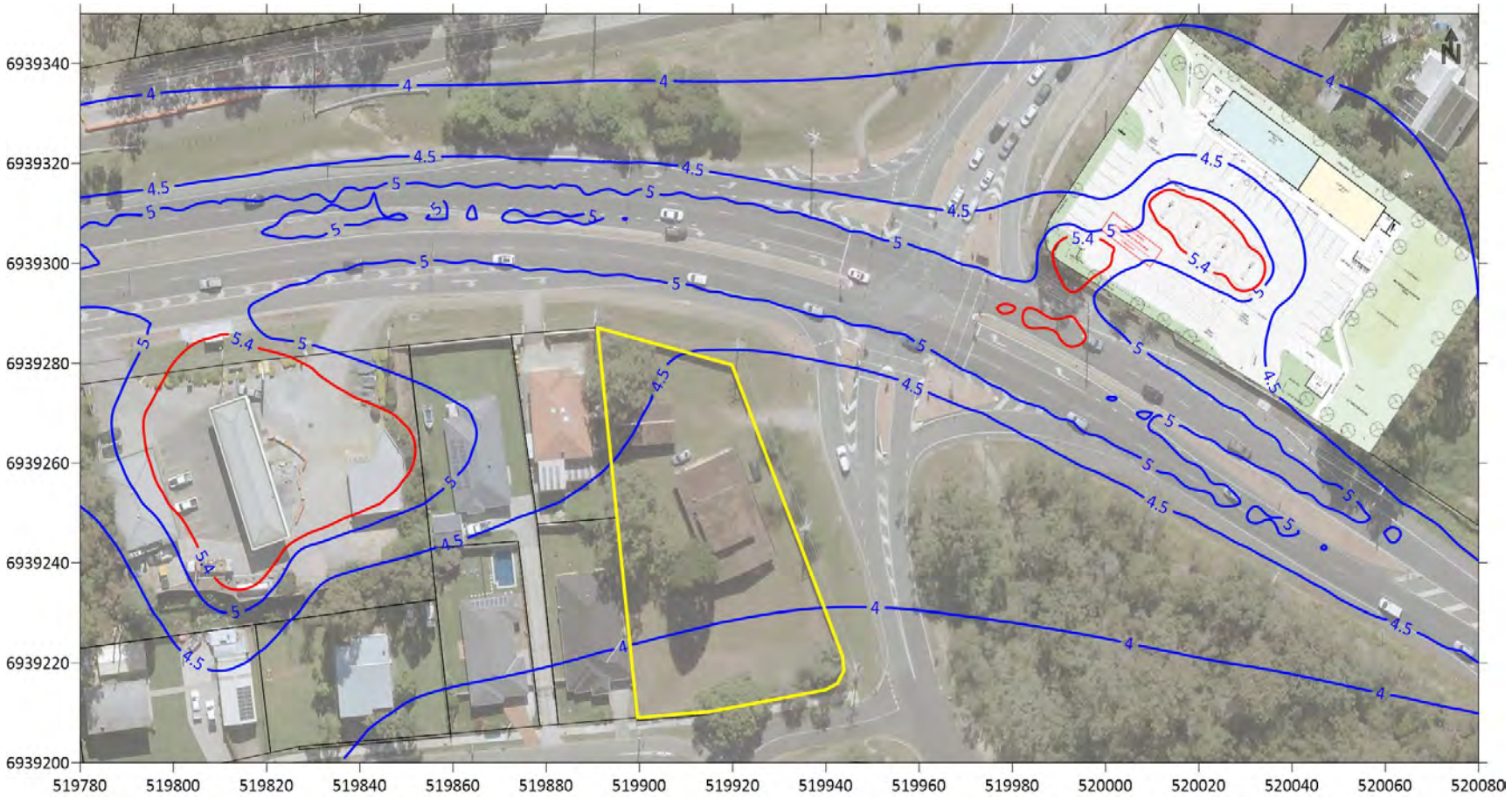
Predicted cumulative road traffic, service stations (Conservatively high 10ML/annum each) and ambient Benzene for Year 2023

Figure A8.14	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Servos + Ambient	Benzene	3-minute average 99.9th percentile	53	µg/m³	30-Mar-2023



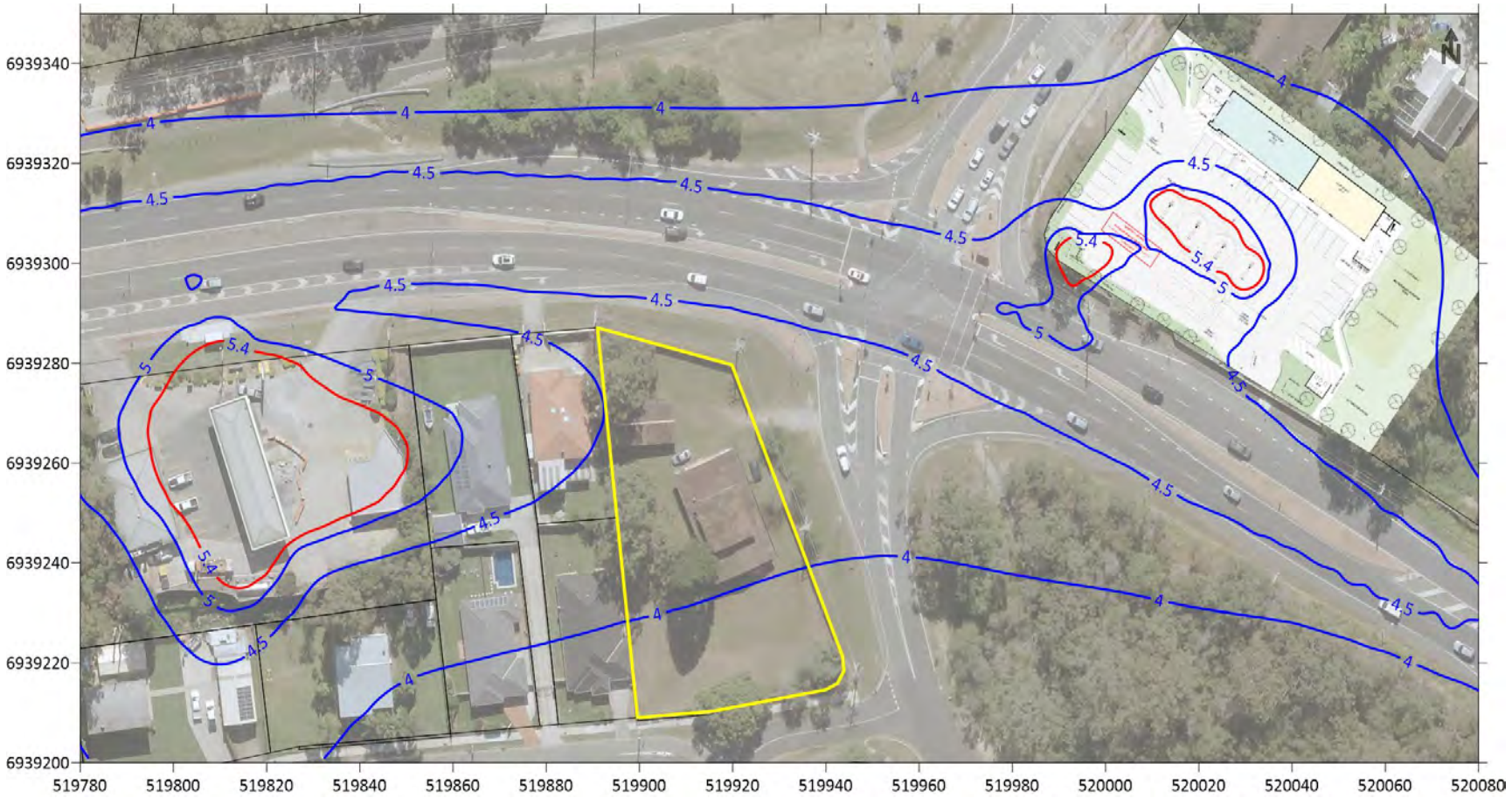
Predicted cumulative road traffic, service stations (Conservatively high 10ML/annum each) and ambient Benzene for Year 2033

Figure A8.15	Source	Pollutant	Averaging Period	Logan Air Emission Standard	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Servos + Ambient	Benzene	3-minute average 99.9th percentile	53	µg/m³	30-Mar-2023



Predicted cumulative road traffic, service stations (Conservatively high 10ML/annum each) and ambient Benzene for Year 2023

Figure A8.16	Source	Pollutant	Averaging Period	EPP Objective	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Servos + Ambient	Benzene	Annual Average	5.4	µg/m³	30-Mar-2023



Predicted cumulative road traffic, service stations (Conservatively high 10ML/annum each) and ambient Benzene for Year 2033

Figure A8.17	Source	Pollutant	Averaging Period	EPP Objective	Units	Date
mwa ENVIRONMENTAL	Road Traffic + Servos + Ambient	Benzene	Annual Average	5.4	µg/m³	30-Mar-2023