Astute Environmental Consulting

Report

Air Quality– Proposed Childcare Centre 1032 Richmond Road, Marsden Park

Swaab

Job: 20-172

Date: 23 May 2021

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Job Number	20-172
Client	Swaab
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1 INTRODUCTION

1. This report has been prepared by Geordie Galvin of Astute Environmental Consulting on behalf of Swaab who act for Universal Property Group Pty Ltd (UPG).

2. UPG has filed a Class 1 appeal in the Land and Environment Court against Blacktown City Council's ("Council") refusal of a development application (DA-19-01484) for a centre based child care facility (100 places) with a six story mixed use building (Blocks A & B) on land described as Proposed Lot 8 in the proposed subdivision of 13 super lots.

3. Specifically, this report was prepared in response to the Statement of Facts and Contentions for Case number 2019/00376150 (20 February 2020), Universal Property Group Pty Ltd (Applicant), v Blacktown City Council (Respondent).

4. A Google Earth image of the site generated using QGIS is shown below in Figure 1-1. The subject site and the nearby roads are labelled in the figure.

5. The ground floor plan is shown in Figure 1-2. Block A is the Northern Block, and block B is the southern block.

6. It is proposed that the centre based child care facility will be in Block A. The blue arrow in Figure 1-2 shows the proposed outdoor play area.

   Based on Figure 1-2 and other information provided to me, I understand that the play area, which is the closest point of the child care centre to Richmond road, will be a distance of at least 20 metres.

Figure 1-1: Nearby Roads and Subject Site

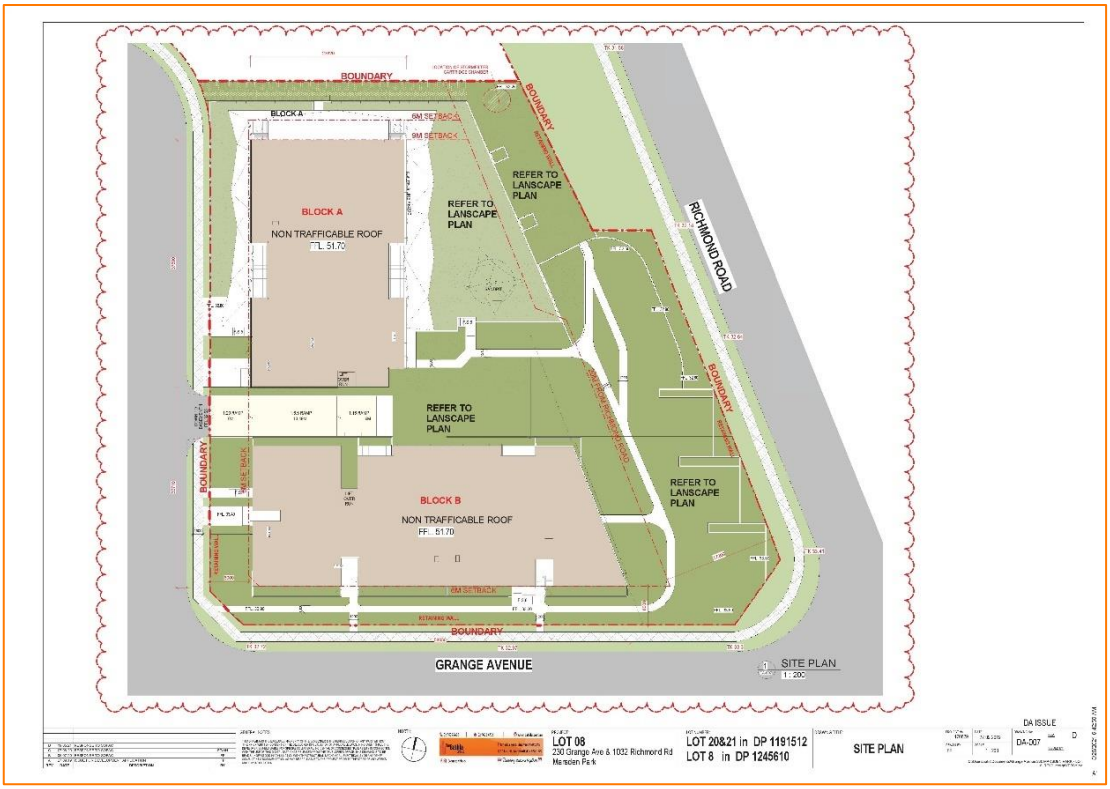

Figure 1-2: Site Plan – DA-007 DA Issue Rev D

1.1 Qualifications of the Author

7. Geordie Galvin is the Director, and a Principal Environmental Engineer at Astute Environmental Consulting Pty Ltd. He holds both Bachelors (BEng (Env Eng)) and Masters (MEng (Env)) degrees in Environmental Engineering.

8. Geordie has over 20 years' experience specialising in air quality assessment and is the current Chair of the Odour Special Interest Group within the Clean Air Society of Australia and New Zealand (CASANZ). Geordie is a Member of Engineers Australia, and a Member Engineer of the American Society of Agricultural and Biological Engineers.

9. Geordie was awarded Accredited Air Quality Professional (A.AirQual) Status by the Clean Air Society of Australia and New Zealand (CASANZ) in 2012.

10. Geordie has consulted to industry as well as government clients throughout Australia and overseas.

11. Geordie was assisted in preparing this report by Mr Warrick Shillito. Mr Shillito has over 10 years' experience in Air Quality, and holds a Bachelor of Applied Science in Environmental Science from the University of Queensland.

1.2 Expert Witness Code of Conduct

12. 'I have read a copy of the Expert Code of Conduct and agree to be bound by it. A copy of Schedule 7 to the Uniform Civil Procedure Rules 2005 (UCPR) and Part 31, Division 2 of the UCPR has been provided to me by my instructing solicitors'.

1.3 Contentions

13. The Statement of Facts and Contentions (SOFAC) for Case 2019/00376150 (this matter) is dated 20 February 2020.

14. In Part B: Contentions, air quality is listed as a contention in Section 10 which states, “Insufficient information has been provided to enable a proper assessment of the proposed child care centre”.

15. Particular 10.2 states the following is required:

> Submission of an Air Quality Assessment Report by a suitably qualified air quality professional to demonstrate that the proposed child care centre can meet air quality standards given proximity to Richmond Road, in accordance with relevant legislation and guidelines, as required under Part 3.6 of the Child Care Planning Guidelines.

2 AIR QUALITY ASSESSMENT (ROAD TRAFFIC)

16. The key Contention raised by Council in the SOFAC relates to vehicle emissions and their potential to impact on the site. These are the “air quality” impacts referred to in the SOFAC.

17. To address the contentions with regard to air quality a screening study of road traffic emissions was performed. This is discussed further below.

2.1 Assessment Methodology

18. To assess the risk that vehicle emissions may pose, the Roads and Maritime (NSW Transport)[1] Tool for Roadside Air Quality (TRAQ) (TRMS, 2018; TRMS, 2012) was used.

19. TRAQ is a screening tool used to assess the potential for air quality impacts from roadways. It is noted that TRAQ does not provide accurate air quality assessments but rather uses worst-case scenarios (TRMS, 2018) and is therefore conservative.

20. As such TRAQ is a worst-case model. Using a series of inputs including vehicle movements, vehcile types and speeds, emissions are calculated. The emission estimation methodology within TRAQ is detailed in the user manual (TRMS, 2012).The CALINE4 (CALTRANS, 2018) (line source air dispersion model) is then used to predict concentrations near the road.

21. The two roads relevant to the site are Richmond Road and Grange Avenue. Of these, Richmond Road the highest traffic volumes.

2.2 Assessment Inputs

22. The required inputs for running TRAQ (for calculating and modelling emissions) include:

- The road type (e.g. residential, arterial, highway)
- The number of lanes (assumed to be parallel);
- For each lane:

[1] “RMS”

  - The traffic volume (i.e. daily flow and peak hourly flow as % of daily total);
  - The peak hour speed;
  - The road gradient (for each lane);
  - The road length (for each lane);
- The traffic mix (either custom or use default values

23. The first point above relates to road type. The road type is important as this is directly related to the emissions input into CALINE4. Based on the definitions in the user manual, Richmond Road falls into the Commercial Arterial Category which is defined as "*Regular intersections, many signalised, characterised by stop-start flow, moderate to high intersection delays and queuing with higher V/C ratios. Speed limits predominantly 60 to 80 km/h, 90 km/h in outlying areas. RMS road types include arterials, state highways*".

24. As shown in Figure 1-1, Richmond Road consists of four lanes with turning lanes with a median strip separating the south and north bound lanes with a width of just over 10 metres.

25. RMS does not have data on its website for up to date traffic counts.

26. To obtain data for this assessment we examined data from a number of sources including:

    a. Traffic and parking Assessment Report (Varga Traffic Planning, 2019);

    b. Marsden Park Industrial (Employment) Precinct Transport and Access Study (Arup, 2009);

    c. North West Growth Centre Indicative Layout Plan Revision – Traffic and Transport Model Year 2036 (Road Delay Solutions, 2009);

    d. Marsden Park North Traffic & Transport Assessment 23-August-2018 Reference 60329496 (AECOM, 2018); and

    e. Transport for NSW, Traffic Volume Viewer, Windsor Road, Station ID 71024.

27. We were unable to find any peak hour traffic statistics for either Richmond Road nor Grange Avenue. Therefore, traffic data for Windsor Road was used to provide information on trends in the area, in particular the peak hour traffic as a percentage of daily traffic, which is an input in the TRAQ model.

28. The daily total vehicle movements for Windsor road were calculated from the hourly data by day downloaded from the RMS website are summarised below in Figure 2-1. The straight blue line in the figure is a line of best fit for the data which shows an increase per year in the order of 1%. The data for 2014 was incomplete so is not shown.

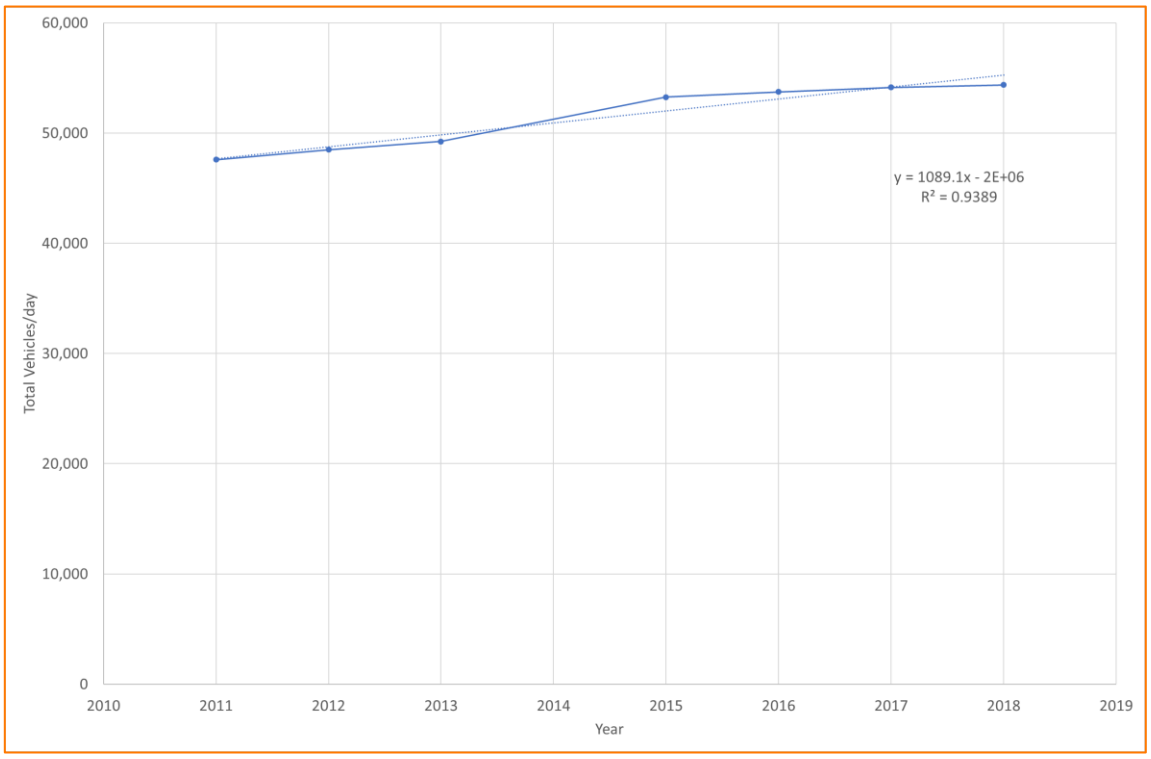

Figure 2-1: Windsor Road Daily Total Traffic Flows by Year Calculated on Daily Hourly Data (inbound and outbound)

29. A key input for TRAQ is the peak hour traffic as a percentage of daily traffic. As no data was available for Richmond Road, the Windsor Road data was interrogated. The results of this are shown in Figure 2-2.

30. The data in Figure 2-2 shows that the peak hourly flow was higher in 2011 to 2013 up to 8.5%, but for the last three years, the maximum (either AM or PM) was 7.5%.

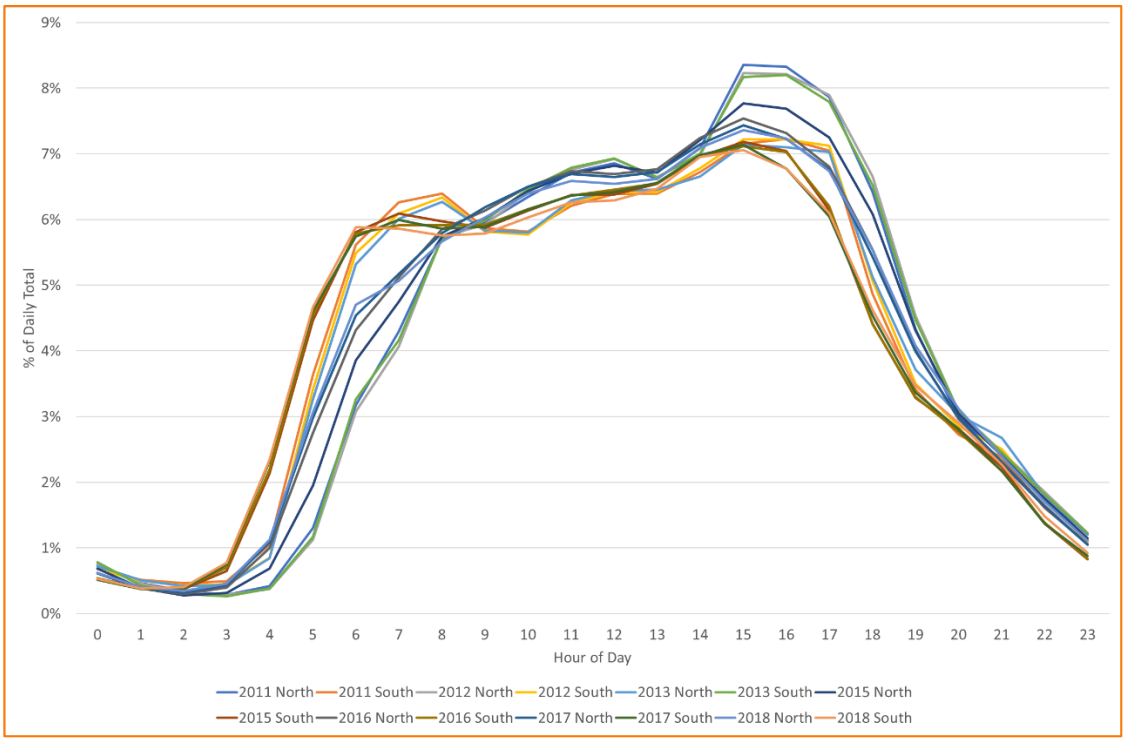

Figure 2-2: Hourly Total Traffic Flows by Year Inbound and Outbound Windsor Road

31. TRAQ enables the user to run a number of scenarios which can be selected from the years 2008, 2011, 2016, 2021, 2026, 2031, 2036. The difference between the years is that the vehicle fleet changes in terms of emissions. This is because improvements in emission controls being adopted by vehicle manufacturers over time is included and therefore emissions per vehicle are expected to reduce over time.

32. As recent traffic data was not available from RMS, the reports in Paragraph 26 were used to derive traffic volumes for the assessment.

33. The Marsden Park Industrial (Employment) Precinct Transport and Access Study (Arup, 2009) highlighted that Richmond Road was a two lane road historically carried daily traffic volumes in the range of 20,000 to 22,000 vehicles per day but at the date of publication, this had risen to approximately 25,000 vehicles per day north of the M7 post M7 opening.

34. Arup predicted that by 2036, Richmond Road would have traffic volumes in the order of 39,000 to 58,000 vehicles per day depending on where on Richmond Road the traffic was estimated. South of Grange Avenue near the subject site was estimated to be 58,000 vehicles a day.

35. The North West Growth Centre Indicative Layout Plan Revision – Traffic and Transport Model Year 2036 (Road Delay Solutions, 2009) contains peak estimated traffic volumes for the years 2016, 2021 and 2036. These are summarised below in Table 1 for the closest location to the site, which is on Richmond Road, north of Garfield Road.

Table 1: Summary of ILP Model Predictions (Table 3 – Road Delay Solutions 2009)

Location	2016 AM Peak	2016 PM Peak	2021 AM Peak	2021 PM Peak	2036 AM Peak	2036 PM Peak
Richmond Road NB N Garfield	960	1,236	1,075	1,324	1,206	1,991
Richmond Road SB N Garfield	1,576	752	1,625	3,336	2,093	1,473
Total	**2,536**	**1,988**	**2,700**	**4,660**	**3,299**	**3,464**

36. The values in Table 1 are peak AM (morning) and PM (afternoon) volumes. Using the data in Figure 2-2, in particular the peak daily volume of 7.5%, the total daily follow can be estimated.

37. The predicted daily volumes are summarised below in Table 2.

Table 2: Predicted Daily Volumes Richmond Road

Year	Maximum AM or PM Peak	Assumed Peak Traffic as % of Daily Total	Predicted Daily Volume
2016	2,536	7.5%	33,813
2021	4,660		62,133
2036	3,464		46,187

38. When looking at Table 2 it can be seen that the 2036 volume is less than that which was predicted by Arup for the same year.

39. The Marsden Park North Traffic & Transport Assessment 23-August-2018 Reference 60329496 (AECOM, 2018) included traffic counts for Richmond Road as well as future predictions.

40. AECOM (2018) state that Richmond Road carries approximately 32,200 vehicles per day (which is consistent with Table 2 above) in the vicinity of Garfield Road West. This is consistent with the information in Arup (2009).

41. The traffic growth shown in AECOM (2018) is also consistent with that measured at Windsor Road (~1% a year) however the heavy vehicle percentage in Table 5 and Table 6 of AECOM (2018) which details a 2017 traffic survey is relatively high in the order of 7-20% depending on where and when it was measured.

42. The location closest to the subject site is “Richmond Road – south of Grange Avenue” which had an average heavy vehicle percentage of 16% in the morning and 9% in the afternoon. The morning peak volume was 2,144 vehicles (both directions) and the evening peak was 2,420 vehicles (both directions). These values are relatively consistent with those in Table 1 for 2016 with the exception that the AM peak in Table 1 was unexpected as peak hours typically occur in the PM period.

43. With regard to the heavy vehicle percentages, AECOM (2018) concluded that "The traffic recorded in the study area includes additional traffic that is associated with **construction activities**[2] of the ongoing development of the surrounding NWGA precincts including Marsden Park and Vineyard, as well the upgrade of Richmond Road and Schofields Road".

44. AECOM (2018) also included estimated peaks for 2036 (Table 18 of AECOM 2018). This included an AM peak of 6,527 and a PM peak of 7,522 for Marsden Park. These values are higher than those in Arup (2009) for 2036 but likely take into account different assumptions and inputs. Based on a daily peak of 7.5% and the values above, the daily volume would be ~100,000 vehicles per day. Based on other reports including Arup (2009) this volume is considered unrealistic, and therefore the 2036 volumes from Arup (2009) and TTPP (2018) were assessed.

45. Based on the information above, the following traffic volumes were modelled:

    a. 2016 – 33,813 vehicles per day based on Arup (2009), marginally higher than AECOM (2018);

    b. 2021 – 62,133 vehicles per day based on Road Delay Solutions (2009);

    c. 2036 – two runs:

        i. 71,920 vehicles per day – Based on TTPP (2018) where the PM peak is 7.5% of daily total; and

        ii. 58,000 vehicles per day – Based on Table 3 of Arup (2009).

46. Other inputs used in the modelling are summarised below in Table 3.

[2] This was bolded in AECOM 2018.

Table 3: TRAQ Inputs and Assumptions

Input	Adopted Value	Comment
Road Type	Commercial Arterial	Regular intersections, many signalised, characterised by stop-start flow, moderate to high intersection delays and queuing with higher V/C ratios.
Vehicle Speed	Default - 38 km/hr	Default
Number of lanes	4	Based on previous design of Richmond road to 2036 – See AECOM (2018) and current road layout.
Median Strip	10 m	Based on existing aerial photography between lanes 2 and 3.
Peak Hour Traffic as percentage of daily traffic	8%	Based on Richmond Road Traffic data
24-hour VKT weighted average speed	Default	Default
Traffic Mix	Highway/Freeway	Values for Highway/Freeway Manually entered to reflect the higher number of heavy vehicles. 64% Petrol Passenger, 20.4% Rigid Truck and Articulated Truck.
Grade	0%	Flat
Length of Road	1km	Default. Only required for Greenhouse Gas Calculations
Season and Cold Start	Worst Case and Yes	
Local Land use and Air Quality Environment	Residential and Sydney South West	

47. As an example, the TRAQ setup screen for the 2016 scenario is shown below in Figure 2-3.

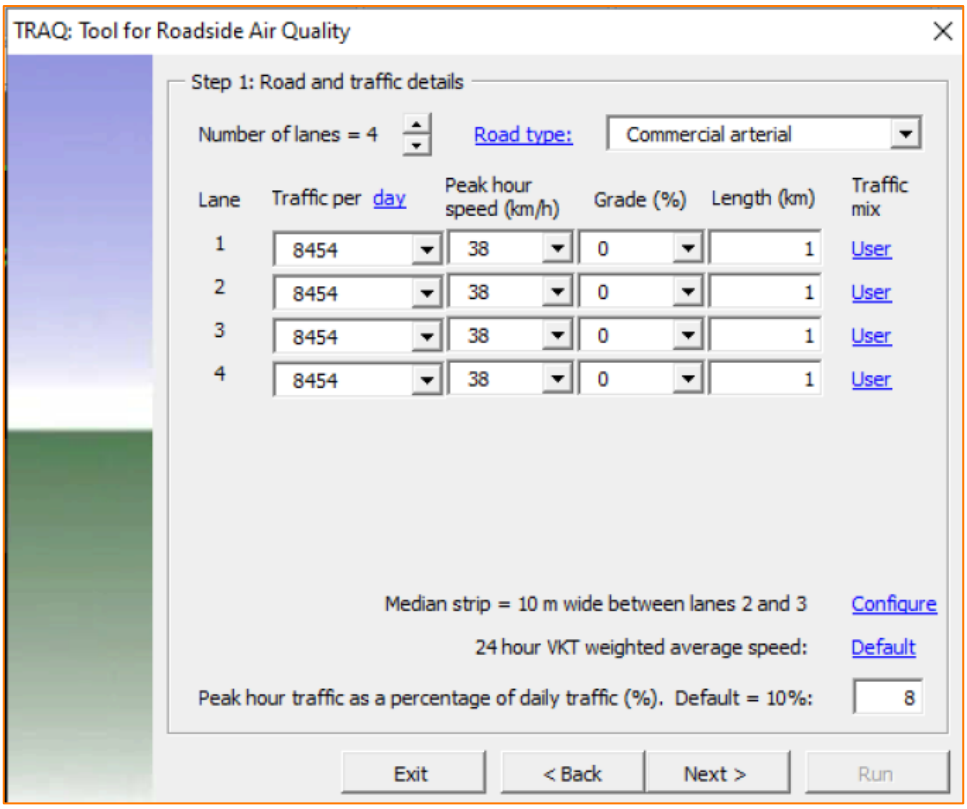

Figure 2-3: 2016 TRAQ Setup Screen

2.3 Air Quality Criteria

48. The air quality criteria in New South Wales are detailed in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA, 2016) ("the approved methods").

49. The criteria used in TRAQ are detailed below in Table 2-4.

50. A check of the approved methods confirmed that the criteria in Table 2-4 are consistent with the criteria for the same compounds in the current version of the approved methods.

Table 2-4: Impact Assessment Criteria from TRAQ

Pollutant	Averaging Time	Criteria	Units
Carbon monoxide	1 hour	30	mg/m^3
	8 hour	10	mg/m^3
Nitrogen dioxide	1 hour	246	µg/m^3
	Annual	62	µg/m^3
Particulate matter (PM_{10})	24 hour	50	µg/m^3
	Annual	25	µg/m^3

2.4 Results

51. The results for Scenario 1 (2016), Scenario 2 (2021) and Scenario 3 (2036)[3] are detailed in Table 2-5 to Table 2-8 respectively. The concentrations are worst case based on the inputs detailed above.

Table 2-5: Results – Scenario 1 - 2016

Compound	Averaging Time	Distance from Curb	Predicted Concentration µg/m3 (with background)	Criterion µg/m3	Assessment
Carbon Monoxide	1 Hour	0 m	1.8	30	Compliant
		10 m	1.4		Compliant
		20 m	1.4		Compliant
	8 Hour	0 m	1.6	10	Compliant
		10 m	1.3		Compliant
		20 m	1.3		Compliant
NO_2	1 hour	0 m	101.2	246	Compliant
		10 m	85.8		Compliant
		20 m	86.1		Compliant
	Annual	0 m	23.8	62	Compliant
		10 m	20.7		Compliant
		20 m	20.8		Compliant
PM_{10}	24 Hour	0 m	45.8	50	Compliant
		10 m	33.5		Compliant
		20 m	30.7		Compliant
	Annual	0 m	23.5	25	Compliant
		10 m	18.6		Compliant
		20 m	17.5		Compliant

[3] ~58,000 and ~71,000 vehicles per day

Table 2-6: Results – Scenario 2 - 2021

Compound	Averaging Time	Distance from Curb	Predicted Concentration µg/m3 (with background)	Criterion µg/m3	Assessment
Carbon Monoxide	1 Hour	0 m	1.9	30	Compliant
		10 m	1.5		Compliant
		20 m	1.4		Compliant
	8 Hour	0 m	1.7	10	Compliant
		10 m	1.4		Compliant
		20 m	1.3		Compliant
NO_2	1 hour	0 m	113.1	246	Compliant
		10 m	92.8		Compliant
		20 m	92.9		Compliant
	Annual	0 m	26.2	62	Compliant
		10 m	22.1		Compliant
		20 m	22.2		Compliant
PM_{10}	24 Hour	0 m	57.1	50	Non Compliant
		10 m	38.3		Compliant
		20 m	34.3		Compliant
	Annual	0 m	28.0	25	Non Compliant
		10 m	20.5		Compliant
		20 m	18.9		Compliant

Table 2-7: Results – Scenario 2 - 2036 – 58,000 vehicles

Compound	Averaging Time	Distance from Curb	Predicted Concentration µg/m3 (with background)	Criterion µg/m3	Assessment
Carbon Monoxide	1 Hour	0 m	1.5	30	Compliant
		10 m	1.3		Compliant
		20 m	1.2		Compliant
	8 Hour	0 m	1.4	10	Compliant
		10 m	1.2		Compliant
		20 m	1.2		Compliant
NO_2	1 hour	0 m	91.1	246	Compliant
		10 m	77.5		Compliant
		20 m	77.6		Compliant
	Annual	0 m	21.8	62	Compliant
		10 m	19.1		Compliant
		20 m	19.1		Compliant
PM_{10}	24 Hour	0 m	52.3	50	Non Compliant
		10 m	36.2		Compliant
		20 m	32.7		Compliant
	Annual	0 m	26.1	25	Non Compliant
		10 m	19.7		Compliant
		20 m	18.3		Compliant

Table 2-8: Results – Scenario 2 - 2036 – 71,920 vehicles

Compound	Averaging Time	Distance from Curb	Predicted Concentration µg/m3 (with background)	Criterion µg/m3	Assessment
Carbon Monoxide	1 Hour	0 m	1.6	30	Compliant
		10 m	1.3		Compliant
		20 m	1.3		Compliant
	8 Hour	0 m	1.4	10	Compliant
		10 m	1.2		Compliant
		20 m	1.2		Compliant
NO_2	1 hour	0 m	99.9	246	Compliant
		10 m	82.9		Compliant
		20 m	82.8		Compliant
	Annual	0 m	23.6	62	Compliant
		10 m	20.2		Compliant
		20 m	20.1		Compliant
PM_{10}	24 Hour	0 m	58.2	50	Non Compliant
		10 m	38.6		Compliant
		20 m	34.4		Compliant
	Annual	0 m	28.5	25	Non Compliant
		10 m	20.6		Compliant
		20 m	19.0		Compliant

3 DISCUSSION

52. The Results shown above were generated using TRAQ for the 2016, 2021 and 2036 scenarios.

53. For the 2016 scenario, compliance was predicted at all distances from the curb for all pollutants assessed.

54. For the 2021 and 2036 scenarios, compliance was not at the curb, however was achieved within 10 metres of the curb.

55. Key to the interpreting the results is the proposed site layout. This was shown in Figure 1-2. It can be seen in Figure 1-2 that there is a set back from Richmond Road to the outdoor area of at least 15 metres, and the building is set back further again.

56. The tool as noted above is a first pass assessment method, and as compliance has been predicted at 5 metres from the curb of the roads, the risk in the outdoor play area is lower than if non-compliance were predicted.

57. TRAQ only considers a single road (i.e. multiple lanes and no intersections), by assuming the same traffic volume on Grange Avenue as Richmond Road, and applying that buffer, the predicted setback from Grange Avenue is considered conservative.

58. As shown in Figure 2-2, the peak period for impacts based on traffic volumes is the afternoon. This is consistent with a number of other roads in western Sydney.

59. This is important as the assessment is based on the peak hourly flow across all seasons. As vehicle numbers correlate with predicted impacts, limiting access during the period (i.e. peak traffic period) would further reduce the risk (i.e. the predicted concentrations are based on peak hour events during poor dispersion conditions).

60. In, simple terms, this means to reduce potential risks to children, children's access to the play area after 4 pm on days during peak traffic events when dispersion is poor (i.e. winter) or general air quality is low should be limited. The NSW Department of Planning Industry & Environment has an Air Quality Category system where the current air quality is ranked from very good to extremely poor (https://www.dpie.nsw.gov.au/air-quality). Where an area has air quality categories of poor or worse, the site operator should consider the recommendations provided by DPIE and NSW Health's Activity Guide (https://www.health.nsw.gov.au/environment/air/Pages/aqi.aspx) with regard to outdoor activities during these conditions.

61. It is noted that the proposed hours of operation are 7 am to 6 pm therefore children are unlikely to be outdoors during the entirety of the peak period.

62. This also needs to be considered in terms of time of year. The TRAQ assessment looks at worst case impacts. These occur during winter when dispersion is poor. This means that the risk can be further reduced if children are not allowed to play during peak traffic events, especially in winter.

63. Limiting the time of day and year that children have access to the outdoor areas could form part of a management plan for the site which in turn forms part of conditions of approval.

64. Further mitigation which could be applied to the site include consideration of air condition inlet locations and also vegetation.

65. With regard to air conditioning, this can be achieved by putting any air inlet vents to the north or east of the subject site away from the roadways. The use of air conditioning in the mornings and evening during peak traffic events throughout the year would also offer further benefit.

66. Finally, vegetation has been shown to offer benefits from an air quality perspective. This is because trees not only filter particulate matter but they also enhance dispersion. Numerous studies have examined this for agricultural operations (Raupach & Leys, 1999; Parker, et al., 2012; Liu, et al., 2015), and the same concepts apply to dispersion of vehicle emissions. By using vegetation as a barrier, this would further reduce potential risks. This would be additional to the management methods detailed above.

4 RESPONSE TO CONTENTION

67. The particulars were summarised in 1.3 and a response is provided below.

4.1 10.2 – Air Quality

68. The contention highlighted that the child care facility would potentially be impacted by road emissions.

69. The results of the Air Quality assessment, which investigated potential air pollution associated with vehicle movements was detailed in Section 2 above.

70. The results indicated that compliance was predicted at 10 metres and beyond the curb for all scenarios based on Richmond Road Traffic. No outdoor activities (i.e. play areas) are located within 10 metres of the curb.

71. Based on the results above we conclude:

    a. Children should have reduced access the outdoor areas during peak traffic periods (4 pm to 6 pm) during winter or where the air quality category is poor or worse;

    b. Ventilation systems should have inlets as far as practicable away from roadways and the systems should be run during peak traffic periods (4 pm to 6 pm) to maintain a suitable degree of indoor air quality; and

    c. An air quality management plan should be developed which incorporates the points above with regard to minimising the risk of air quality impacts.

5 REFERENCES

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