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Report

171-189 PARRAMATTA ROAD GRANVILLE – AIR QUALITY ASSESSMENT

CATYLIS PROPERTIES PTY LTD

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1 INTRODUCTION

This report has been prepared by Pacific Environment for Catylis Properties Pty Ltd (Catylis) to assess the effects of traffic emissions on air quality at a proposed mixed residential commercial building at 171-189 Parramatta Road and 58 & 60 Victoria Street, Granville. The NSW Department of Planning and Environment's (DP&E) State Environmental Planning Policy (Infrastructure) (the 'Infrastructure SEPP') has been taken into consideration, as well as the relevant air quality criteria listed by the NSW Environment Protection Authority (EPA).

The assessment of the impacts of motor vehicle emissions is based on the use of a computer model to determine the dispersion of emissions and to predict ground-level concentrations of the various exhaust components in the area close to the road. The primary pollutants of concern are carbon monoxide, oxides of nitrogen, particulate matter and to some extent sulphur dioxide.

2 LOCAL SETTING AND PROJECT DESCRIPTION

The proposal involves the demolition of existing buildings at 171-189 Parramatta Road, Granville and 58 & 60 Victoria Street, Granville. The location of the site is shown in **Figure 2.1**. The proposal is primarily residential in use and will include two towers of up to 35 storeys each with two storeys of commercial use facing Parramatta Road. At the base of the towers will be a four storey podium which extends along Parramatta Road and Victoria Street. Vehicle access to the site will be from both Parramatta Road and Victoria Street.

Figure 2.1: Location of proposed development site

3 LEGISLATIVE SETTING

The Infrastructure SEPP refers to guidelines which must be taken into account where development is proposed in, or adjacent to, specific roads and railway corridors under clauses 85, 86, 87, 102 and 103 of the SEPP. These guidelines (hereafter referred to as The Guideline) were developed by the NSW DP&E (**DP&E, 2008**). While The Guideline does not refer to it specifically, there is an additional Clause 101 which aims "*to prevent or reduce the potential impact of traffic noise and vehicle emissions on development adjacent to classified roads.*"

Clauses 85, 86 and 87 do not apply to this assessment as they refer specifically to rail corridors. Clause 102 refers to roadways with an annual average daily traffic volume of 40,000 or more, which does not apply in this case. In addition, Clause 103 refers to excavation beneath road corridors and is therefore a structural issue rather than an air quality issue.

Air quality has therefore been considered in the context of The Guideline and Clause 101. The Guideline recommends that air quality should be a design consideration for any development upon land:

- Within 10 metres of a congested collector road (traffic speeds of less than 40 km/hr at peak hour) or a road grade > 4% or heavy vehicle percentage flows > 5%.
- Within 20 metres of a freeway or main road (with more than 2,500 vehicles per hour, moderate congestion levels of less than 5% idle time and average speeds of greater than 40 km/hr).
- Within 60 metres of an area significantly impacted by existing sources of air pollution (road tunnel portals, major intersection / roundabouts, overpasses or adjacent major industrial sources).
- Ws considered necessary by the approval authority based on consideration of site constraints, and associated air quality issues.

This development is proposed to be set back approximately 10 m from Parramatta Road, which is congested with speeds less than 40 km/hr at peak times. As such, air quality has been investigated further to assure compliance with the EPA criteria outlined in **Section 4**.

4 AIR QUALITY CRITERIA

Motor vehicles emit a number of pollutants that are known to be potentially harmful to human health. These pollutants are carbon monoxide (CO), nitrogen oxides (NO_x), hydrocarbons (HC), sulphur dioxide (SO_2) and particulate matter. Each of these pollutants has the capacity to adversely affect health if the concentration is too great over a particular exposure period. Emissions of SO_2 are minor, due to the low sulphur content of fuels in Australia, and are not considered further in this assessment.

The NSW EPA has historically noted air quality goals determined by the World Health Organisation (WHO), the United States Environmental Protection Agency (US EPA) and the National Health and Medical Research Council of Australia (NHMRC).

The NSW EPA specifies ground-level concentration (glc) criteria for criteria pollutants (**EPA, 2005**), as listed in **Table 4.1**. The basis of these air quality goals and, where relevant, the safety margins which they provide, are outlined in the following sections.

Table 4.1: NSW EPA Air Quality Assessment Criteria

Pollutant	Goal	Averaging period	Source
Carbon monoxide (CO)	30 mg/m³ 10 mg/m³	1-hour 8-hour	WHO (2000) NEPC (1998)
Nitrogen dioxide (NO_2)	246 µg/m³ 62 µg/m³	1-hour Annual	NEPC (1998) NEPC (1998)
Ozone (O_3)[a]	214 µg/m³ 171 µg/m³	1-hour 4-hour	NEPC (1998) NEPC (1998)
Particulate matter < 10 µm (PM_{10})	50 µg/m³ 30 µg/m³	24-hour Annual	NEPC (1998) EPA (1998)

mg/m³ – milligrams per cubic metre
ppm – parts per million
µg/m³ – micrograms per cubic metre

4.1 Carbon Monoxide

Carbon monoxide is produced from incomplete combustion of fuels, where carbon is only partially oxidised instead of being fully oxidised to form carbon dioxide.

Carbon monoxide can be harmful to humans because its affinity for haemoglobin is more than 200 times greater than that of oxygen. When it is inhaled it is taken up by the blood and therefore reduces the capacity of the blood to transport oxygen. This process is reversible and reducing the exposure will lead to the establishment of a new equilibrium. A period of three hours is the approximate time required to reach fifty per cent of the equilibrium value.

Symptoms of carbon monoxide intoxication are lassitude and headaches, however these are generally not reported until the concentrations of carboxyhaemoglobin in the blood are in excess of ten per cent of saturation. This is approximately the equilibrium value achieved with an ambient atmospheric concentration of 70 mg/m³ for a person engaged in light activity. However, there is evidence that there is a risk for individuals with cardiovascular disease when the carboxyhaemoglobin concentration reaches four per cent, and the World Health Organisation (WHO) recommends that ambient concentrations be kept to values which would protect individuals from exceeding the four per cent level.

The 1-hour and 8-hour goals noted by the EPA provide a significant margin for safety to protect a wide range of people in the community including the very young and elderly. The 1-hour and 8-hour goals are 30 mg/m³ and 10 mg/m³, respectively.

4.2 Oxides of Nitrogen

Oxides of nitrogen (NO_x) are produced by motor vehicles when nitrogen from the air is oxidised at high temperature and pressure in the combustion chamber.

NO_x emitted by motor vehicles are comprised mainly of nitric oxide (NO, approximately 95 per cent at the point of emission) and nitrogen dioxide (NO_2, approximately 5 per cent at the point of emission). NO is much less harmful to humans than NO_2 and is not generally considered a pollutant at the concentrations normally found in urban environments. Monitoring data collected in Sydney (**RTA, 1997**) indicate that close to the roadways, nitrogen dioxide would make up from 5 to 20 per cent by weight of the total oxides of nitrogen.

[a] It should be noted that direct predictions are not made for ozone since it results from photochemical reactions that take some time to occur.

Concern with nitric oxide is related to its transformation to nitrogen dioxide and its role in the formation of photochemical smog. Nitrogen dioxide has been reported to have an effect on respiratory function, although the evidence concerning effects has been mixed and conflicting.

The NSW EPA has not set any air quality goals for NO, however it has adopted the NEPM standard 1-hour and annual average goals for NO_2 as shown in **Table 4.1**.

4.3 Particulate Matter

Particulate matter is emitted by motor vehicles due to incomplete combustion of fuels, additives in fuels and lubricants, worn material that accumulates in the engine lubricant, and brake and tyre wear.

The presence of particulate matter in the atmosphere can have an adverse effect on health and amenity. Larger particles PM_{10}, that is, those greater than 10 µm, generally adhere to the mucus in the nose, mouth, pharynx and larger bronchi and from there are removed by either swallowing or expectorating. Finer particles can enter bronchial and pulmonary regions of the respiratory tract, with increased deposition during mouth breathing, which increases during exercise. The health effects of particulate matter are further complicated by the chemical nature of the particles and by the possibility of synergistic effects with other air pollutants such as sulfur dioxide.

The current proposal will be assessed using the NEPM standards for particulate matter adopted by the NSW EPA and shown in **Table 4.1**.

4.4 Sulfur Dioxide

Sulfur dioxide (SO_2) is an acid gas that can have harmful effects on the respiratory system as well as on vegetation and building materials. It is however a minor component of motor vehicle emissions, due to the low sulfur content of Australian petrol, and has not been assessed quantitatively in this study. For example, the Metropolitan Air Quality Study (MAQS) (**Carnovale et al, 1997**) estimates that for the 1992 Sydney fleet, average sulfur dioxide emissions under arterial travel conditions are 0.065 g/km compared to emissions of nitrogen oxides of 2.33 g/km for the same conditions. The 1-hour average air quality goal for SO2 is 570 µg/m^3 compared with the 1-hour average goal for NO_2 which is 246 µg/m^3, given that the average SO_2 emissions are only 2% of the NO_2 emission rates, compliance with the NO_2 goal will ensure compliance with the SO_2 goal.

In addition transient emissions of above average levels of odorous sulfur compounds such as hydrogen sulfide and carbonyl sulfide (which may be smelt at concentrations as low as 5 ppb) have been noted from vehicles fitted with catalytic converters. While these compounds may produce a local short-term nuisance, they do not represent significant emissions under normal running conditions.

4.5 Vehicle Emissions and Photochemical Smog

Motor vehicle emissions have the potential to contribute significantly to photochemical smog in an urban environment. Photochemical smog is formed by the reaction between nitrogen oxides and reactive hydrocarbons in the presence of sunlight. Models for the formation of photochemical smog envisage hydrocarbon emissions mostly from motor cars, facilities for the storage of hydrocarbons or spray painting operations and so on, mixing with nitrogen oxides from either industrial sources or from motor cars. The mixture of pollution from these sources then reacts photochemically to form photochemical smog comprising mainly ozone, but also including other oxidants. At concentrations of 0.1 ppm and above the smog can affect the eyes and respiratory system and can adversely affect plants and building materials.

Ozone is not emitted directly from motor vehicles but results from photochemical reactions that take some time to occur. Concentrations close to roadways are low because fresh emissions of nitric oxide titrate out any ozone that may be present.

5 DISPERSION METEOROLOGY

This section provides a review of the dispersion conditions in the area with a view to identifying where the prevailing winds blow from (in relation to the major emission sources that are likely to affect the area) and to determine how well ventilated the area is likely to be. In addition, information on atmospheric stability[b] is also presented as this assists in assessing the rate at which emissions would be expected to disperse.

5.1 Wind Speed and Direction

Annual and seasonal windroses, prepared from data collected in 2004 by Shell at the Clyde Refinery approximately 2.5 km to the east, are presented in **Figure 5.1**. Similar windroses collected by the EPA in 1991 at their Lidcombe meteorological station approximately 6 km southeast of the development site are presented in **Figure 5.2**. The percentage of calms (winds less than 0.5 m/s) for the Shell Clyde Refinery and Lidcombe sites is 14.4 % and 16.3 % respectively.

Although the winds from the western quadrant at Lidcombe are rotated anticlockwise by between 22.5 and 45 degrees relative to those from the Shell Refinery, the two monitoring sites show similar patterns of wind and similar seasonal variations. This suggests that this part of Sydney is subject to similar conditions. Because the Shell site is closer and there is no significant intervening terrain, this data set has been chosen to represent conditions at the development site.

The most common winds are from the northwest quadrant during most of the year. Winds from the southeast quadrant become the dominant winds during the summer months and to a lesser extent during winter and spring. Winds from the west-northwest and northwest are the most common winds in winter.

[b] In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford-Turner stability class assignment scheme there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

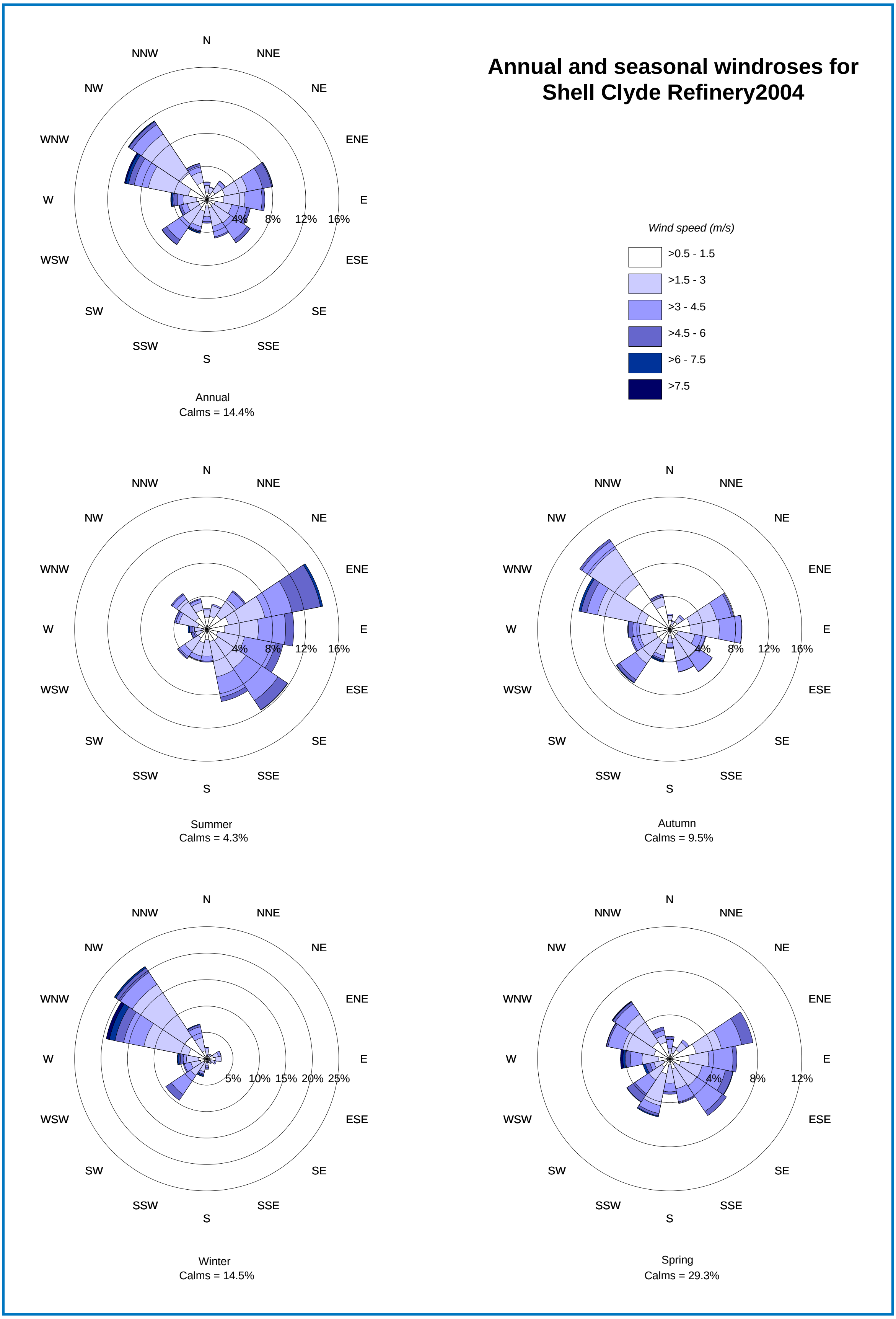

Figure 5.1: Annual and seasonal windroses for Shell Clyde Refinery 2004

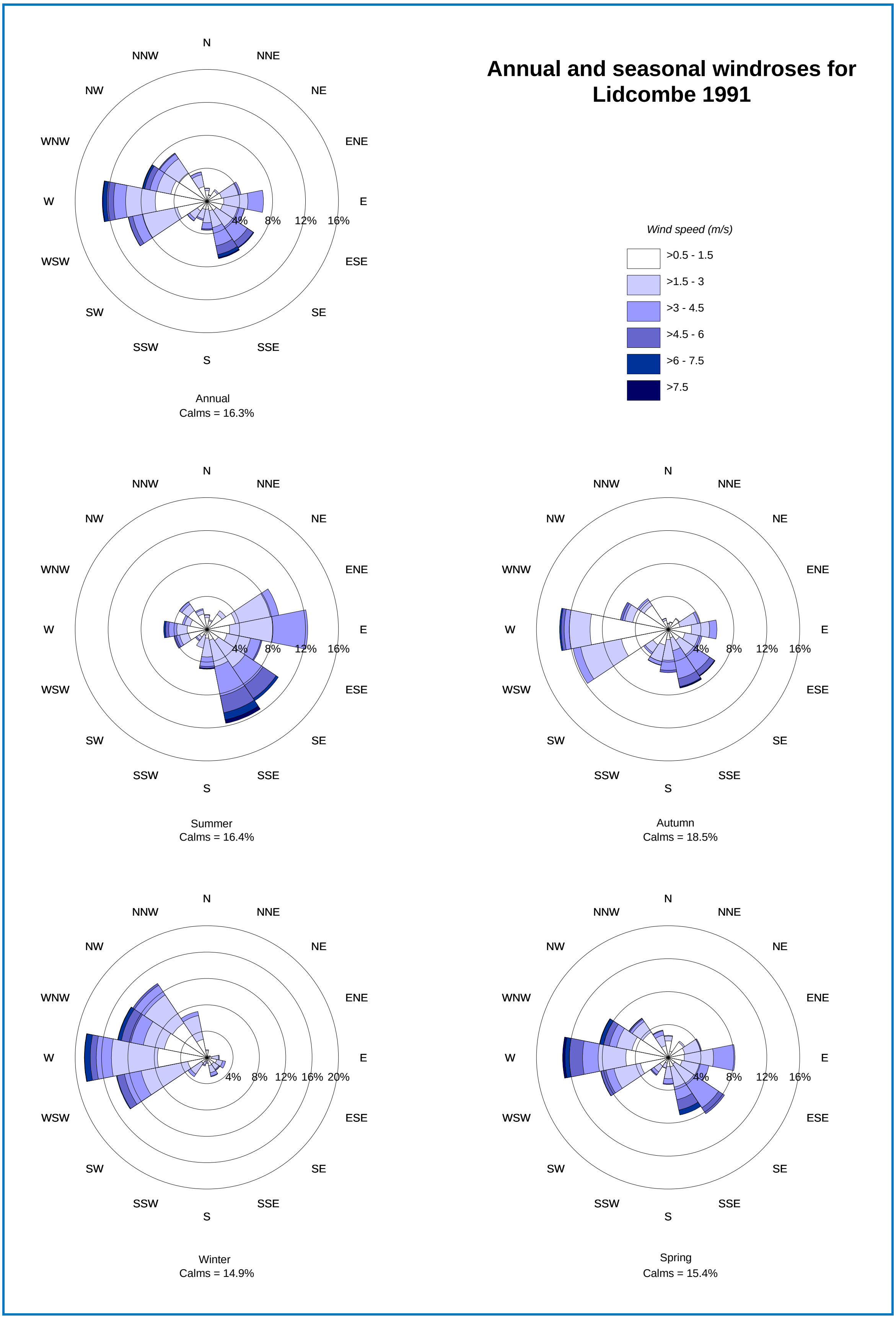

Figure 5.2: Annual and seasonal windroses for Lidcombe – 1991

5.2 Atmospheric Stability

The rate at which pollutants disperse is controlled by atmospheric stability class and mixing height[c]. **Table 5.1** provides the frequency of occurrence of the six stability classes for the Shell Clyde Refinery using the method of **Turner (1994)**. It can be seen from **Table 5.1**that D-class stability occurred approximately one third of the time. Pollutant dispersion is moderate for these conditions with stability conditions considered neutral.

Table 5.1: Frequency of occurrence of stability class

Pasquill-Guifford stability class	Frequency of occurrence (%)
A	10.9
B	10.3
C	12.9
D	33.9
E	13.2
F	18.8

5.3 Temperature and Rainfall

Temperature and rainfall data are available from the Bureau of Meteorology site located at Parramatta, north of the proposed site. The data indicate that temperatures are typical for the Western suburbs of Sydney. The annual average maximum and minimum temperatures experienced are 23.3°C and 12.1°C. January is the warmest month with a mean daily maximum temperature of 28.3°C and July is the coolest with a mean daily minimum temperature of 6.2°C.

Rainfall data show that February is on average the wettest month, with a mean rainfall reading of 106.1 mm, over 11.8 raindays. July is the driest month with an average rainfall of 45.7 mm, over an average of 7.8 raindays. The average annual rainfall is 962.6 mm and the average number of rain days annually is 120.5. These data are only of peripheral interest for the current review and will not be discussed further in this report.

6 EXISTING AIR QUALITY

There has been no air quality monitoring undertaken at the site of the proposed development. However, monitoring data collected by the NSW EPA at Chullora may be considered indicative of the air quality in the study area. This station measures CO, NO_2 and PM_{10}.

Table 6.1 shows the measured values of CO, NO_2 and PM_{10} from the monitoring station for the last six years from 2008 to 2013. Up until 2008, EPA compiled monthly monitoring reports which included summaries of monthly average and maximum readings for 1-hour and 8-hour CO, 1-hour NO_2 and 24-hour PM_{10}. From 2008 the format changed and all data can now be downloaded directly for each day. Unfortunately however, the 1-hour CO information is no longer available, but is presented as 8-hour rolling averages on a daily basis. A maximum 1-hour value of 2.8 mg/m^3 was recorded at the Prospect station in 2007 and will be used here for the cumulative analysis.

The highest 8-hour average CO value was 3.3 mg/m^3 in 2009 and this is well below the air quality criterion. The highest annual average NO_2 value was 26 µg/m^3 measured in 2011, 2012 and 2013, which is below the criterion of 62 µg/m^3. The highest 1-hour value was 121 µg/m^3, measured in 2013, which is

[c] The term mixed-layer height refers the height of the turbulent layer of air near the earth's surface, into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

below the criterion of 246 µg/m³. The highest annual average PM_{10} value was 26 µg/m³, measured in 2009, which is below the criterion of 30 µg/m³. Levels were generally high in 2009 with a total of nine results above the 50 µg/m³ criterion, the largest of which was 1,475 µg/m³ recorded during a severe dust storm which covered much of the eastern states on 23rd September. In 2009, dust levels in many areas of the state were elevated on occasion due to bushfires, as well as dust storms originating from inland NSW.

Table 6.1: Summary of EPA monitoring data at Chullora

Year	CO (mg/m³)	NO_2 (µg/m³)		PM_{10} (µg/m³)	
	Maximum 8-hour average	Maximum 1-hour average	Annual average	Median 24-hour average	Annual average
2008	2.0	84	25	19	20
2009	3.3	99	25	20	26
2010	2.9	109	24	17	18
2011	1.9	105	26	18	20
2012	2.5	121	26	17	18
2013	3.1	113	26	17	18

6.1 Estimation of Background Levels

In assessing air quality at any particular roadside site, some account needs to be taken of the background pollutant level that occurs from sources other than the road. For most pollutants (for example CO, SO_2 or NO_2) this is simple enough and estimates of an appropriate background level can be made by reviewing monitoring data. In most circumstances the background concentrations will not exceed the assessment criteria and one can determine the acceptability or otherwise of a new source by ensuring that the background concentration plus the specific source being considered do not cause the concentration to exceed the assessment criteria.

However, for 24-hour PM_{10} concentrations in large cities such as Sydney the maximum 24-hour background concentrations will, from time-to-time, exceed the 24-hour PM_{10} assessment criterion of 50 µg/m³, regardless of the emissions from specific sources such as Parramatta Road. This will occur whenever the city is affected by smoke from large bushfires or a remote dust storm, as was the case in 2009. However, this may also occur due to the combined volumes of traffic on surrounding roadways in conjunction with poor atmospheric dispersion conditions.

Under these conditions, emissions from existing traffic on Parramatta Road would cause the assessment criterion of 24-hour PM_{10} concentrations to be exceeded or increase an exceedance that would have already occurred due to these regional factors.

In selecting the background level to be added to the effect of the road, we have analysed the most recent six years of data available from the EPA's air quality monitoring site at Chullora, as discussed earlier. In most cases, concentrations of CO and NO_2 rarely reach levels near the air quality criteria. Therefore, the conservative approach of simply adding a maximum prediction to the average maximum measurement will, in most cases, achieve compliance with the EPA criteria. This is true for this assessment as will be shown later.

However, in the case of PM_{10}, this overly conservative approach is not appropriate and can be misleading. There are two main reasons for this:

- Firstly, the roadway being modelled already exists and has large volumes of traffic using it. To simply add these modelling results to measurements involves an element of double counting and can lead to a significant overestimate of concentrations. In other words, the existing traffic will already be included to some extent in the measurement data. To then add modelled concentrations, also due to this traffic, will mean including the existing traffic twice, thereby overestimating results.

- Secondly, and perhaps more significant, is the fact that the PM_{10} goal refers to a 24-hour average and not a 1-hour average. The modelling has been carried out for peak hour traffic volumes, which will obviously not occur during the whole 24-hour period. In other words, while traffic volumes will be high during those few hours of the day, they will be significantly lower at other times, leading to reduced concentrations during those times. It should also be noted that the model has conservatively used worst-case dispersion conditions combined with peak traffic flows. In reality, these worst-case dispersion conditions are likely to occur at different times in the day to the times of peak flow. This again leads to an over prediction of roadside concentrations.

It was therefore necessary to use a different approach for background PM_{10} to that adopted for CO and NO_2. The maximum of the median 24-hour average PM_{10} concentrations for each year was taken to represent a more realistic background level (as shown in **Table 6.1**). This approach removes the influence of the extreme concentrations due to extraordinary events such as bushfires and dust storms, but also provides a more conservative estimate than simply taking the highest median value over the whole monitoring period. In the case of the Chullora monitoring data, this level is approximately 20 $\mu g/m^3$.

The annual average PM_{10} concentration for 2009 was also elevated compared with the other years presented, due to bushfires and dust storms. The average monitored PM_{10} level at Chullora from 2008 to 2013 was 20 $\mu g/m^3$. This concentration has been used as indicative of the background annual average PM_{10} for this assessment.

In summary then, the following values have been assumed for background levels and will be added to model predictions to assess cumulative impacts.

- 1-hour CO – 2.8 mg/m^3
- 8-hour CO – 2.5 mg/m^3
- 1-hour NO_2 – 112 $\mu g/m^3$
- Annual average NO_2 – 25 $\mu g/m^3$
- 24-hour average PM_{10} – 20 $\mu g/m^3$
- Annual average PM_{10} – 20 $\mu g/m^3$

7 APPROACH TO ASSESSMENT

The first step in assessing air quality was to determine whether or not SO_2 emissions from nearby industry contribute significantly to ground-level concentrations at the proposed development site. In general, the emissions from tall stacks are adequately dispersed before reaching ground-level. Modelling studies undertaken for Shell (**HAS, 2007**) indicated that concentrations of SO_2 are unlikely to be exceeded at the development site, as shown below:

- 100 $\mu g/m^3$ (10-minute average)
- 50 $\mu g/m^3$ (1-hour average)
- 6 $\mu g/m^3$ (24-hour average)
- 1 $\mu g/m^3$ (annual average)

These concentrations are too low to be of concern at this location and sulphur dioxide is not discussed further in this report.

The Caline4 dispersion model has been used to estimate the concentration of carbon monoxide, oxides of nitrogen and particulate matter, that are likely to result due to road traffic emissions in the vicinity of the proposed redevelopment site. This model is an upgrade of Caline3, is the most recent US EPA approved model, and is a steady state Gaussian model which can determine concentrations at receptor locations downwind of "at grade", "fill", "bridges" and "cut section" highways located in relatively uncomplicated terrain. The model is applicable for any wind direction, roadway orientation and receptor location.

The approach in this report has been to identify worst case conditions which comprise 1-hour peak hour traffic flow, combined with the poorest dispersion conditions, equivalent to atmospheric inversions with very light winds. This has been done for the two major roadways in the vicinity of the development site, namely the M4 Motorway and Parramatta Road. Woodville Road and Church Street are also major roads in the area, but these are further removed and carry less traffic. As such they have not been included in this assessment as Parramatta Road and the M4 Motorway will provide a worst-case assessment. The traffic flows have been assumed to be constant (at peak levels), and although this is clearly a simplification, it is a reasonable approximation to what could happen in practice and is deemed a conservative approach. Traffic volumes were taken from the updated traffic report carried out for this development (**McLaren, 2014**).

8 EMISSION ESTIMATES

This section provides a brief description of the methods used to calculate the major emissions from vehicles, namely CO, NO_2 and PM_{10}. This information is required as input to the dispersion models used to predict ground-level concentrations of the various pollutants.

Vehicle emission data from PIARC[d] (**PIARC, 2004**) were adjusted to reflect the NSW vehicle fleet. The modified tables include emissions of CO, NO_x and PM_{10} by age and type of vehicle. The ages of vehicles are categorised into seven periods which correspond to the introduction of emission standards. The types of vehicle are categorised into light and heavy vehicle groups.

Proportions of traffic within each age category have been extrapolated from the New South Wales traffic registration data from the Australian Bureau of Statistics Motor Vehicle Census (**ABS, 2005**). No future improvements in vehicle technology or fuel standards have been included in the emission estimates.

Annual average daily traffic (AADT) volumes for each of the roadways in the vicinity of the development site have been taken from **McLaren (2014)** and are presented in **Table 8.1**. These numbers represent the estimated AADT values for 2031. **Table 8.2**Table 8.2 indicates the breakdown of light and heavy vehicles based on the AADT values and the assumptions listed below.

Table 8.1: Annual average daily traffic (AADT) volumes for selected roads

Roadway	AADT
Parramatta Road	62,490
M4 Motorway	169,760

[d] The acronym PIARC refers to the Permanent International Association of Road Congress. While this body is now known as the World Road Association, the PIARC acronym has been retained.

Table 8.2: Estimated peak hour traffic volumes on each roadway

Roadway	Light vehicles	Heavy vehicles
Peak Hour flow		
Parramatta Road	5,812	437
M4 Motorway	15,695	1,181
Non-peak flow		
Parramatta Road	2,906	219
M4 Motorway	7,847	591

The modelling assumptions for these calculations are as follows:

- The traffic speed for the M4 is 90 km/h and 60 km/h for Parramatta Road.
- In the absence of information on fleet mix, the percentage of heavy vehicles in the peak hour traffic is assumed to be 7% (a judgement based on professional experience on roadway projects).
- In the absence of other information, peak hour traffic is assumed to be 10% of the AADT (a judgement based on professional experience of roadway projects).
- In the absence of directional flow data it was assumed that this traffic was split evenly in each direction, and also between each lane.
- The development site is more than 100 m from the M4 Motorway and 10 m from Parramatta Road.

Emission estimates based on the traffic volumes presented in **Table 8.2** are summarised in **Table 8.3**.

Table 8.3: Estimated peak hour traffic emissions for each roadway (g/km/v)

Roadway	Carbon Monoxide	Nitrogen Oxides	Particulate Matter
Parramatta Road	4.37	0.95	0.05
M4 Motorway	3.64	1.09	0.05

In determining the effects of these emissions on air quality at the development site, it should be noted that the locations of the roads are such that only one road would affect the site at any one time. For example, the M4 is on one side of the site and Parramatta Road is on the other (see **Figure 2.1**) and therefore emissions from both roads would not affect the site at the same time.

9 ASSESSMENT OF IMPACTS

Table 9.1 presents modelling results for both peak and non-peak traffic flows. Assuming a wind speed of 1.0 m/s and that F-class stability conditions occur, the model has been set to determine the worst-case wind angle (that is, across the road and towards the development).

In the case of annual average NO_2, 24-hour and annual average PM_{10}, these concentrations will in reality be lower than those predicted. This is due to the fact that constant traffic volumes and worst-case dispersion conditions were modelled which will obviously not occur for extended periods of time such as one day or one year. In other words, the worst case wind angle (blowing across the roadway to incorporate combined emissions from all lanes) will not prevail over a whole 24-hour or annual period. Similarly, low wind speeds and F-class stability will not occur constantly over those time periods either. Therefore, in reality, the resultant ground level concentrations are likely to be lower than those predicted.

It can be seen from the results in **Table 9.1**, that there are no predicted exceedances of the relevant short-term EPA criteria at the proposed development during peak traffic flow conditions. In the case of NO_2, it is likely that these concentrations will in reality be lower than those predicted. This is due to the fact that the main sources of NO_2 in a Sydney suburban area such as this will be vehicle emissions, and so the background estimates used will already account for this. Adding modelling results to background in this case will therefore be conservative. Notwithstanding this, predicted levels are well below the EPA criterion.

Table 9.1: Predicted ground level concentrations due to vehicle emissions

Roadway and distance from roadway	Pollutant and averaging time	Predicted concentration due to roadway	Estimated background	Total cumulative concentration	Assessment criterion
Parramatta Road at 10 m	Maximum 1-hour average CO (mg/m³)	2.3	2.8	5.1	30
	Maximum 8-hour average CO (mg/m³)	1.6	2.5	4.1	10
	Maximum 1-hour average NO_2 (µg/m³)	76	112	188	246
	Annual average NO_2 (µg/m³)	15	25	40	62
	Maximum 24-hour average PM_{10} (µg/m³)	14	20	34	50
	Annual average PM_{10} (µg/m³)	6	20	26	30
M4 Motorway at 100 m	Maximum 1-hour average CO (mg/m³)	1.1	2.8	3.9	30
	Maximum 8-hour average CO (mg/m³)	0.1	2.5	2.6	10
	Maximum 1-hour average NO_2 (µg/m³)	66	112	178	246
	Annual average NO_2 (µg/m³)	13	25	38	62
	Maximum 24-hour average PM_{10} (µg/m³)	7	20	27	50
	Annual average PM_{10} (µg/m³)	3	20	23	30

10 CONCLUSIONS

Due to the setback distance of the proposed development and the volume of traffic on Parramatta Road, the Infrastructure SEPP and DP&E Guidelines have been considered in relation to the proposal. Modelling has been conducted under worst-case dispersion conditions under peak volumes and predictions are summarised in this report.

Based on these predictions it is concluded that the emissions from traffic on both Parramatta Road and the M4 Motorway, are unlikely to result in exceedances of air quality criteria at the proposed development. The proposal is therefore predicted to comply with these criteria.

11 REFERENCES

ABS (2005), "Motor Vehicle Census 2005", Australian Bureau of Statistics.

Carnovale F and Tilly K (1995), "MAQS Consultancy - Emissions Inventory Report" prepared by the Environment Protection Authority of Victoria, 1995.

DP&E (2008), "Development Near Rail Corridors and Busy Roads – Interim Guideline". Prepared by the NSW Department of Planning, 2008.

EPA (2005), "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales", Department of Environment and Conservation, NSW.

HAS (2007), "Air quality impact assessment fluidised catalytic cracker unit reactor and regenerator rejuvenation project – Shell Clyde Oil Refinery", Prepared by Holmes Air Sciences, Suite 2B, 14 Glen Street, Eastwood, NSW 2122 for CH2M Hill Australia Pty Ltd on behalf of Shell Refining (Australia) Pty Ltd.

McLaren (2014), "Planning proposal to increase FSR for Mixed use Development traffic Impact Assessment, 171-189 Parramatta Road, Granville. Draft Issue: A – 19th September. Prepared by McLaren Traffic Engineering

PIARC (2004), "Road Tunnels: Vehicle Emissions and Air Demand for Ventilation", PIARC Technical Committee on Road Tunnels Operation (C5).

RTA (1997), "RTA Air Quality Monitoring Program", prepared for the RTA by Holmes Air Sciences, Suite 2B, 14 Glen Street, Eastwood, NSW 2122, January 1997.

Turner, D.B. (1994), "Workbook of Atmospheric Dispersion Estimates", United States Environmental Protection Agency, Office of Air Programs, Research Triangle Park, North Carolina, Revised 1994, Office of Air Programs Publication Number AP-26.