Western Parkland City Authority

Bradfield City Centre
Master Plan Application

Air Quality Impact Assessment

Prepared by Todoroski Air Sciences

October 2023

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NSW GOVERNMENT

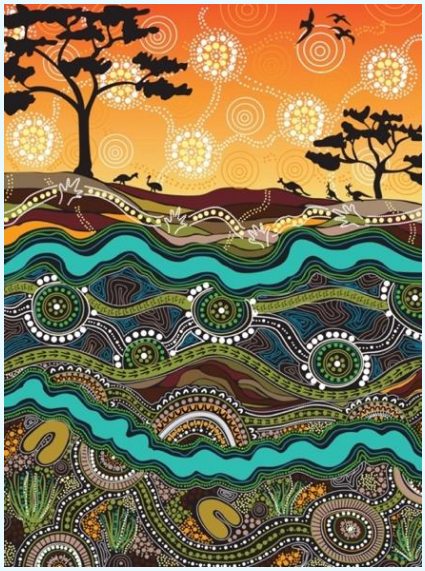
Acknowledgement of Country

Aboriginal people have had a continuous connection with the Country encompassed by the Western Parkland City (the Parkland City) from time immemorial. They have cared for Country and lived in deep alignment with this important landscape, sharing and practicing culture while using it as a space for movement and trade.

We Acknowledge that four groups have primary custodial care obligations for the area: Dharug/Darug, Dharawal/Tharawal, Gundungurra/Gundungara and Darkinjung. We also Acknowledge others who have passed through this Country for trade and care purposes: Coastal Sydney people, Wiradjuri and Yuin.

Western Sydney is home to the highest number of Aboriginal people in any region in Australia. Diverse, strong and connected Aboriginal communities have established their families in this area over generations, even if their connection to Country exists elsewhere. This offers an important opportunity for the future of the Parkland City.

Ensuring that Aboriginal communities, their culture and obligations for Country are considered and promoted will be vital for the future of the Parkland City. A unique opportunity exists to establish a platform for two-way knowledge sharing, to elevate Country and to learn from cultural practices that will create a truly unique and vibrant place for all.



Garungarung Murri Murri Nuru
(Beautiful Grass Country)
Artwork created by Dalmarri artists Jason Douglas and Trevor Eastwood for the Western Parkland City Authority

Version	Status	Date	Prepared By	Reviewer	Comments
1	Draft	22/02/2023	PH (TAS)		First draft
2	Draft	25/03/2023	PH (TAS)		Update based on review comments
3	Draft	08/11/2022	PH (TAS)		Update based on review comments
4	TAP issue	23/11/2022	PH (TAS)		Update based on review comments
5	Final issue	15 June 2023	PH (TAS)		New study template
6	Final issue	23 June 2023	PH (TAS)	DK (TAS)	Update based on final review comments
7	Final issue	30 June 2023	PH (TAS)		Minor update
8	Final issue	4 Aug 2023			Minor update
9	Final issue	17 Aug 2023		JA (WPCA)	Minor update
10	Publish	13 Sept 2023		JA (WPCA)	Amendment to Table 1
11	Publish	19 Oct 2023		HG (WPCA)	Update Lot and DP

Executive Summary

The Western Parkland City Authority (WPCA) is the NSW Government agency responsible for delivering, coordinating and attracting investment to the Western Parkland City. A key component of the WPCA's work is the delivery of the Bradfield City Centre. WPCA has been granted permission by the NSW Department of Planning and Environment (DPE) to prepare a master plan for the Bradfield City Centre.

This air quality impact assessment investigates the potential air quality effects that may arise as a result of the Bradfield City Centre Master Plan within the Western Sydney Aerotropolis. The Bradfield City Centre Master Plan sets out a framework for the development of the site with Stage 1 of the Master Plan which comprises land centred around the future Sydney Metro Station.

The local climatic conditions are typical of conditions experienced in western Sydney with a mean maximum temperature of 30.3 degrees Celsius and mean minimum temperatures of 4.1 degrees Celsius with an average annual rainfall of 658.1 millimetres. The prevailing wind flows in the area surrounding the Bradfield City Centre are from the southwest and are influenced by the local topography of the site. The ambient air quality levels that are monitored at various locations surrounding the Bradfield City Centre indicate that air quality is generally good and is typically below the relevant National Environment Protection Measure (NEPM) Ambient Air Quality and the New South Wales (NSW) Environment Protection Authority (EPA) impact assessment criteria for the various air pollutants. The monitoring data suggests regional air quality effects dominate the measured levels and we would expect with the development of the Bradfield City Centre the ambient air quality levels for the local area will increase slightly relative to the current existing levels.

The air quality assessment requirements for the Bradfield City Centre Master Plan are to aim to achieve ambient air quality levels in accordance with the environmental objectives of the National Environment Protection Measure (NEPM) air quality standards and that future industry and activity can comply with the NSW EPA impact assessment criteria. Controls outlined in the various plans for the Western Sydney Aerotropolis are designed to ensure the air quality amenity of the area remains good and industry and activity does not adversely affect the residential areas within the Bradfield City Centre.

The assessment finds that key components of the Bradfield City Centre Master Plan relating to air quality have considered the likely sources of air pollutants and measures to mitigate elevated levels. The road network is structured with the main transport corridors positioned away from the residential uses. The proposed built form provides variability in building structures which allows for cross wind flows around and between buildings to promote good air flow. The positioning of enterprise activity to the north of residential areas and generally downwind will assist with minimising the potential for air quality impact.

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Glossary of Terms

Aerotropolis	Western Sydney Aerotropolis
Background levels	Existing concentration of pollutants in the ambient air
DPE	NSW Department of Planning and Environment
EPA	Environmental Protection Authority
Incremental impact	The impact due to an emission source (or group of sources) in isolation, i.e. without including background levels.
LGA	Local Government Area
mg/m^3	milligrams per cubic metre
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measures
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen, including NO and NO2
NSW Government	State Government for NSW
OU	Odour units
O3	Ozone
PM_{10}	Particulate matter less than 10 µm in aerodynamic equivalent diameter
$PM_{2.5}$	Particulate matter less than 2.5 µm in aerodynamic equivalent diameter
PPM	Parts per million
Sensitive receptor	A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area
SEPP	State Environmental Planning Policy
SO_2	Sulphur dioxide
SO_3	Sulphur trioxide

µg/m³	micrograms per cubic metre

References

Ref	Title	Author	Date
1	*National Environmental Protection (Ambient Air Quality) Measure*	*Australia Government*	May 2021
2	*Climate statistics for Australian locations*	*Bureau of Meteorology*	April 2021
3	*Technical framework – Assessment and management of odour from stationary sources in NSW*	*NSW DEC*	November 2006
4	*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*	*NSW EPA*	August 2022
5	*Draft Aerotropolis Precinct Plan*	*NSW Government*	November 2020
6	*Western Sydney Aerotropolis Development Control Plan 2022 – Phase 2*	*NSW Government*	November 2022
7	*Western Sydney Aerotropolis Precinct Plan*	*NSW Government*	May 2023

1 Introduction

1.1 Purpose of this report

This report accompanies the Master Plan Application for the Bradfield City Centre submitted to the Department of Planning and Environment (DPE).

All matters were considered to have been adequately addressed within the Master Plan Application or in the accompanying appendices.

1.2 The Western Sydney Aerotropolis

The Western Sydney Aerotropolis is an 11,200-hectare region set to become Sydney's third city (the Western Parkland City), and the gateway and economic powerhouse of Western Sydney.

The Aerotropolis comprises of the new Western Sydney (Nancy-Bird Walton) International Airport surrounded by five initial precincts which include the Aerotropolis Core, Wianamatta– South Creek, Northern Gateway, Agri-business and Badgerys Creek outlined in **Figure 1** below.

The final Aerotropolis planning package, including the Precinct Plan and State Environmental Planning Policy (SEPP) Amendment, was gazetted by DPE in March 2022 and the Development Control Plan (DCP) Phase 2 was finalised in November 2022. These documents have been used to inform the preparation of the Bradfield City Centre Master Plan.

The proposed Master Plan Application for the site has also been prepared using the Western Sydney Aerotropolis Master Plan Guideline and Master Plan Requirements.

2 Bradfield City Centre

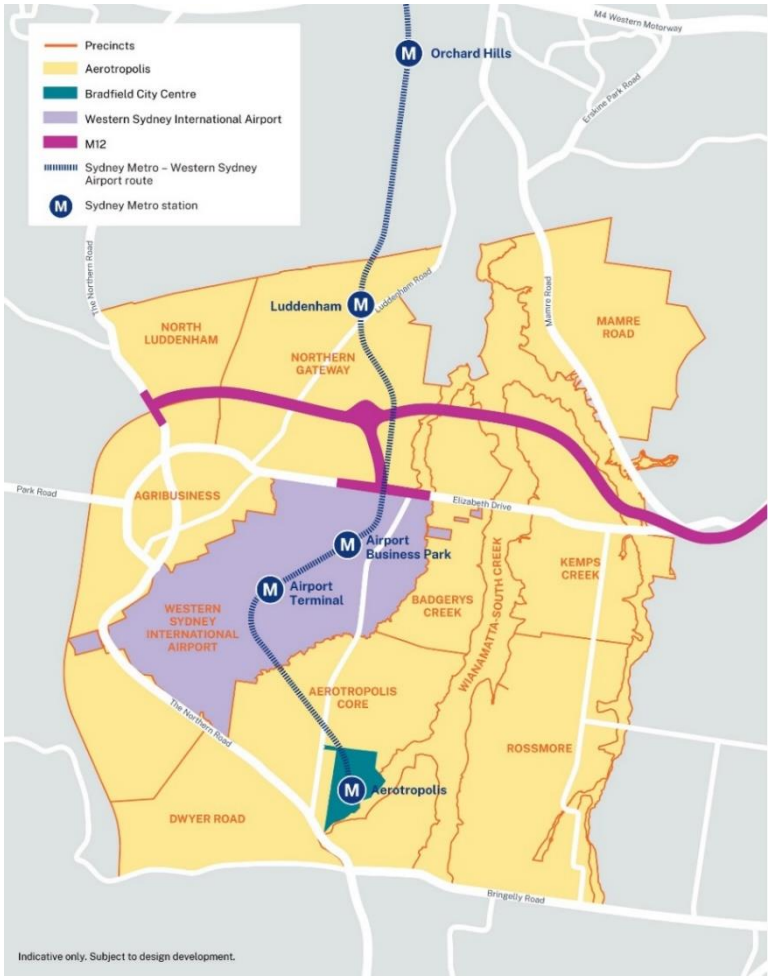
2.1 Strategic Context

The Bradfield City Centre is located to the south-east of the new Western Sydney International (Nancy-Bird Walton) Airport at the intersection of Badgerys Creek Road and The Northern Road (see **Figure 1** below).

The Sydney Metro Western Sydney Airport line runs through the site, providing connections from the key centre of St Marys through to stations at Orchard Hills, Luddenham, Airport Business Park, Airport Terminal and the Aerotropolis which is located within the site.

The site is surrounded by several key roads and infrastructure corridors including Bringelly Road, Badgerys Creek Road, Elizabeth Drive, M12 and The Northern Road.

Figure 1 Strategic Context



Set on natural waterways, Bradfield City Centre presents a rare opportunity to showcase the best urban design and to create a thriving, blue and green, connected City in which Australians will want to live, learn and work. The Bradfield City Centre will be a beautiful and sustainable 22nd Century City. It will foster the innovation, industry and technology needed to sustain the broader Aerotropolis and fast track economic prosperity across the Western Parkland City.

2.2 The Master Plan Site

The street address for Bradfield City Centre is 215 Badgerys Creek Road, Bradfield (the Site) within the Liverpool Council Local Government Area (LGA). The site is legally described as Lot 3101 DP 1282964 and has an area of 114.6 hectares, with road access to Badgerys Creek Road located at the north-western corner. The site spans across the Aerotropolis Core and Wianamatta-South Creek Precinct, within Western Sydney Aerotropolis. The Site is outlined in **Figure 2** below.

The Site is predominantly zoned Mixed Use under the Western Parkland City SEPP, with a small portion of Enterprise zoned land located on the north-western corner of the site. The site also includes Environment and Recreation zoned land mostly along Thompsons Creek in the sites south-east.

Figure 2 Master Plan Site

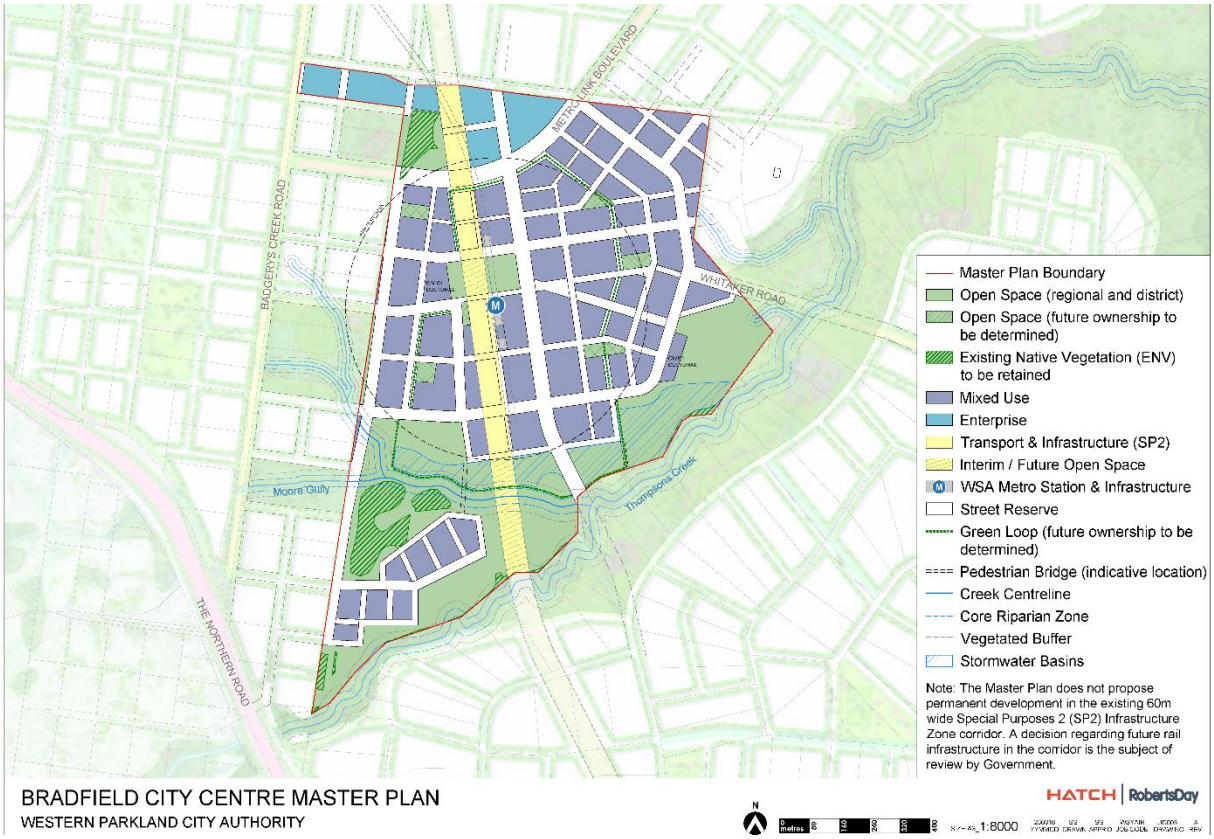
2.3 The Bradfield City Centre Master Plan

The Western Parkland City Authority has prepared a Master Plan (**Figure 3** below) in accordance with the DPE Master Plan Requirements.

The Master Plan sets out a framework for future development within the Bradfield City Centre which includes:

- Road network, key connectors to adjoining land and the regional road network (existing and future)
- Block structure
- Indicative open space network
- Sustainability strategy
- Social and infrastructure strategy
- Arts and culture strategy
- Infrastructure servicing strategy

Figure 3 Master Plan



2.4 The Proposal

The Bradfield City Centre Master Plan is intended to facilitate the growth of the centre over time. The Master Plan has established the following three planning horizons for technical assessments.

Table 1 – Planning & Development Horizons

Phase	Indicative Timeframe	Estimated employment	Estimated residential population	Estimated Gross Floor Area (cumulative)
Immediate	2026	1,000 - 1,200 jobs	0 residents	48,500 sqm
Medium-term	2036	8,000 - 8,300 jobs	3,000 - 3,100 residents	341,000 sqm
Long-term	2056	20,000 – 24,000 jobs	15,000 – 15,200 residents	1,258,000 sqm

Note: The table above is an estimate of the population and employment forecast used for the purposes of modelling only.

The master plan has the capacity to accommodate ~10,000 residential dwellings. In accordance with NSW Government policy a proportion of the residential dwellings will be affordable housing. The timing and delivery of residential dwellings will be subject to market demand and future master plan reviews that consider the impact of additional population on the scope and timing of social and physical infrastructure.

3 Baseline investigations

This section describes the existing environment including the local setting, topography, climate, meteorology, and ambient air quality.

3.1 Technical baseline site consideration

3.1.1 Local setting

The Bradfield City Centre covers an area of approximately 114.6 hectares (ha) located to the southeast of the Western Sydney Airport and is located approximately 18 kilometres (km) south-southeast of Penrith and approximately 18km east of Liverpool. The existing land use surrounding the Bradfield City Centre consists of a mixture of low density residential and rural properties.

The Bradfield City Centre area is defined by Thompsons Creek to the southeast, Badgerys Creek Road to the west and the proposed location of a new Metro station central to the site.

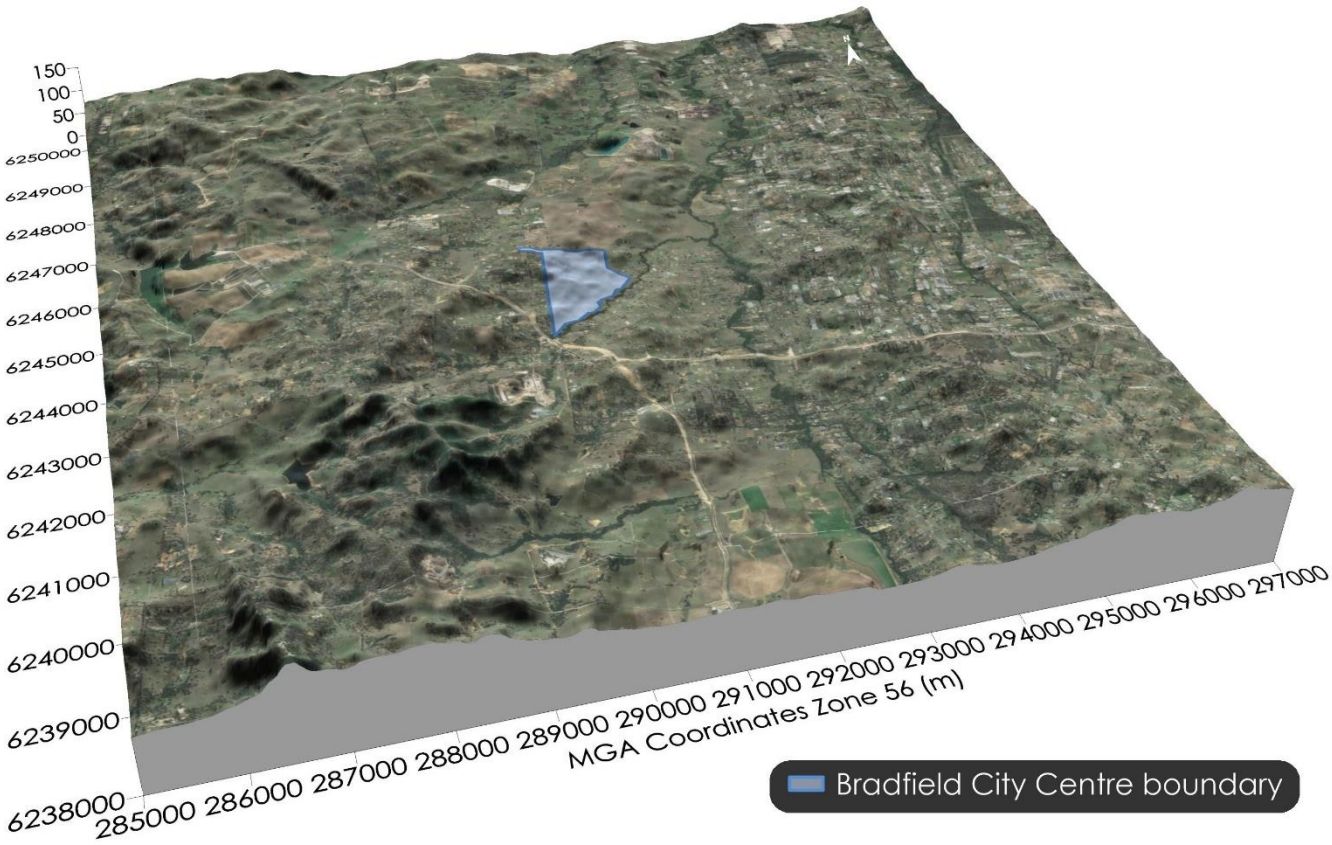
3.1.2 Local topography

Figure 4 presents a three-dimensional visualisation of the terrain features surrounding the Bradfield City Centre.

The topography of the Bradfield City Centre is gently undulating with decreasing elevation to the southeast towards Thompsons Creek. Outside of the Bradfield City Centre there are elevated ridges to the southwest and northwest. To the east of the site the terrain remains relatively flatter with some slight undulations.

The terrain features of the surrounding area influence the local wind distribution patterns and flows which are important for the dispersion and propagation of air and odour emissions.

Figure 4 Representative visualisation of the local topography



3.1.3 Local climatic conditions

Table 2 and **Figure 5** present a summary of data from the Badgerys Creek Automatic Weather Station (AWS) site collected over an approximate 14 to 25-year period for the various meteorological parameters.

The data indicates that January is the hottest month with a mean maximum temperature of 30.3 degrees Celsius (ºC). July is the coldest month with mean minimum temperatures of 4.1ºC.

Rainfall is generally higher during the first half of the year, with an average annual rainfall of 658.1 millimetres (mm) over 66.9 days. The data shows February is the wettest month with an average rainfall of 108.8mm over 7.4 days and July is the driest month with an average rainfall of 24.8mm over 3.8 days.

Relative humidity levels exhibit some variability over the year and seasonal fluctuations. Mean 9am relative humidity levels range from 62% in October to 84% in June. Mean 3pm humidity levels vary from 44% in August and September to 56% in June.

Wind speeds have a greater spread between the 9am and 3pm conditions during the cooler months of the year compared to the warmer months. The mean 9am wind speeds range from 8.4 kilometres per hour (km/h) in March to 11.8km/h in October. The mean 3pm wind speeds vary from 13.7km/h in June to 19.9km/h in October.

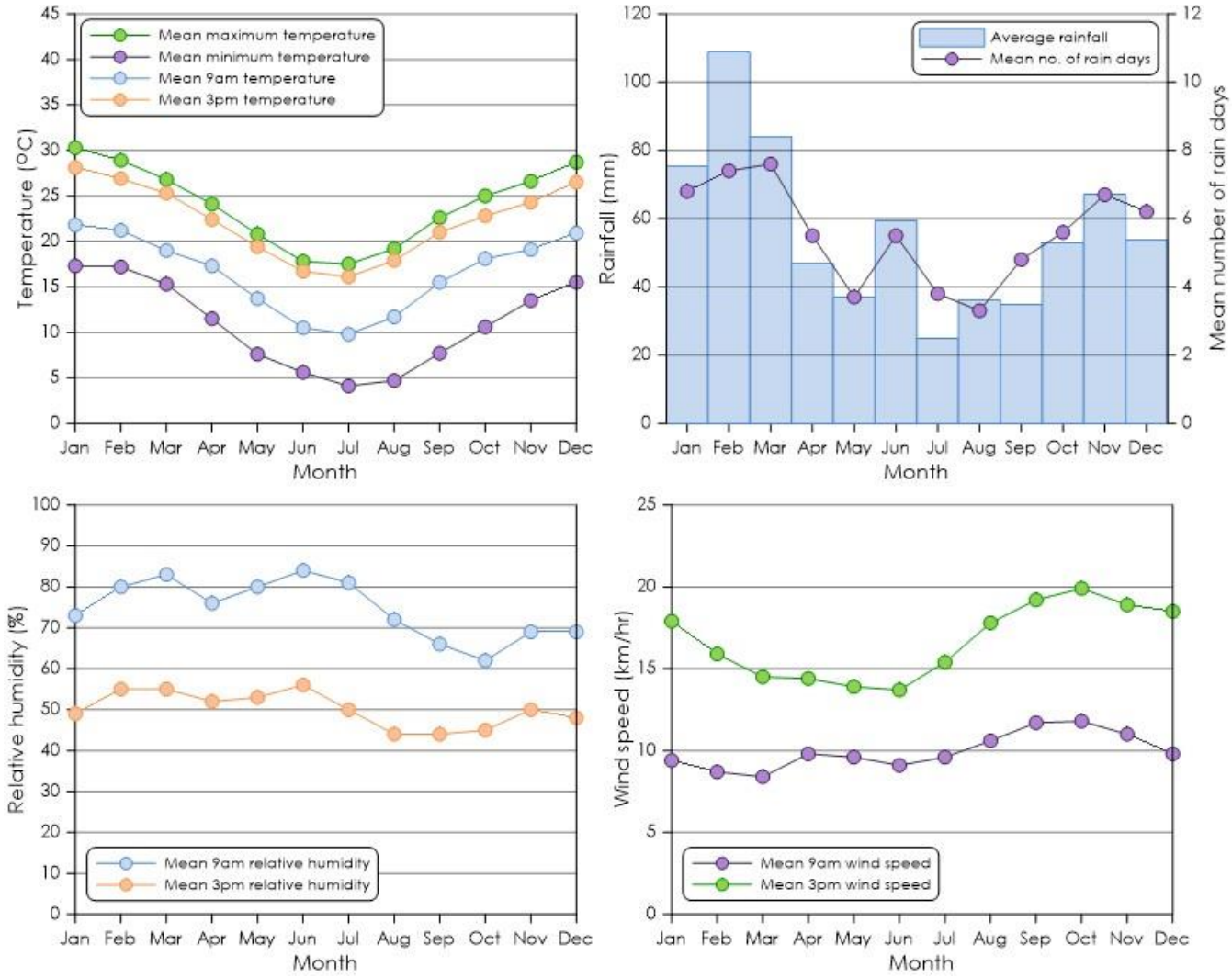
Table 2 – Monthly climate statistics summary – Badgerys Creek AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temp. (°C)	30.3	28.9	26.8	24.1	20.8	17.8	17.5	19.2	22.6	25.0	26.6	28.7	24.0
Mean min. temp. (°C)	17.3	17.2	15.3	11.5	7.6	5.6	4.1	4.7	7.7	10.6	13.5	15.5	10.9
Rainfall													
Rainfall (mm)	75.1	108.8	84.1	46.8	36.8	59.2	24.8	36.2	34.9	52.9	66.9	53.6	658.1
No. of rain days (≥1mm)	6.8	7.4	7.6	5.5	3.7	5.5	3.8	3.3	4.8	5.6	6.7	6.2	66.9
9am conditions													
Mean temp. (°C)	21.8	21.2	19.0	17.3	13.7	10.5	9.8	11.7	15.5	18.1	19.1	20.9	16.6
Mean R.H. (%)	73	80	83	76	80	84	81	72	66	62	69	69	75
Mean W.S. (km/h)	9.4	8.7	8.4	9.8	9.6	9.1	9.6	10.6	11.7	11.8	11.0	9.8	10.0
3pm conditions													
Mean temp. (°C)	28.1	26.9	25.3	22.4	19.4	16.7	16.1	17.9	21.0	22.8	24.3	26.5	22.3
Mean R.H. (%)	49	55	55	52	53	56	50	44	44	45	50	48	50
Mean W.S. (km/h)	17.9	15.9	14.5	14.4	13.9	13.7	15.4	17.8	19.2	19.9	18.9	18.5	16.7

Source: Bureau of Meteorology (2021)

R.H. – Relative humidity, W.S. – wind speed

Figure 5 Monthly climate statistics summary – Badgerys Creek AWS



3.1.4 Local meteorological conditions

Period and seasonal wind roses generated from data collected at the Badgerys Creek AWS during 2015 to 2020 are presented in **Figure 6**.

For the period reviewed, winds are varied and predominantly occur from the southwest and the west-southwest. In summer, winds predominantly occur from the east. The autumn distribution is similar to the annual distribution with varied winds predominantly from the southwest and the west-southwest. In winter winds typically occur from the southwest and the west-southwest. In spring, the winds from the southwest are most dominant and varied winds from other directions.

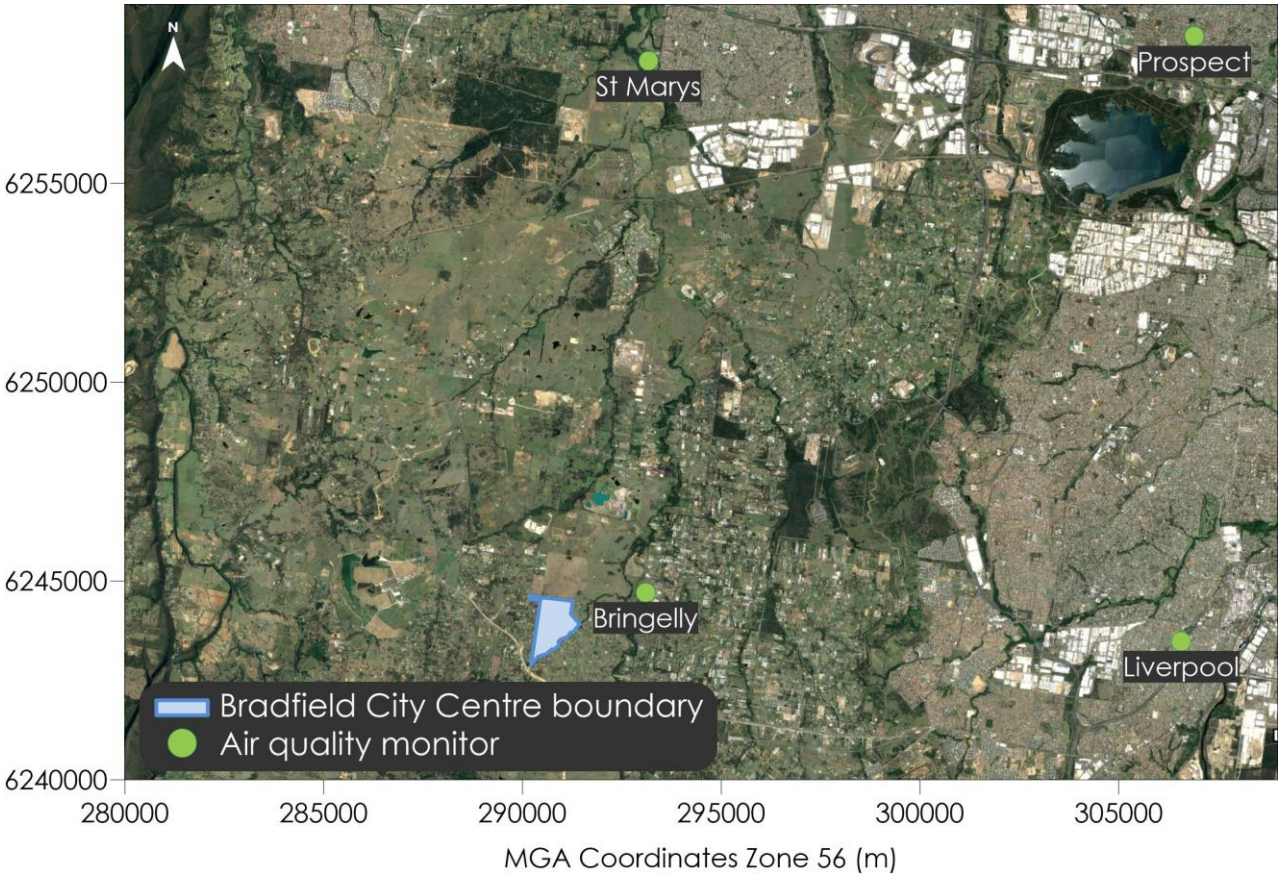
Figure 6 Annual and seasonal windroses for Badgerys Creek AWS (2015-2020)

3.1.5 Local air quality

The available data from air quality monitors operated by the NSW Department of Planning & Environment (DPE) were used to quantify the existing background level for assessed pollutants at the Bradfield City Centre site. These include the St Marys, Prospect, Liverpool and Bringelly monitors. The location of these monitors relative to the Bradfield City Centre site are approximately 14.5km, 22km, 16km and 2.6km, respectively.

Figure 7 presents the location of the air quality monitors reviewed.

Figure 7 Air quality monitoring locations



3.1.5.1 PM_{10} monitoring

A summary of the available annual average PM_{10} monitoring data from the NSW DPE monitoring stations is presented in **Table 3**.

A review of **Table 3** indicates that the annual average PM_{10} concentrations for all monitoring stations reviewed were below the relevant NSW EPA criterion of 25µg/m³ with the exception of the Liverpool and the Prospect monitors which exceeded the relevant criterion during the 2019 calendar year. The likely cause of the elevated annual levels at the Liverpool and Prospect monitors was the NSW bushfire event during 2019.

Table 3 – Summary of annual average PM_{10} levels from NSW DPE monitoring (µg/m³)

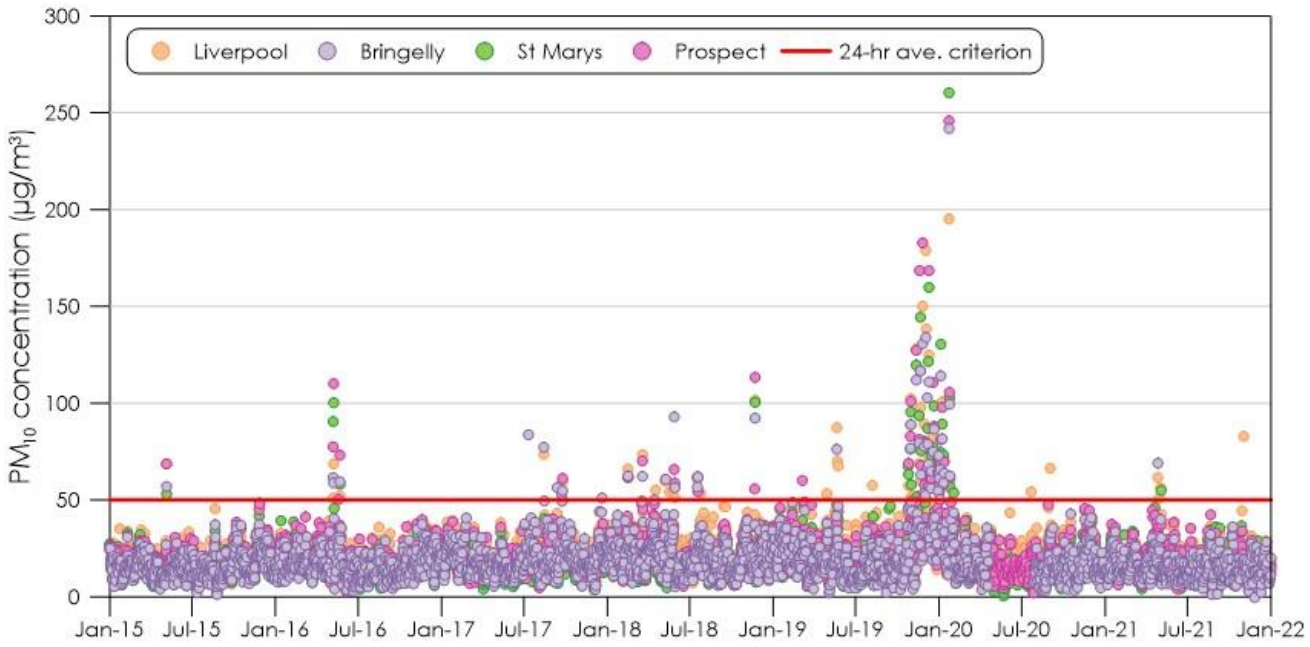
Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2015	18.4	15.8	15.0	17.6	**25**
2016	19.5	16.9	16.1	18.9	**25**
2017	20.6	19.8	16.2	18.9	**25**
2018	24.2	21.2	19.4	21.9	**25**
2019	**27.7**	23.6	24.7	**26.0**	**25**
2020	20.8	20.1	18.9	20.2	**25**
2021	18.1	15.3	16.2	17.2	**25**

Recorded 24-hour average PM_{10} concentrations are presented in **Figure 8**.

It can be seen from **Figure 8** that PM_{10} concentrations nominally peak in spring and summer with the warmer weather raising the potential for drier ground, elevating the occurrence of windblown dust.

A brief examination of the elevated PM_{10} levels indicates that they typically correspond with regional dust events and bushfires which affect a wide area, this is particularly evident in 2019 as a result of the NSW bushfires in November and December. At other times, potential dust sources such as local agricultural sources, industrial activity and other such dust sources may have contributed to periods of elevated PM_{10} levels.

Figure 8 24-hour average PM_{10} concentrations



3.1.5.2 $PM_{2.5}$ monitoring

A summary of the available annual average $PM_{2.5}$ monitoring data from the NSW DPE monitoring stations is presented in **Table 4**.

A review of **Table 4** indicates that the annual average $PM_{2.5}$ concentrations for all monitoring stations were below the NSW EPA criterion of 8µg/m³ with the exception of the Liverpool and Prospect monitors in 2015 and 2016, the Liverpool monitor in 2017, the Liverpool, Bringelly and Prospect monitors in 2018, all monitors in 2019 and the Liverpool, Bringelly and Prospect monitors in 2020. The likely cause of the elevated annual levels at the monitors are attributed to bushfire events, wood smoke from domestic wood heaters and automobile exhaust.

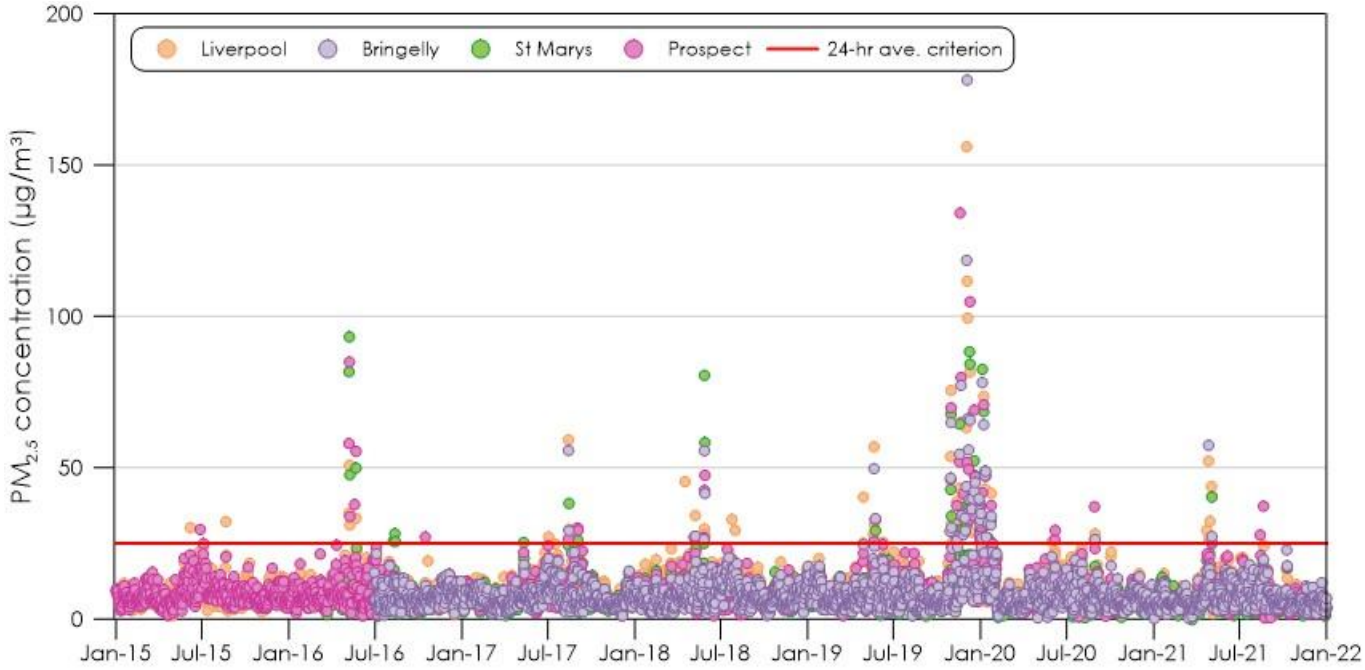
Table 4 – Summary of annual average $PM_{2.5}$ levels from NSW DPE monitoring (µg/m³)

Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2015	**8.5**	-	-	**8.2**	**8**
2016	**8.8**	7.6	7.9	**8.7**	**8**
2017	**8.9**	7.5	7.0	7.7	**8**
2018	**10.1**	8.0	7.8	**8.5**	**8**
2019	**12.8**	**11.3**	**9.8**	**11.9**	**8**
2020	**9.1**	**8.5**	7.6	**8.6**	**8**
2021	7.9	7.2	5.8	6.9	**8**

Recorded 24-hour average $PM_{2.5}$ concentrations are presented in **Figure 9**.

It can be seen from **Figure 9** that $PM_{2.5}$ concentrations follow a seasonal trend with peaks occurring in winter periods and are likely associated with wood heater emissions. This is opposite to the seasonal trend for PM_{10} concentrations which have elevated levels during the warmer months. As mentioned, the very high $PM_{2.5}$ levels seen in late 2019 are a result of the widespread NSW bushfires.

Figure 9 24-hour average $PM_{2.5}$ concentrations



3.1.5.3 NO_2 monitoring

A summary of the available annual average NO_2 monitoring data from the NSW DPE monitoring stations is presented in **Table 5**.

A review of **Table 5** indicates that the annual average NO_2 concentrations for all monitoring stations were below the NSW EPA criterion of 62µg/m³.

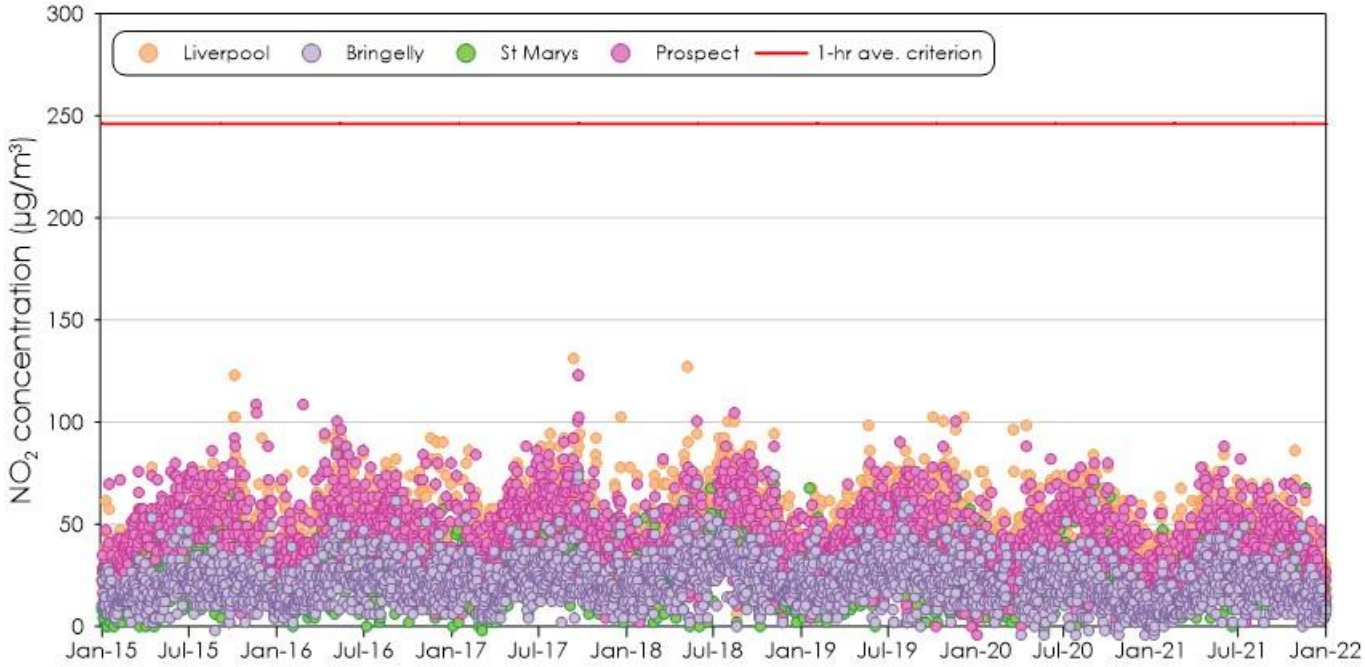
Table 5 – Summary of annual average NO_2 levels from NSW DPE monitoring (µg/m³)

Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2015	43.2	19.4	23.0	46.2	**62**
2016	48.0	22.2	24.3	45.0	**62**
2017	51.3	22.8	26.1	46.7	**62**
2018	50.9	25.3	27.5	44.4	**62**
2019	50.4	24.9	24.6	42.6	**62**
2020	45.5	17.7	22.8	37.7	**62**
2021	42.8	18.0	22.4	37.2	**62**

Recorded daily maximum 1-hour average NO_2 concentrations are presented in **Figure 10**.

It can be seen from Figure 10 the NO_2 concentrations are generally higher in cooler months when temperatures are low and there is less sunlight, making it more difficult for NO_2 to convert to ozone.

Figure 10 Daily maximum 1-hour average NO_2 concentrations



3.1.5.4 SO_2 monitoring

A summary of the available SO_2 data from the NSW DPE monitoring stations is presented in **Table 6.** A review of **Table 6** indicates that the annual average SO_2 concentrations for all monitoring stations were below the NSW EPA criterion of 60µg/m³.

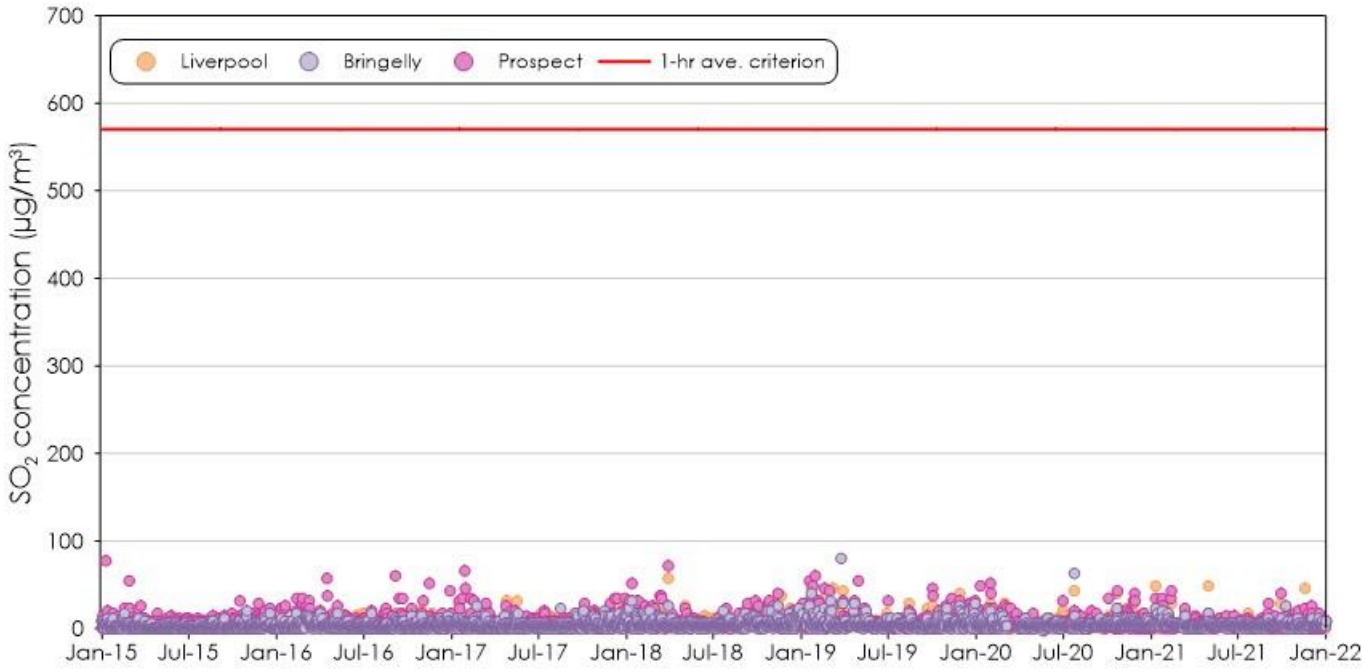
Table 6 – Summary of annual average SO_2 levels from NSW DPE monitoring (µg/m³)

Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2015	-	2.3	NA	6.3	**60**
2016	6.2	3.2	NA	7.5	**60**
2017	6.6	3.7	NA	7.5	**60**
2018	7.1	4.9	NA	8.2	**60**
2019	7.2	5.8	NA	8.3	**60**
2020	5.1	4.0	NA	6.2	**60**
2021	5.3	3.8	**NA**	5.7	60

NA – data not available

Recorded daily maximum 1-hour average SO_2 concentrations are presented in **Figure 11**. It can be seen from **Figure 11** that SO_2 concentrations are low and there is no apparent seasonal trend.

Figure 11 Daily maximum 1-hour average SO_2 concentrations



3.1.5.5 CO monitoring

A summary of the available maximum 1-hour average CO data from the NSW DPE monitoring stations is presented in **Table 7**. It is noted that the Bringelly and St Marys monitors do not record measured CO data. **Table 7** indicates that the maximum 1-hour average CO concentrations for all monitors during the review period are well below the NSW EPA criterion.

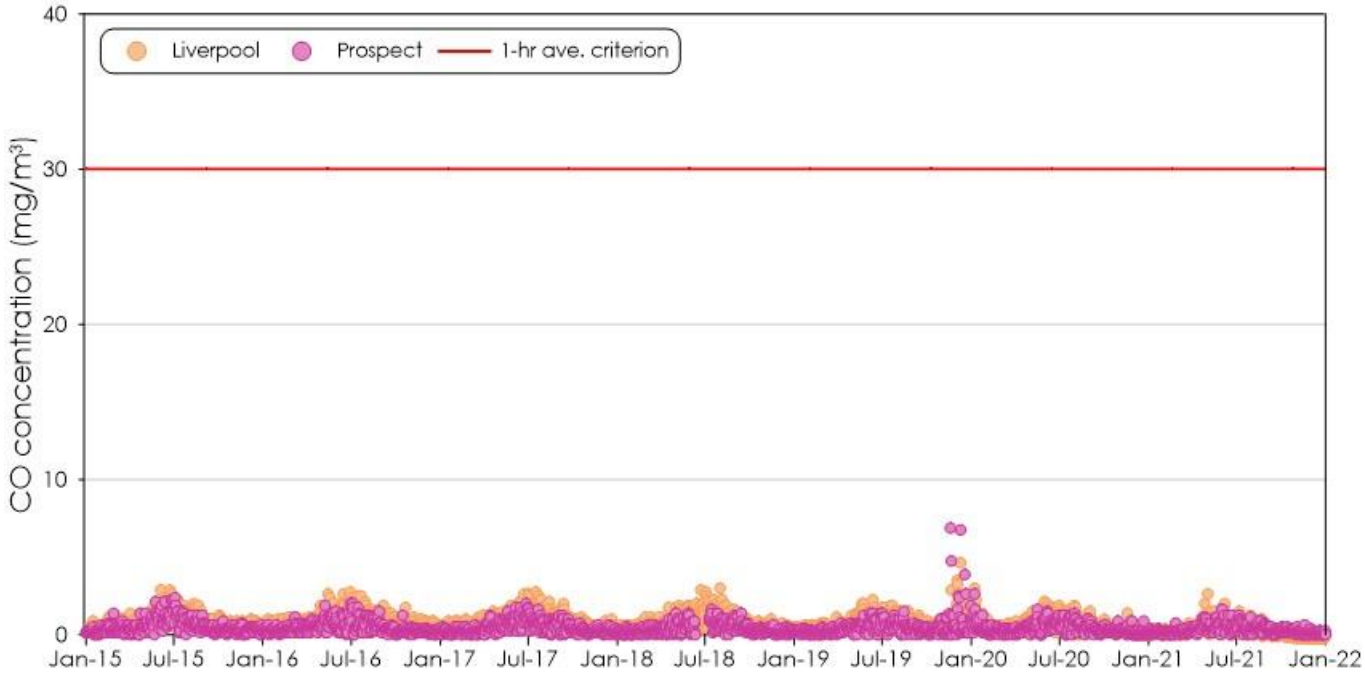
Table 7 – Summary of maximum 1-hour average CO levels from NSW DPE monitoring (µg/m³)

Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2015	2.9	NA	NA	2.4	**30**
2016	2.8	NA	NA	2.0	**30**
2017	2.8	NA	NA	2.0	**30**
2018	3.0	NA	NA	1.6	**30**
2019	4.6	NA	NA	6.9	**30**
2020	3.0	NA	NA	2.6	**30**
2021	2.6	NA	NA	1.6	**30**

NA – data not available

Recorded daily maximum 1-hour average CO concentrations are presented in **Figure 12**. **Figure 12** shows a similar seasonal trend to the NO_2 data with levels increasing during the cooler months.

Figure 12 Daily maximum 1-hour average CO concentrations



3.1.5.6 O_3 monitoring

A summary of the available maximum 1-hour average O_3 data from the NSW DPE monitoring stations is presented in **Table 8**.

Table 8 indicates that the 1-hour average O_3 concentrations for all monitoring stations were below the NSW EPA criterion of 214µg/m³ with the exception of the St Marys and Prospect monitors in 2015, the Liverpool, St Marys and Prospect monitors and 2016, and all monitors in 2018, 2019 and 2020. The likely cause of the elevated 1-hour average levels at the monitors are attributed to bushfires events, high photochemical activity and emissions of ozone precursors.

Table 8 – Summary of maximum 1-hour average O_3 levels from NSW DPE monitoring (µg/m³)

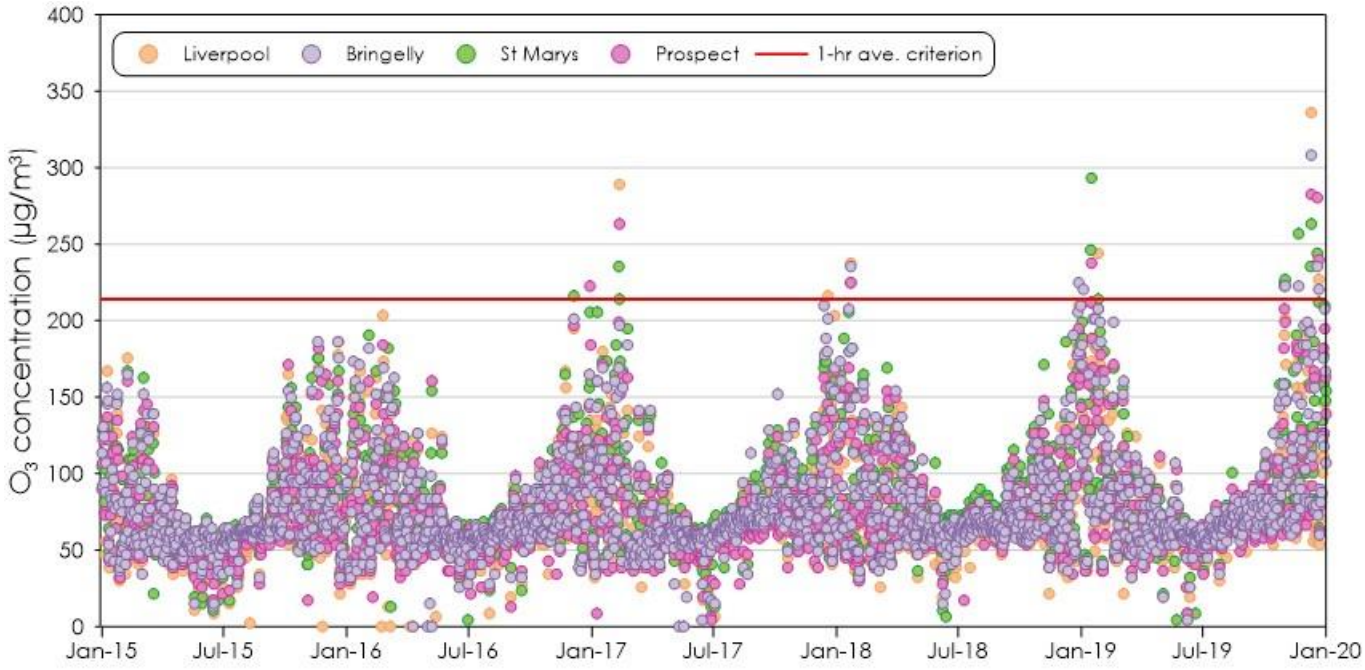
Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2015	186.2	186.2	175.5	181.9	**214**
2016	203.3	201.2	**216.1**	**222.6**	**214**
2017	**288.9**	209.7	**235.4**	**263.2**	**214**
2018	**237.5**	**235.4**	**224.7**	**224.7**	**214**
2019	**336.0**	**308.2**	**293.2**	**282.5**	**214**
2020	**218.3**	**239.7**	**246.1**	**218.3**	**214**

Year	Liverpool	Bringelly	St Marys	Prospect	Criterion
2021	199.0	199.0	149.8	190.5	**214**

NA – data not available

Recorded daily maximum 1-hour average O_3 concentrations are presented in **Figure 13**. **Figure 13** shows a seasonal trend with O_3 levels increasing during the warmer months.

Figure 13 Daily maximum 1-hour average O_3 concentrations



3.1.5.7 Existing odour

Existing odour sources in the surrounding area would likely comprise of operating poultry farms and from other agricultural activities.

The development of the Bradfield City Centre will change the current makeup of the area to a more urbanised setting and as such it needs to be recognised that some of the key air emission sources would no longer be compatible and may need to cease or relocate to other appropriate locations.

3.2 Area of Focus

Overall, the monitors indicate generally similar levels of ambient air quality at each of the monitoring stations reviewed which suggests regional air quality effects dominate the measured levels.

It is noted that urban monitors (e.g., Liverpool and Prospect) record typically more elevated levels which would be influenced by localised sources including a greater density of anthropogenic sources such as wood heaters, combustion engines and motor vehicles.

We would expect that with the development of the Bradfield City Centre, the ambient air quality levels will increase slightly relative to the current levels as the site is predominantly low density residential and rural properties (noting the nearest monitor is the Bringelly monitor to the site). The ambient air quality levels at the Bradfield City Centre would be comparable to the other DPE monitors reviewed in the surrounding area.

4 Assessment Requirements and Policy Context

4.1 Master Plan Requirements

The DPE and EPA have issued Master Plan Requirements (MPRs) to WPCA for the preparation of a Master Plan for Bradfield City Centre. This report has been prepared to address the following MPRs. **Table 9** presents the Master Plan Requirements.

Table 9 - Master Plan Requirements

Reference	Master Plan Requirement	Where addressed
4. NSW DPE Air Quality and Odour	The Assessment references one odour intensive use, namely, poultry. It is not clear what activity the Assessment is referring to. The EPA recommends that the Assessment include greater detail regarding likely air emission and odour impacts on sensitive receivers in the city centre from existing industrial uses in the area (see list of nearby scheduled activities above). This analysis would be most effective if it was informed by on-site testing . This would enable mitigation strategies, such as buffers, to be developed. Additionally, potential future industrial uses may exacerbate existing odour issues, particularly if further intensive agriculture and poultry activities are located nearby the city centre. The Assessment would be strengthened by recognising this risk in terms of cumulative impact."	Section 3.1.5.7
5. NSW EPA Air Quality and Odour	Comment on the amended road network proposed under the masterplan and potential impact on air quality	Section 5.1

4.2 National and State Government Plans/Policies

Air quality standards and goals are benchmarks set to protect the general health and amenity of the community in relation to air quality.

The following sub-sections identify the relevant standards and goals for the likely air pollutants of consideration for the Bradfield City Centre Master Plan.

4.2.1 National Environmental Protection (Ambient Air Quality Measures)

The *National Environment Protection Council (NEPC) Act 1994* and subsequent amendments define the National Environment Protection Measures (NEPMs) as instruments for setting environmental objectives in Australia.

It is important to note that NEPM air quality standards are not designed to be applied to specific projects. The NEPM standards apply to the average exposure to air pollutants of the general population, in each state. The NEPM requires that the states report to the Commonwealth on the trends in air quality by way of reference to the standards. The NEPM allows communities to understand their local air quality and assist the formulation of air quality policies.

The NEPM Ambient Air Quality Measure specifies national ambient air quality standards for air pollutants as outlined in **Table 10**. The NEPM Ambient Air Quality Measure was recently amended in May 2021 to include more stringent NO_2 and SO_2 goals.

Table 10 – Standards for Pollutants

Pollutant	Averaging period	Maximum concentration standard
Carbon monoxide (CO)	8 hours	9.0 ppm
Nitrogen dioxide (NO_2)	1 hour	0.08 ppm
	1 year	0.015 ppm
Ozone (O_3)	8 hours	0.065 ppm
Sulphur dioxide (SO_2)	1 hour	0.1 ppm
	1 day	0.02 ppm
Particles as PM_{10}	1 day	50 µg/m³
	1 year	25 µg/m³
Particles as $PM_{2.5}$	1 day	25 µg/m³
	1 year	8 µg/m³

Source: **Australian Government (2021)**

4.2.2 Protection of the Environment Operations Act 1997

The general obligations of the Protection of the Environment Operations Act, 1997 and the Regulations made under the Act (namely the Protection of the Environment Operations (Clean Air) Regulation, 2021) are the regulatory mechanisms for reducing emissions of harmful air pollutants in NSW.

The Clean Air Regulation specifies limits for the air emission concentration of designated pollutant by plant, equipment, industrial and commercial activities, households and fuels which are enforced by the NSW EPA.

4.2.3 NSW EPA Impact Assessment Criteria

The NSW EPA assess significant new or modified industry and activity using a set of air quality goals as outlined in the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2022).

The air quality goals for total impact relate to the total pollutant burden in the air and not just the pollutants from the industry or activity being assessed (incremental impact). Consideration of background pollutant levels needs to be made when using these goals to assess potential impacts.

Table 11 presents the air quality goal relevant for the Bradfield City Centre Master Plan.

Table 11 – NSW EPA air quality impact assessment criteria

Pollutant	Averaging period	Percentile	Impact	Criteria
CO	15 minutes	100	Total	100 mg/m³
	1 hour	100	Total	30 mg/m³
	8 hours	100	Total	10 mg/m³
NO_2	1 hour	100	Total	164 µg/m³
	1 year	100	Total	31 µg/m³
O_3	8 hours	100	Total	139 µg/m³
SO_2	1 hour [a]	100	Total	286 µg/m³
	1 hour [b]	100	Total	215 µg/m³
	24 hours	100	Total	228 µg/m³
Particles as PM_{10}	24 hours	100	Total	50 µg/m³
	1 year	100	Total	25 µg/m³
Particles as $PM_{2.5}$	24 hours	100	Total	25 µg/m³

Pollutant	Averaging period	Percentile	Impact	Criteria
	1 year	100	Total	8 µg/m³
Total suspended particulates	Annual	100	Total	90 µg/m³
Deposited dust	Annual	100	Incremental	2 g/m²/month
	Annual	100	Total	4 g/m²/month
Odour	1 hour peak to mean corrected	99	Incremental	2 OU

[a] Applies to assessments prepared before 1 January 2025
[b] Applies to assessment prepared after 1 January 2025
Source: **NSW EPA (2022)**

4.2.4 NSW EPA Odour Policy

The NSW EPAs policy framework for managing odour is set out in the NSW EPA documents *Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW* (NSW DEC, 2006).

The framework guides the management of odour concerns by industry, planners, consent authorities, environmental regulators and odour experts. It suggests best management practices and continual environmental improvement to stop or lessen odour and avoid land use conflict.

4.3 Western Sydney Aerotropolis

The relevant air quality related controls in the various plans for the Western Sydney Aerotropolis are listed below.

4.3.1 Aerotropolis Precinct Plan

There are no specific air quality objectives identified in the *Western Sydney Aerotropolis Precinct Plan* (NSW Government, 2023).

4.3.2 Western Sydney Aerotropolis Development Control Plan 2022 – Phase 2

There are no specific air quality objectives identified in the *Western Sydney Aerotropolis Development Control Plan 2022 – Phase 2* (NSW Government, 2022).

4.4 Summary of Key Implications for Master Plan

The air quality requirements for the Bradfield City Centre Master Plan are to aim to achieve ambient air quality levels in accordance with the environmental objectives of the NEPM air quality standards and to ensure that future development and activity can comply with the NSW EPA impact assessment criteria.

Controls outlined in the various plans for the Western Sydney Aerotropolis focus on the amenity of the area which includes the potential for air quality impacts associated with existing industry and activity in Bradfield City Centre. As the Western Sydney Aerotropolis is developed, there would be a period of transition for the existing operations to adapt or relocate with the changing landscape.

The Bradfield City Centre Stage 1 development will provide a range of uses including Advanced Manufacturing Research Facilities which may generate some air emissions. These facilities will need to be assessed through detailed design to ensure they do not cause any air quality impacts. Similarly, any future development within the Bradfield City Centre will need to consider their potential for air quality impacts and ensure that they do not adversely affect the amenity of the area.

5 Technical Assessment

The Bradfield City Centre Master Plan Stage 1 includes key components such as the road network, the built form arrangement, and the initial development of the AMRF. These development components have been assessed in further detail as they include air emission sources which may influence the air quality.

5.1 Road network

Road traffic emissions is likely to be a source of air pollution in the Bradfield City Centre that can limit the overall amenity associated with air quality. The road network is structured to provide access to each area within the Precinct and the main transport corridor to the north of the site.

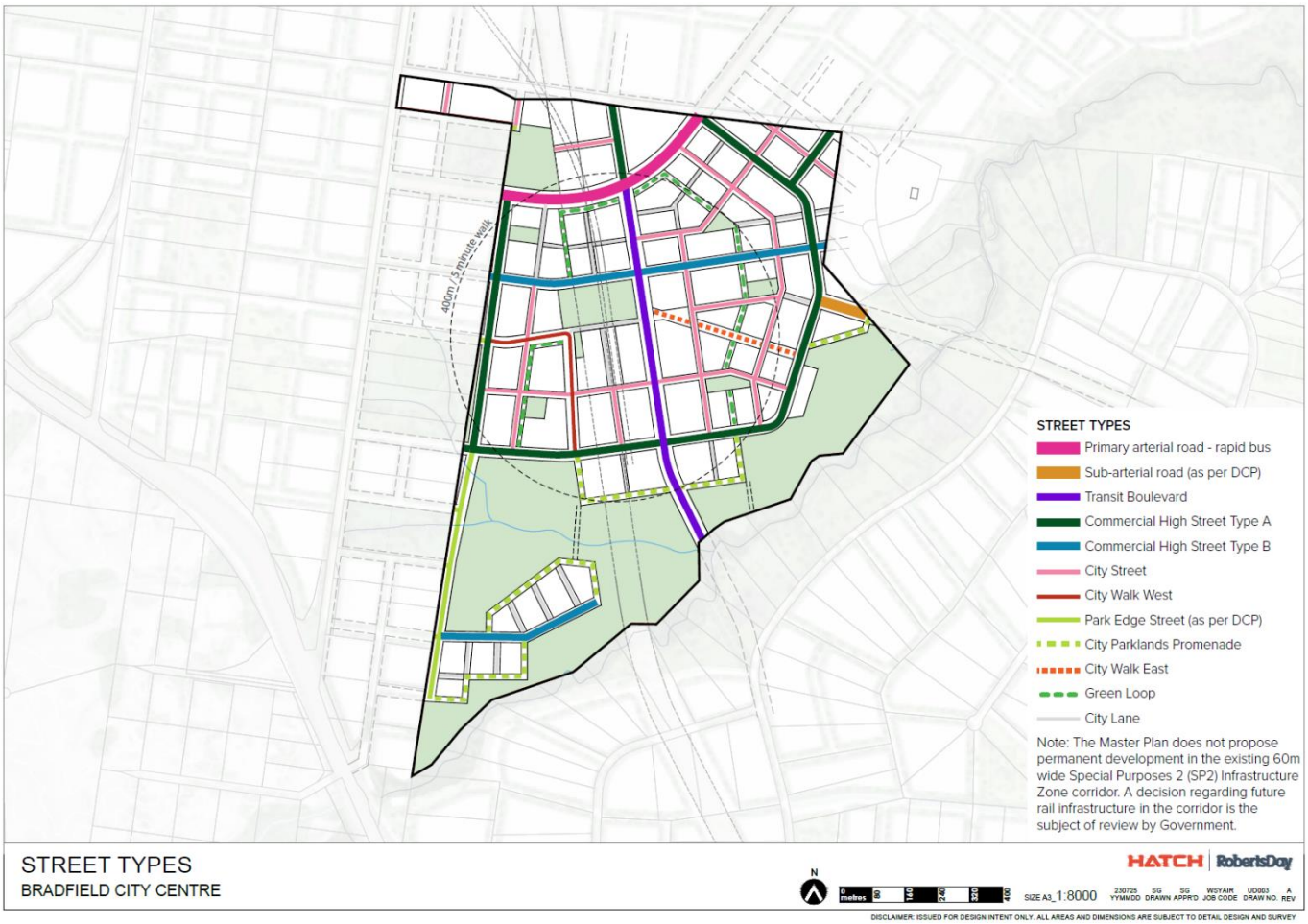
The access through the road network is expected to enable good traffic flows with reduced idling times to minimise the generation of traffic related air emissions. Heavy vehicles are a dominant contributor to the air emissions from traffic with these vehicle types emitting a large proportion relative to passenger cars. It is not expected to see a high proportion of heavy vehicles travelling through the city centre and past more development areas such as the residential areas.

The main arterial roads and road network in the Bradfield City Centre Master Plan is shown in **Figure 14**.

The amount of vegetation and trees positioned along the road network in the Bradfield City Centre Master Plan will result in an improvement of air quality as trees absorb some air pollution.

Traffic related air emissions would be a key air emission source for the immediate future in the Bradfield City Centre. We note that the future vehicle fleet projections indicate that overall exhaust emissions would continue to decrease through engine advancements, greater uptake of electric vehicles, stricter controls on exhaust emissions and improvements in tyre and brake emissions.

Figure 14 Identified main roads



5.2 Built form

The building design and built form of the Bradfield City Centre Master Plan provides variability and a discontinuous façade which would allow for cross wind flows around and between buildings. Laneways and access between the buildings assists with air flows, prevents stagnation and accumulation, and allows for air pollutants to disperse into large volume of air.

The retail / commercial / residential areas incorporate a design that would provide good air flow around and between the buildings. The design avoids construction of dead-end courtyards or long narrow spaces perpendicular to the prevailing winds where air can lay dormant and stagnate. The layout permits the design of buildings so living and workspaces such as bedrooms and offices do not face air emission sources, such as roadways, with cleaner air from central areas of the building directed into the building rather than from the side of the air emission source side.

5.3 Initial development

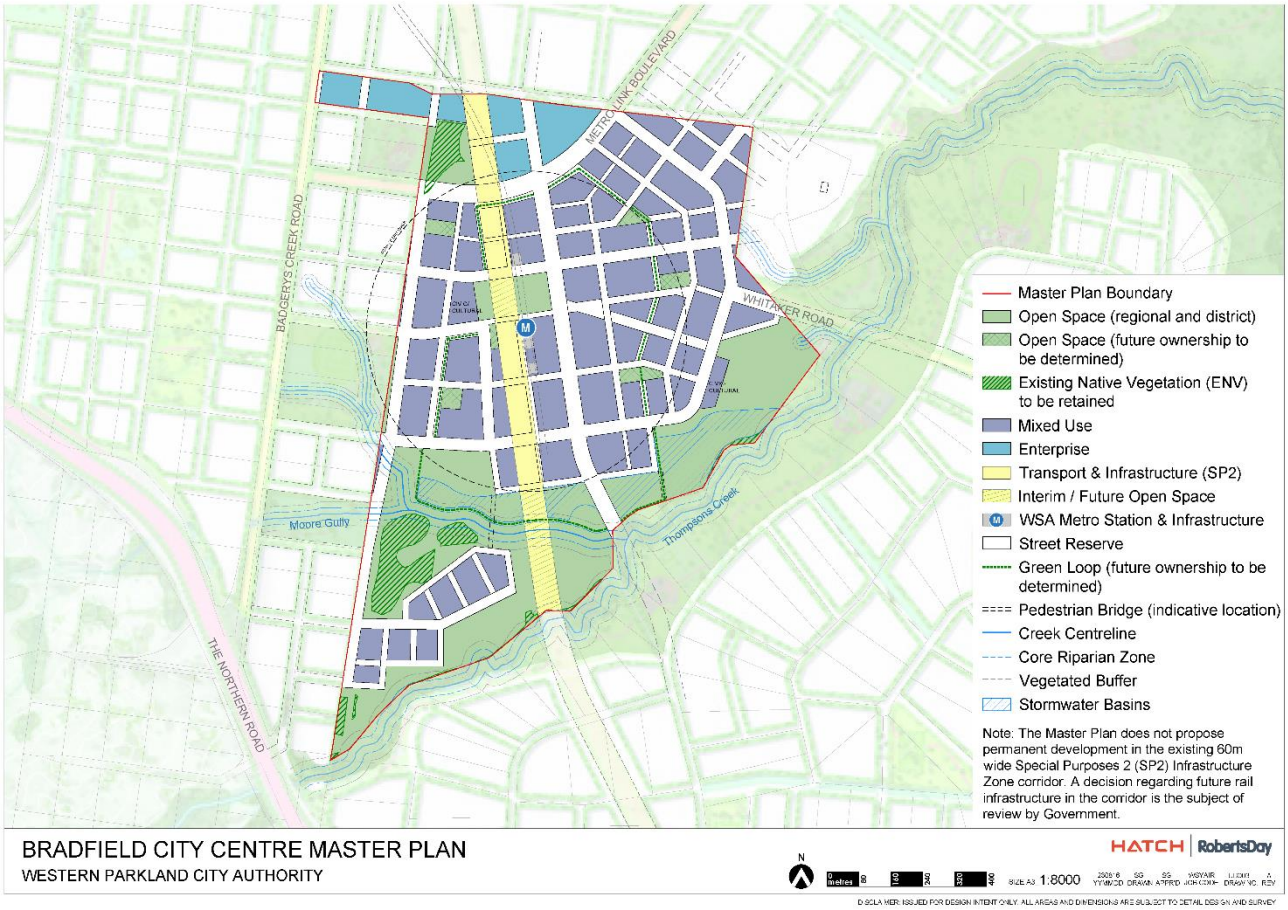
The initial development in Bradfield City Centre Master Plan Stage 1 will provide a range of uses including Advanced Manufacturing Research Facilities in the Enterprise zone. This development can have some potential for air emissions from various activity and would need to be considered on an individual basis, albeit this is not expected to be significant compared to other types of industry. Similarly, any future development in the Bradfield City Centre need to consider their potential for air quality impacts to ensure that they can comply with the relevant regulatory requirements.

The location of the Enterprise zone is shown in **Figure 15.**

The Advanced Manufacturing Research Precinct has been positioned in the northern portion of the Bradfield City Centre Master Plan and is separated from the residential areas. They would be positioned predominately downwind of these residential areas and would reduce the potential for air quality impacts and minimise the likelihood of land-use conflict.

Greenspaces within the Bradfield City Centre Master Plan would act as buffers between air emission sources and sensitive land uses. Greenspaces also promote good air quality as trees can absorb air pollution and green areas also reduce heat generation that can affect air pollutant transformation.

Figure 15 Location of Enterprise zone



6 Conclusion

This study has examined the potential air quality impacts that may arise associated with the Bradfield City Centre Master Plan.

The key source of air emissions associated with the Bradfield City Centre Master Plan is identified as road traffic emissions and from future development and activity. The Master Plan incorporates a layout which is designed to reduce effects of air emissions from road traffic through position of major transport corridors relative to sensitive uses, promotion of good air flow throughout the Bradfield City Centre and development from the sensitive uses to minimise the potential for land use conflict.

The design of the Bradfield City Centre Master Plan has considered the various air quality objectives in the development control plan for the Western Sydney Aerotropolis and would likely see these objectives being achieved.

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