ARUP

NSW Department of Planning and Environment

Bays West Stage 1 Rezoning

Air Quality Review

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1. Introduction

Arup has prepared this air quality review of the Bays West, White Bay Power Station (Metro) Sub-Precincts Masterplan (herein referred to 'Bays West precinct') on behalf of NSW Department of Planning and Environment (DPE).

At this stage of the planning process, a quantitative assessment of the Masterplan has not been undertaken, instead a qualitative review has been carried out of the Master Plan and Rezoning for the White Bay Power precinct – Proof of Concept prepared by Cox (19 July 2022) to determine if the precinct could support residential development in relation to the local air quality environment.

This report provides a high-level review of the existing and known future pollution sources and how these contribute to the air quality environment of the Bays West Precinct, with consideration of the potential residential uses proposed at the south-western side of the precinct.

1.1 Project Overview

The Bays West Precinct is located to the west of Sydney Central Business District (CBD), situated north to the ANZAC bridge, east of Victoria Road and west of Glebe Island and White Bay Ports (refer to Figure 1).

The proposed Masterplan is shown in Figure 2, and includes a range of commercial, retail, recreational, and cultural uses. The draft Masterplan indicates that residential uses might be appropriate in the south-western urban blocks (refer to the red markup in Figure 2).

Figure 1 – Site location

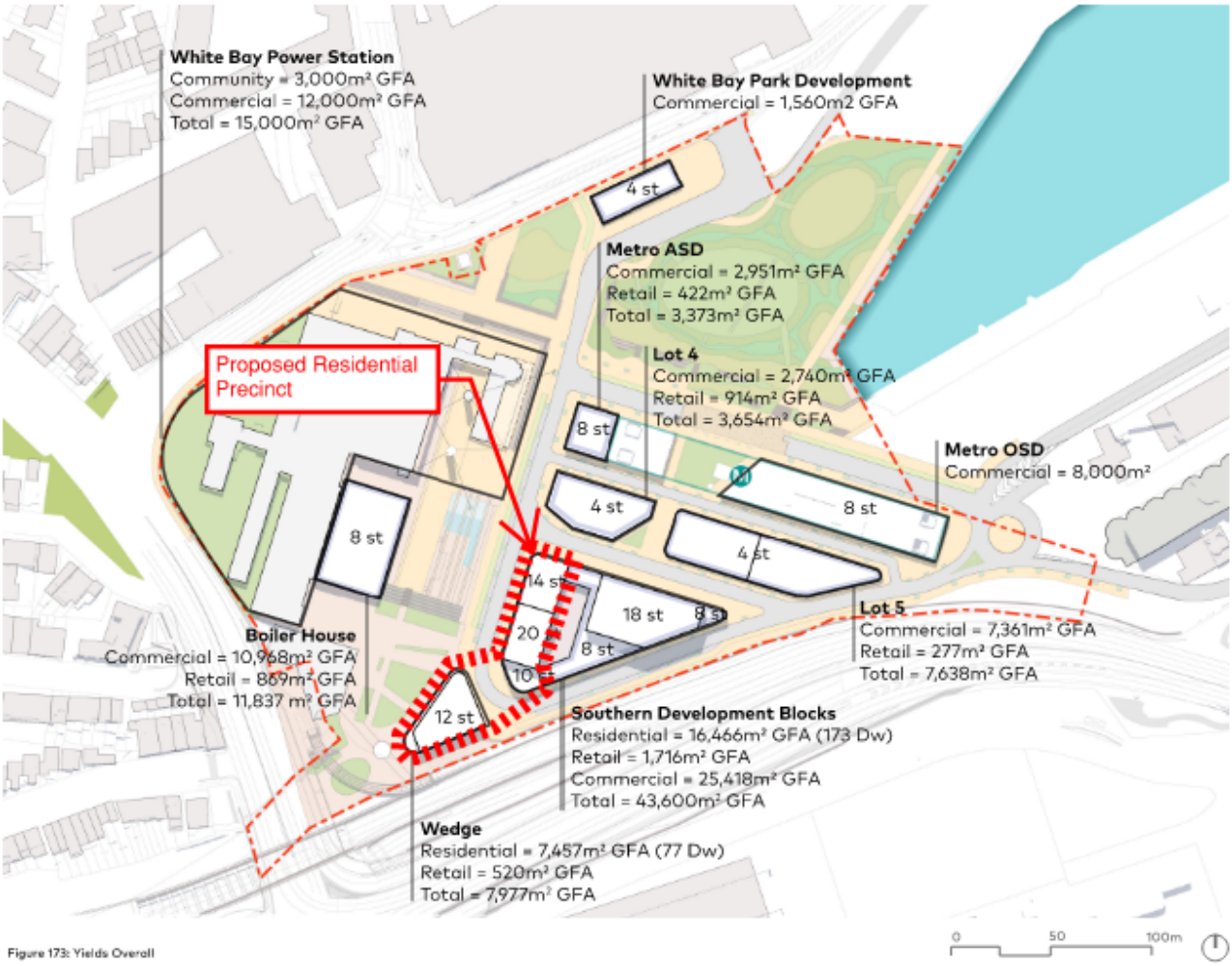

Figure 2 – Location of proposed residential uses

2. Air Quality Legislation and Guidelines

2.1 Commonwealth

2.1.1 National Environment Protection (Ambient Air Quality) Measures

The *National Environmental Protection Council Act 1994* is the federal legislation that established the *National Environmental Protection Council* (NEPC). The NEPC has two primary functions established by the Act:

- To make National Environment Protection Measures (NEPMs)
- To assess and report on the implementation and effectiveness of NEPMs in participating jurisdictions.

The NEPMs are a special set of national objectives designed to assist in protecting or managing particular aspects of the environment, including health-based Ambient Air Quality. The *National Environment Protection (Ambient Air Quality) Measure 2021(NEPM AAQ)* defines Commonwealth requirements for air pollutants national standards in Australia, aimed to provide equivalent protection for population exposure for a collective of air pollutants.

The NEPM AAQ standards apply to air quality experienced by the general population within a region, and not to air quality in areas within the region affected by localised air emissions, such as heavily trafficked streets. It should be noted that the Bays West Precinct, in particular proposed residential development, is impacted by localised emission sources located adjacent to ANZAC Bridge and Victoria Road, as discussed below.

The goal of the NEPM AAQ is to minimise the adverse effects of emissions to air, as assessed in accordance with the associated monitoring protocol. The standards are not relevant to air emissions from individual sources, specific industries or roadside locations, but rather to be applied at performance monitoring locations representing air quality in a region of 25,000 people or more. The standards are set at a level intended to adequately protect human health and well-being. Standards, goals, monitoring, and reporting protocols are stated for seven common pollutants, which are shown in Table 1.

The NEPM AAQ standards are to be considered when proposing a development precinct in overall in Australia to ensure the air quality environment amenity within the precinct is preserved in accordance with the national air quality objective.

Table 1 – NEPM AAQ standards

Pollutant	Average 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
Photochemical Oxidants (as Ozone)	8 hours	0.065 ppm
Sulphur Dioxide (SO_2)	1 hour	0.10 ppm
	1 day	0.02 ppm
Lead	1 year	0.50 ppm
Particle as PM_{10}	1 day	50 µg/m^3
	1 year	25 µg/m^3
Particle as $PM_{2.5}$	1 day	25 µg/m^3
	1year	8 µg/m^3

2.2 State Legislation

2.2.1 Protection of the Environment Operations Act 1997

The NSW Protection of the Environment Operations (POEO) Act 1997 is administered by the New South Wales (NSW) Department of Planning and Environment, under the Environment, Energy and Science group. The Act is formed to protect, restore and enhance the environment in NSW and to promote public access to information and involvement in environment protection. The Act designates the NSW EPA (Environment Protection Authority) as the regulatory authority.

2.2.2 Protection of the Environment Operations (Clean Air) Regulation 2021

The NSW Protection of the Environment Operations POEO (Clean Air) Regulation 2021 is specifically regulated to manage air quality issues associated with various sources, such as burning activities, motor vehicles fuels, fuel usage and transfer, air impurities from activities and plant, storage of volatile organic liquids and many others.

Part 5 of the POEO (Clean Air) Regulation specifically addresses air impurities from activities and plant, and refers to Schedule 4 to set the *Standard of concentrations for scheduled premises of general activities and plant* and Schedule 6 to set the *Standard of concentrations for non-scheduled premises*.

The POEO (Clean Air) Regulation 2021 is applicable should there be any scheduled or non-scheduled premises within the Bays West precinct that have the potential to be source of air pollution, which may impact the health and amenity within as well as outside the precinct.

2.2.3 The EPA Approved Methods 2017

As the Regulatory Authority designated by the POEO Act 1997, EPA NSW has published the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (January 2017), hereafter referred to as the Approved Methods, to provide detailed statutory methods in modelling and assessing air pollutants in the state of NSW. The Approved Methods provides methods and impact assessment criteria for assessing emissions of air pollutants from stationary sources in NSW.

As the project moves through the planning process, the Approved Methods would be applied to assess potential air quality impacts from the operation of any stationary sources associated with future commercial activities within the Bays West precinct, to the surrounding environment within as well as outside the precinct.

While there is no specific policy or guidance document to determine the suitability of land for residential development, given previous responses provided by the EPA[1] for the Bays West Precinct, the impact assessment criteria in the Approved Methods has been used to provide guidance on how surrounding emission sources impact the local air quality environment at the Bays West precinct. Exceedances of these criteria highlight a potential risk of pollutant concentrations impacting health and amenity of users/residents within a development.

[1] NSW EPA comments under DOC22/709137-3, 8 September 2022.

Table 2 – The EPA Approved Methods Air Quality Criteria

Pollutant	Averaging Period	Maximum Concentration, pphm	Maximum Concentration, µg/m^3
Carbon Monoxide (CO)	15 minutes	8,700	100,000
	1 hour	2,500	30,000
	8-hour	900	10,000
Sulphur dioxide (SO_2)	10 minutes	25	712
	1 hour	20	570
	24-hour	8	228
	Annual	2	60
Nitrogen dioxide (NO_2)	1 hour	12	246
	Annual	3	62
Ozone	1 hour	10	214
	4 hours	8	171
PM_{10}	24 hours	-	50
	Annual	-	25
$PM_{2.5}$	24 hours	-	25
	Annual	-	8

3. Air Quality Review

The air quality review is structured as follows:

- Discussion on local meteorological conditions representative of the Bays West precinct
- Discussion on existing background air quality representative of the Bays West precinct
- Discussion on potential air quality impacts from surrounding existing as well as known future sources, onto the Bays West precinct
- Discussion on the suitability of the Bays West precinct for the proposed residential development

3.1 Local Meteorological Conditions

Local meteorology conditions, including wind direction and speed, affect the dispersal of pollutants in a local area.

Meteorological data measured by the Bureau of Meteorology (BoM) weather station with anemometer at a standard height of 10 m at Sydney Airport from 1995 to 2020 were reviewed. The anemometer is located about 10 km to the south of the precinct but is determined to be most representative of the Bay West Precinct.

3.1.1 Annual Average Wind Rose

The annual average wind rose for the reviewed period between 1995 and 2021, and the associated wind class frequency distribution are shown in Figure 3. Based on Figure 3, the following features can be observed:

- The prevailing winds are organised into three main groups: north-east, north-west, and south quadrants.
- The southern and north-western prevailing winds indicate that any source of pollution (such as the ANZAC Bridge and Victoria Road, respectively) will be downwind to the Bays West precinct.
- Strong summer winds occur mainly from the south and north-east quadrants.
- Winter and early spring strong winds typically occur from the south-west and west quadrants.
- The local Balmain peninsula topography channels winds from the north-east through White Bay, while offering some protection to winds from the west. Winds from the south are relatively unaffected by topography, with a slight funnelling of wind between the Glebe and Annandale ridges.

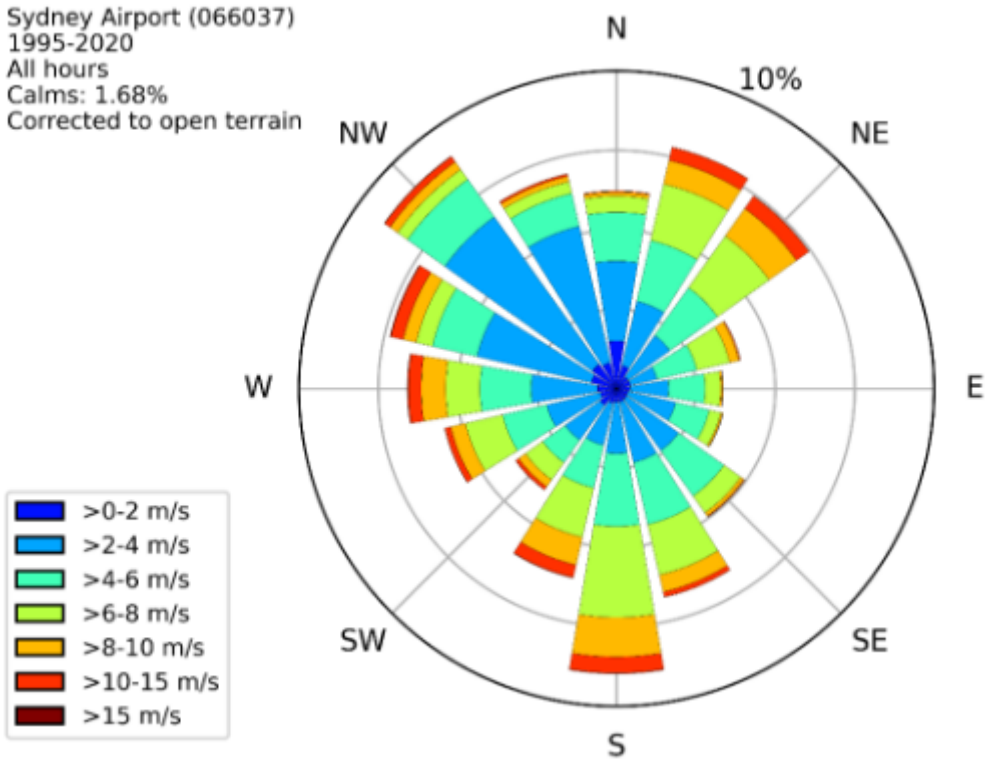

Figure 3 – Wind Rose for Sydney Airport (1995 to 2020)

3.2 Background Air Quality

Existing or background ambient air quality refers to the concentration of relevant substances that are already present in the environment from various sources that may include industrial processes, commercial and domestic activities, agriculture, traffic and natural sources. Establishment of baseline air quality conditions is important to inform the required design considerations for the Project to minimise exposure.

There is currently no ambient air quality monitoring data specifically within the Bays West precinct. There is a NSW DPE air quality monitoring station (AQMS) located at Rozelle, approximately 1 km west of the Bays West precinct, currently operated by the Environment, Energy and Science Group (EESG) of the NSW DPE. The Rozelle AQMS currently records relevant pollutants such as CO, NO_2, SO_2, PM_{10} and $PM_{2.5}$. The latest five-year monitoring data in Rozelle is available up to 2020[2]. It is noted that major bushfire activity had occurred in late 2019 and early 2020.

The annual maximum 24-hour average concentration data for particulate matters generally exceed the air quality criteria over the years due to occasional occurrence of regional events such as bushfires, hazard reduction burns and dust storms. Hence, the average 90th percentile background concentration across the years have been considered to determine the likely representative maximum 24-hour average background concentrations for particulate matter. The reviewed 2016 to 2020 monitoring data is presented in Table 3.

[2] NSW Government, DPIE, 2020. *New South Wales Annual Compliance Report 2020*. October 2021. (https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Air/national-environment-protection-measure-ambient-air-quality-nsw-compliance-report-2020-210479.pdf)

Table 3 – Background air quality concentrations at Rozelle

Pollutant	Averaging Period	Approved Methods Criteria, µg/m³	Maximum Background Concentration, µg/m³				
			2016	2017	2018	2019	2020
Carbon Monoxide (CO)	8-hour	10,000	1,380	1,035	805	2,530	2,990
Nitrogen Dioxide (NO_2)	1-hour	246	94	115	107	169	81
	Annual	62	21	21	19	19	15
Sulphur Dioxide (SO_2)	1-hour	570	52	63	79	84	42
	24-hour	228	13	8	13	13	8
	Annual	60	3	3	3	3	<3
PM_{10}	24-hour	50	26.9[a]	27.8[a]	27.5[a]	35.9[a]	28.6[a]
	Annual	25	16.8	18.1	18.4	22.7	18.1
$PM_{2.5}$	24-hour	25	n/a	11.3[a]	11.5[a,b]	16.4[a]	13.6[a]
	Annual	8	7.4	7.2	7.3	10.3[c]	7.5

Note:

a. Values based on the 90th percentile 24-hour average, due to maximum exceedances caused by bushfires or hazard reduction burns.

b. Data capture less than 75%.

c. Exceedance of criteria heavily influenced by major bushfires in NSW later in 2019.

In addition, the Port Authority of NSW installed an air quality monitoring station at the corner of Grafton and Adolphus Streets, in Balmain, to monitor the ambient air quality in the immediate vicinity of the White Bay Cruise Terminal (WBCT), since September 2015. The station monitors sulphur dioxide (SO_2) and particulate matter less than 2.5 microns diameter ($PM_{2.5}$), deemed to be the pollutants of concern from cruise ships. The maximum concentrations for SO_2 and $PM_{2.5}$ between 2016 and 2021 have been reviewed and presented in Figure 4 to Figure 7. Detailed results are presented in Appendix A. The WBCT facility was closed during 2020-2021 due to the COVID-19 pandemic.

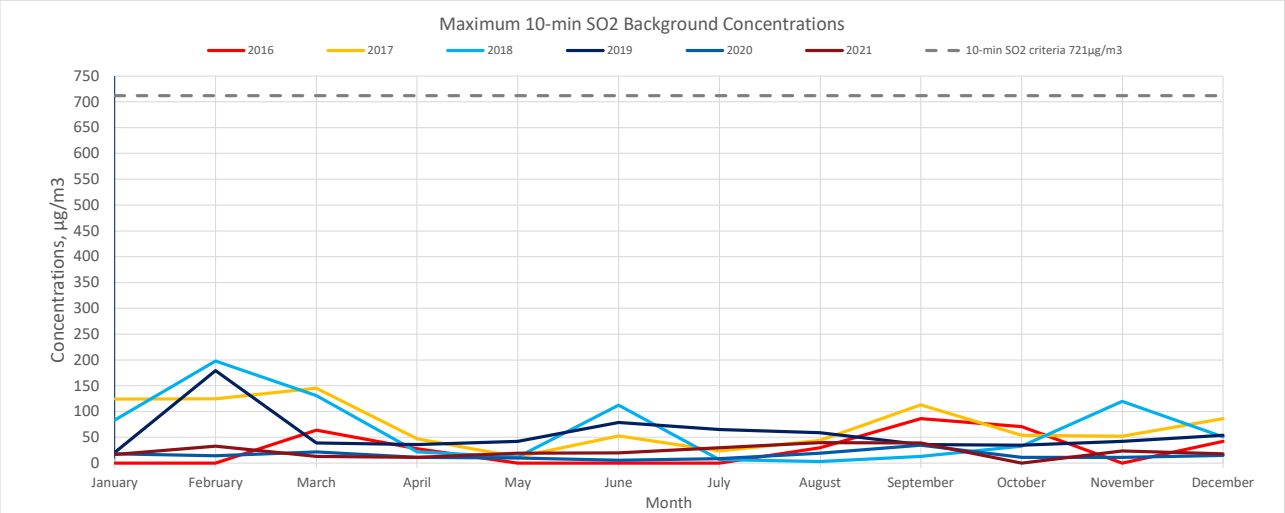

Figure 4 – Port Authority of NSW – Maximum 10-min SO_2 background concentrations (2016-2021)

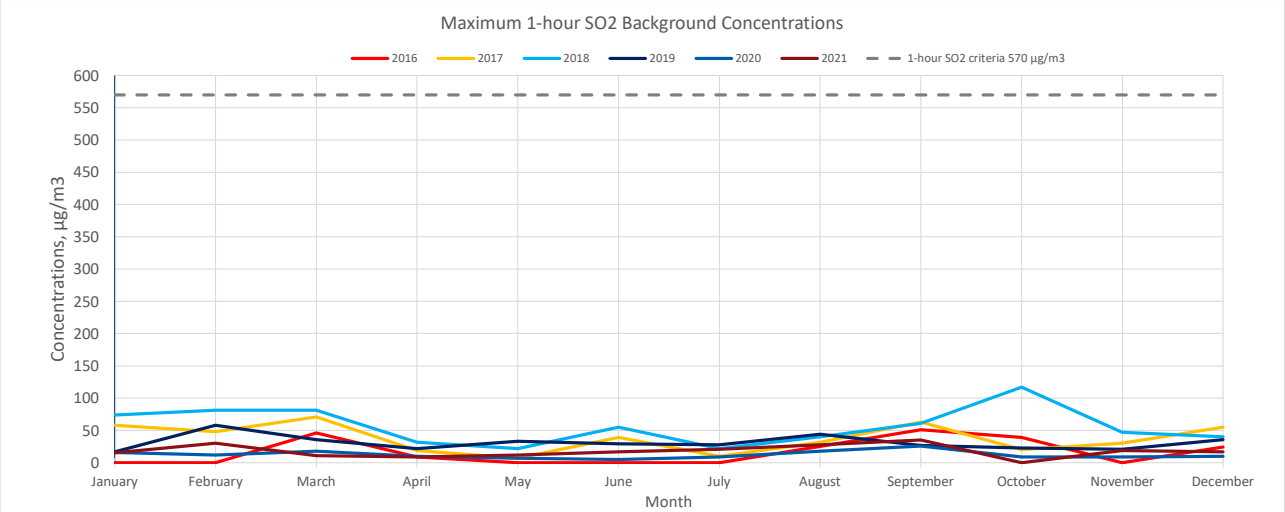

Figure 5 – Port Authority of NSW – Maximum 1-hour SO_2 background concentrations (2016-2021)

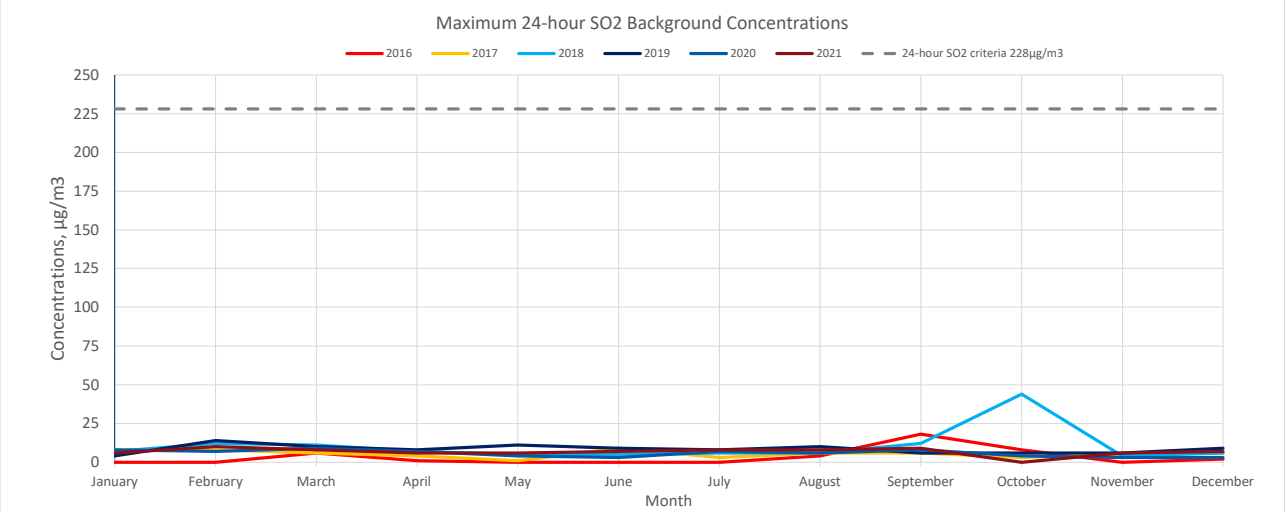

Figure 6 – Port Authority of NSW – Maximum 24-hour SO_2 background concentrations (2016-2021)

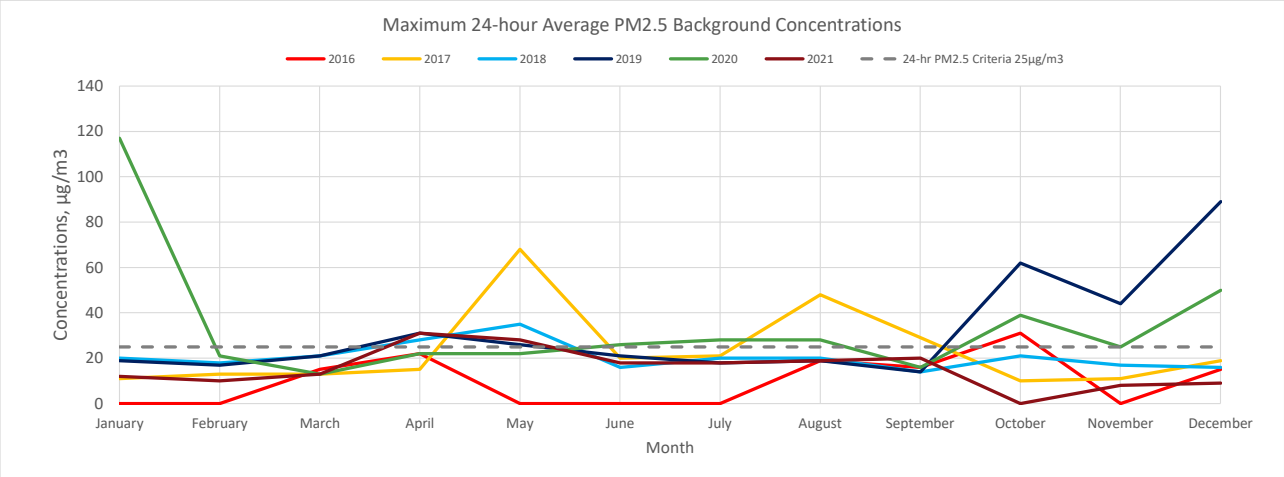

Figure 7 – Port Authority of NSW – Maximum 24-hour $PM_{2.5}$ background concentrations (2016-2021)

The tables provided in Appendix A show that monitored SO_2 concentrations at the Port Authority monitoring station are generally slightly higher than monitored concentrations at the Rozelle AQMS, which is to be expected given the proximity of this monitoring to cruise ship emission sources using the WBCT. SO_2 background concentrations for all averaging periods at both monitoring locations are all below the Approved Methods criteria.

Monitored $PM_{2.5}$ concentrations are similar at both site or slightly higher at the Port Authority monitoring station at times, and across a recent five year period a number of exceedances have been recorded, however these generally align with the occurrence of regional events such as bushfires, hazard reduction burns and dust storms. Outside of those periods, maximum 24-hour average $PM_{2.5}$ concentrations generally sit between 16 to 19 $\mu g/m^3$, below the Approved Methods criterion of 25 $\mu g/m^3$.

3.2.1 Adopted Background Air Quality Concentrations

A summary of background data preliminarily adopted for the proposed Bays West precinct is shown in Table 4 for relevant pollutants, along with comparison against the Approved Methods criteria. The adopted background concentrations were based on year 2016 to 2018 data from both DPE and Port Authority NSW stations, and excluded year 2019 and year 2020 data due to influence of major bushfires and reduced industrial activity in the area associated with the Covid-19 pandemic.

The adopted background air quality for relevant air pollutants within the Bays West precinct are all below the Approved Methods criteria.

Table 4 – Adopted background air quality concentrations for Bays West Precinct

Pollutant	Averaging Period	Approved Methods Criteria, µg/m^3	Adopted Background Concentration, µg/m^3
Carbon Monoxide (CO)	8-hour	10,000	1,380
Nitrogen Dioxide (NO_2)	1-hour	246	115
	Annual	62	21
Sulphur dioxide (SO_2)	1-hour	570	117
	24-hour	228	44
	Annual	60	3
PM_{10}	24-hour	50	35.9
	Annual	25	18.4
$PM_{2.5}$	24-hour	25	16.4
	Annual	8	7.5

3.3 Definition of Air Quality Sensitive Receivers

Air quality sensitive receivers are defined under the Approved Methods as:

"A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors."

The proposed Bays West precinct comprises of mixed-use and potential residential development in the southwest corner of the Sub-precincts (refer to Section 1.1), and therefore an understanding of the existing local air quality at the Project Site is important to determine the suitability for the introduction of sensitive receivers through development of a precinct. Existing and future air pollution sources are discussed in Section 3.4 and 3.5.

This report focusses on dwellings identified as air quality sensitive receivers. Suitability of the precinct for other sensitive receivers (e.g. medical facilities/offices) also needs to be considered however it is expected that any impacts on these types of receivers could be controlled via mechanical ventilation, and therefore are considered to be less critical than those buildings dedicated for residential dwelling purposes.

3.4 Existing Air Pollution Sources

The existing sources that influence local air quality at the Project Site are:

- Traffic-related air pollutants associated with the ANZAC Bridge and Victoria Road
- Cruise ships operation at White Bay Cruise Terminal
- Industrial activities and shipping within the port area

3.4.1 Transportation

ANZAC Bridge and Victoria Road

The ANZAC Bridge and Victoria Road are arterial roads located to the south and west of the Bays West precinct respectively. Both roads are relatively busy roads with high traffic volumes. By reference to the *Westconnex M4-M5 Link Rozelle Interchange Modification Noise Assessment*[3], the two-way (annual average daily traffic) AADT for the ANZAC Bridge is approximately 190,000 vpd, whereas for Victoria Road is approximately 70,000 vpd. The nearest proposed buildings are approximately 20 m from the ANZAC Bridge on-ramp and 40 m from the main carriageway, and 45 m from Victoria Road. These buildings are currently proposed to include mixed-use as well as potentially residential development (refer to Section 1.1) and therefore would be at high risk of elevated pollutant concentrations from nearby transport sources.

An indicative calculation using the Transport for NSW's (TfNSW's) Tool for Roadside Air Quality (TRAQ) and the aforementioned traffic data has been undertaken to determine potential air quality impact risk at the Bays West precinct, in particular for those areas proposed to include residential development. The TRAQ assessment summarised in Figure 8 to Figure 17 show that levels of particulate matter concentrations are elevated within close proximity to the Anzac Bridge. This poses a high risk of exceeding air quality criteria which could impact amenity for proposed residential premises.

Further, the meteorological analysis in Section 3.1.1 indicated southerly and north-westerly prevailing winds in which air pollutants from the Anzac Bridge to the south of the precinct and Victoria Road to the west will predominantly be carried downwind and influence the air quality at the Bays West precinct.

While exceedances of the air quality criteria does not automatically preclude residential development, further mitigation measures would be required to make sure pollutant concentrations at proposed dwellings are minimised as far as practicable and preferably below the air quality criteria. Mitigation measure options are limited however would likely include mechanical ventilation options and minimising opportunities for natural ventilation using polluted air.

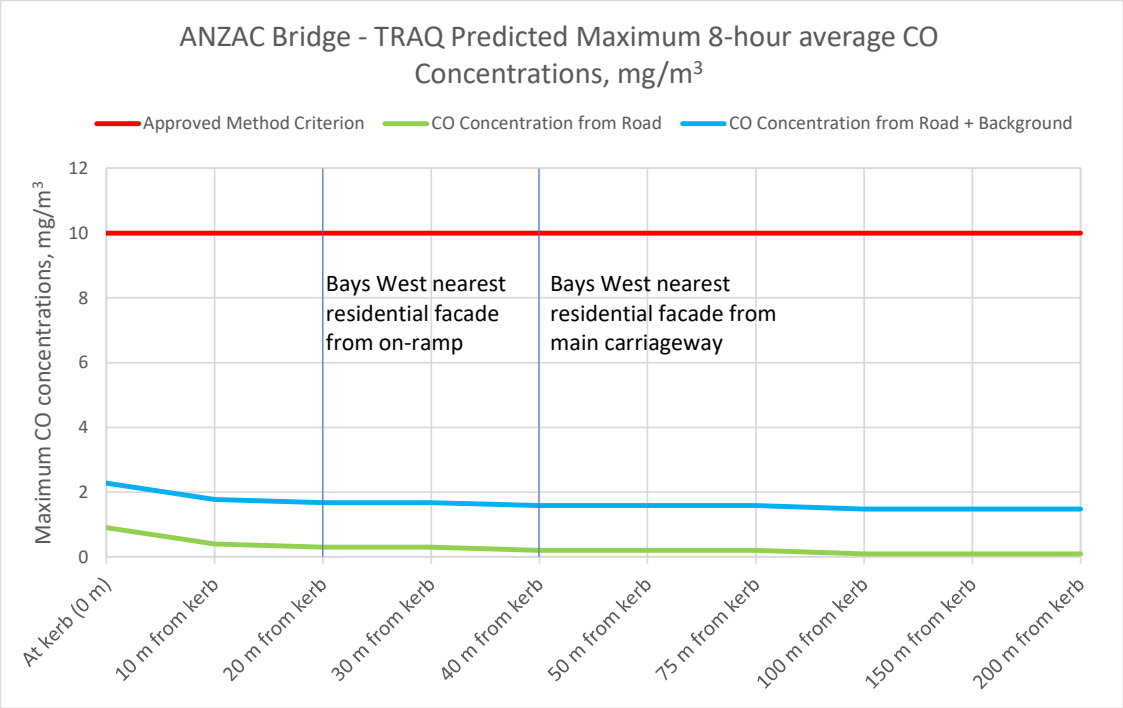

Figure 8 – TRAQ predicted ANZAC Bridge maximum 8-hour average CO concentrations at incremental distances

[3] SLR Consulting, *"Westconnex M4-M5 Link - Rozelle Interchange - Modification: The Crescent overpass and active transport links - Appendix C Noise and Vibration Assessment,"* NSW Government, Sydney, 2019.

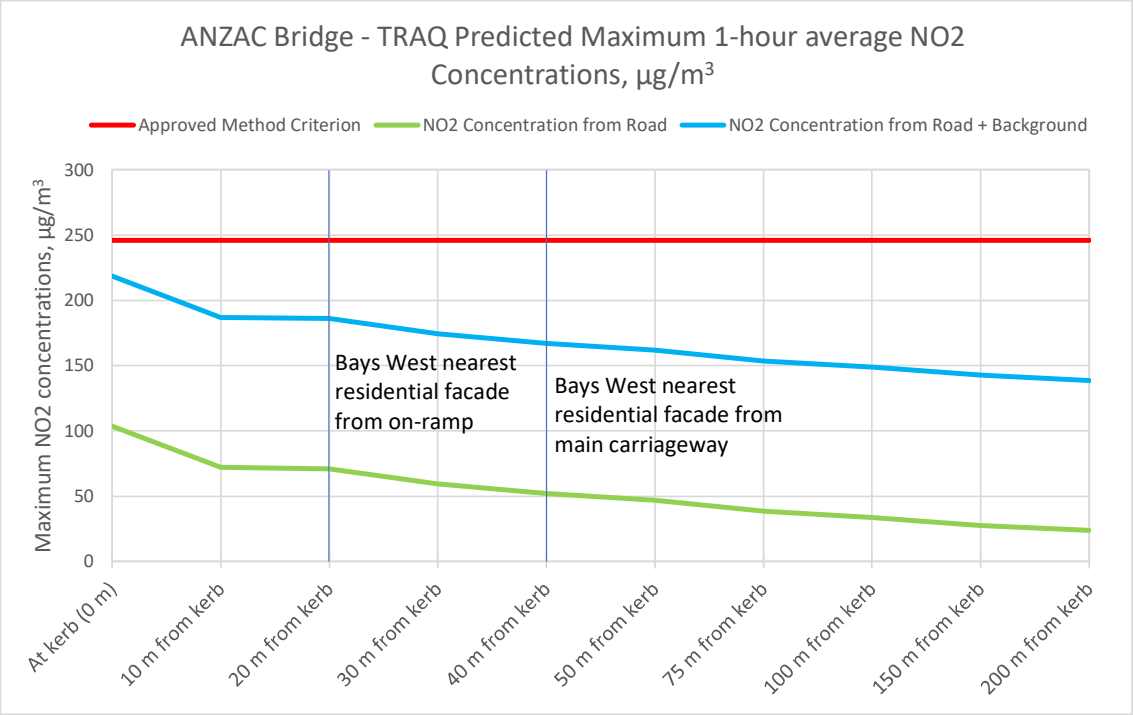

Figure 9 – TRAQ predicted ANZAC Bridge maximum 1-hour average NO_2 concentrations at incremental distances

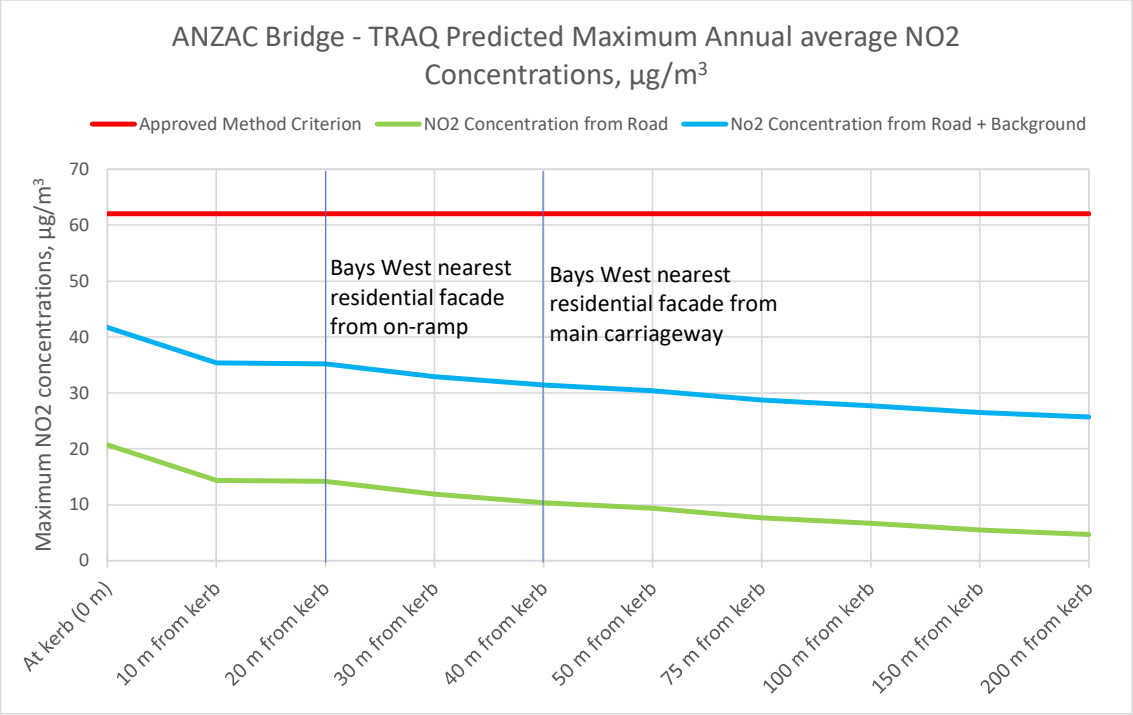

Figure 10 – TRAQ predicted ANZAC Bridge maximum annual average NO_2 concentrations at incremental distances

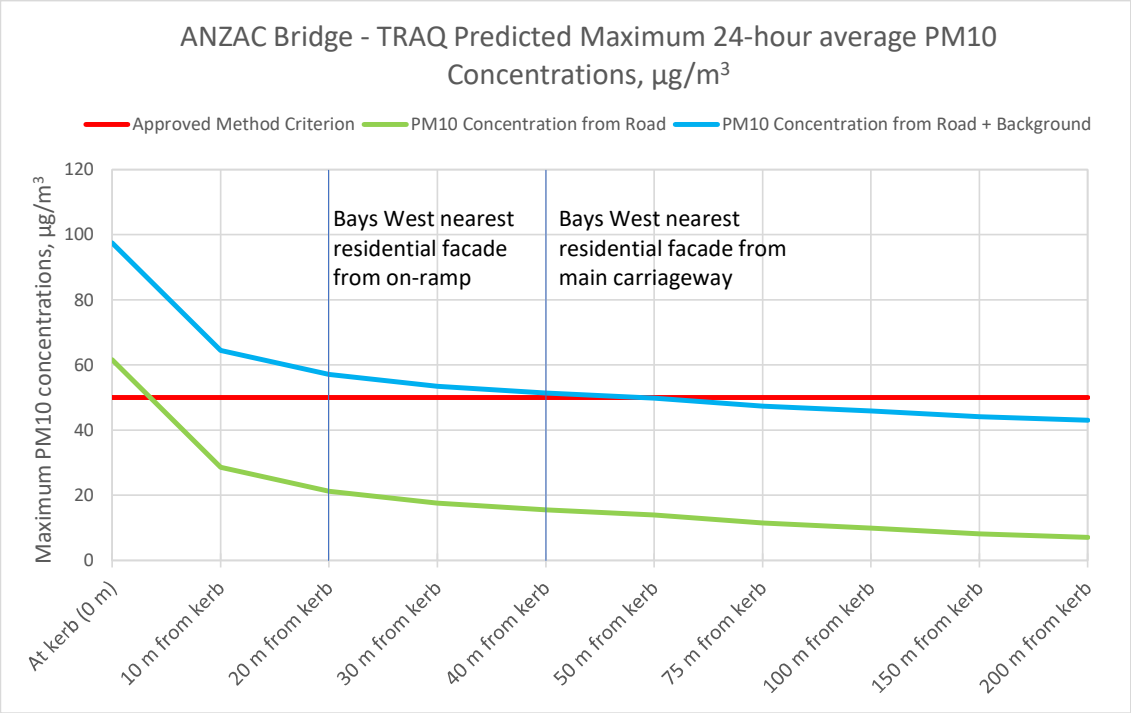

Figure 11 – TRAQ predicted ANZAC Bridge maximum 24-hour average PM_{10} concentrations at incremental distances

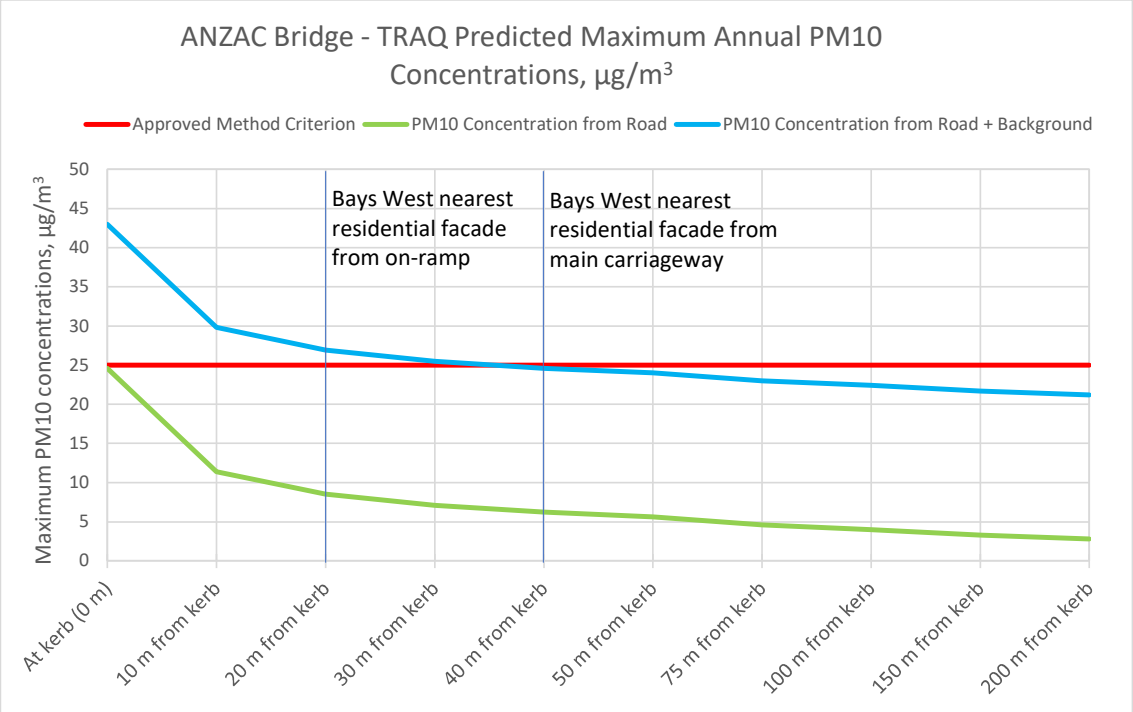

Figure 12 – TRAQ predicted ANZAC Bridge maximum annual average PM_{10} concentrations at incremental distances

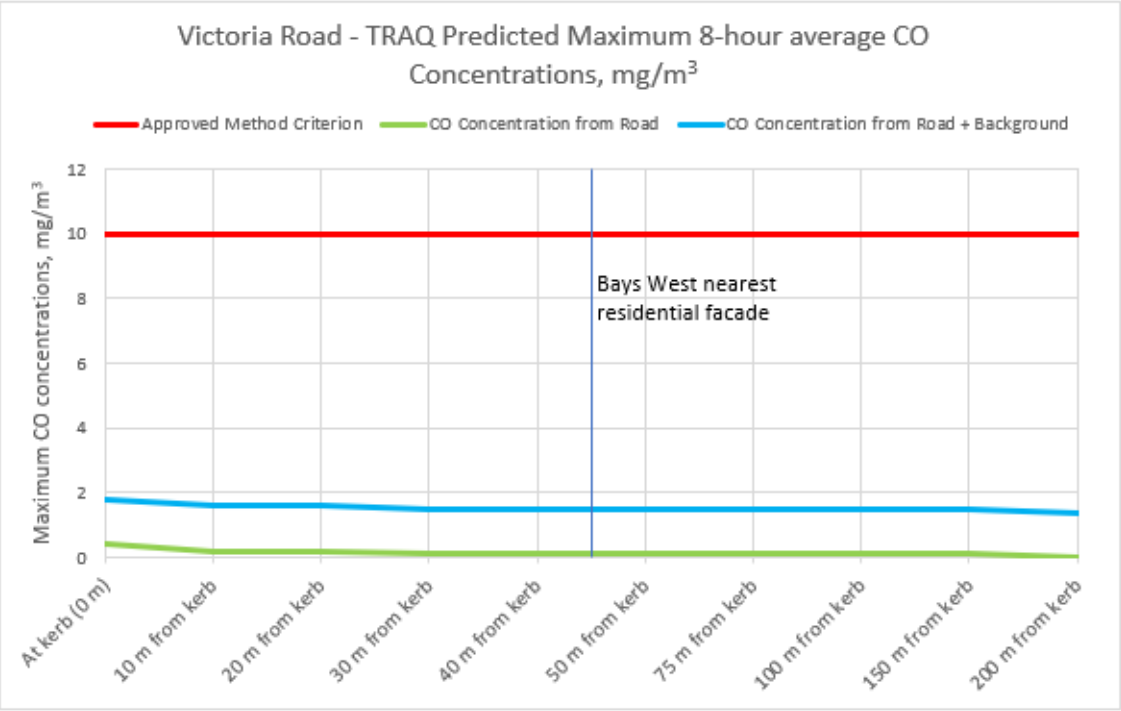

Figure 13 – TRAQ predicted Victoria Road maximum 8-hour average CO concentrations at incremental distances

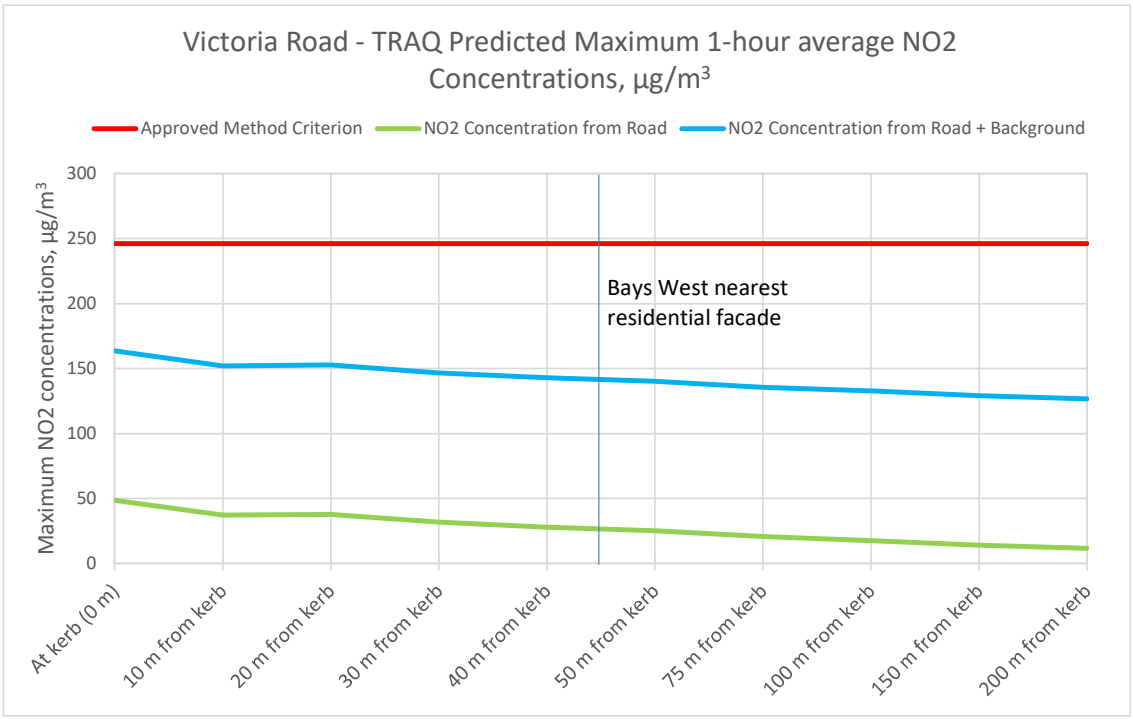

Figure 14 – TRAQ predicted Victoria Road maximum 1-hour average NO_2 concentrations at incremental distances

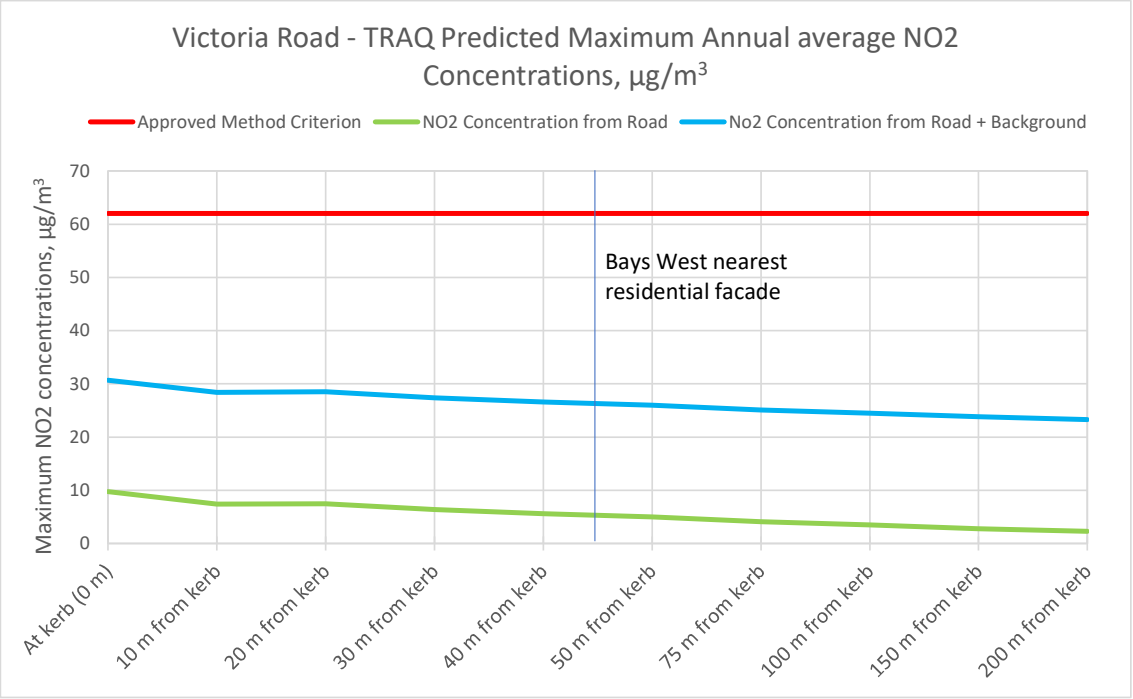

Figure 15 – TRAQ predicted Victoria Road maximum annual average NO_2 concentrations at incremental distances

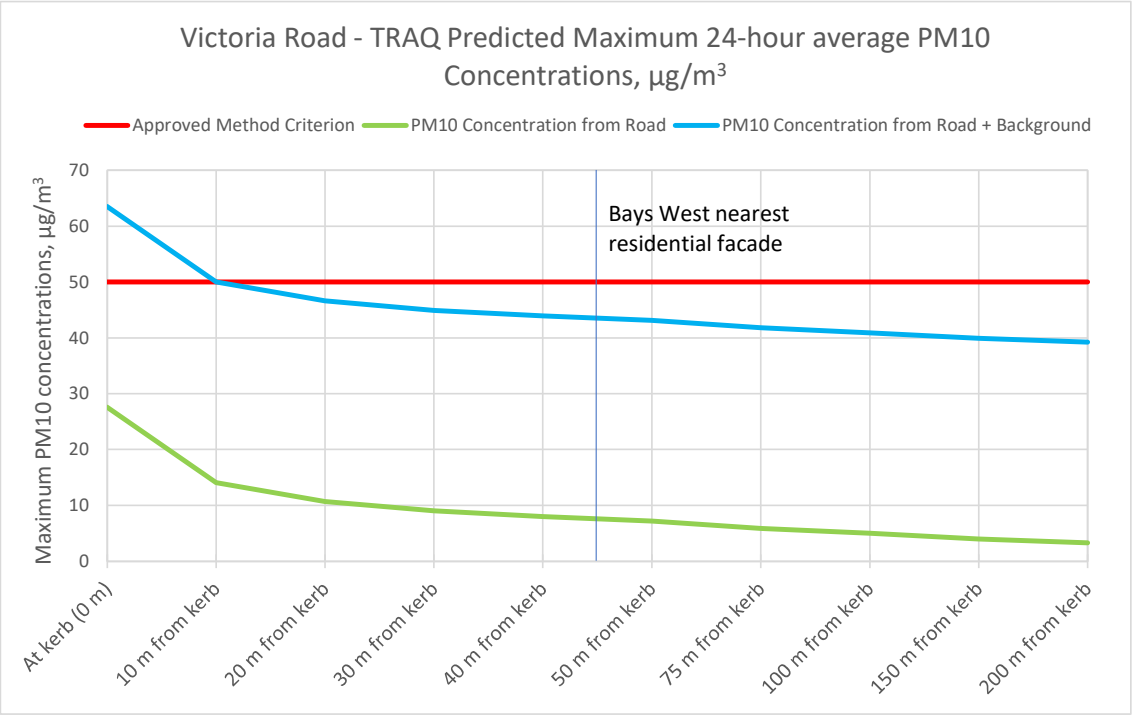

Figure 16 – TRAQ predicted Victoria Road maximum 24-hour average PM_{10} concentrations at incremental distances

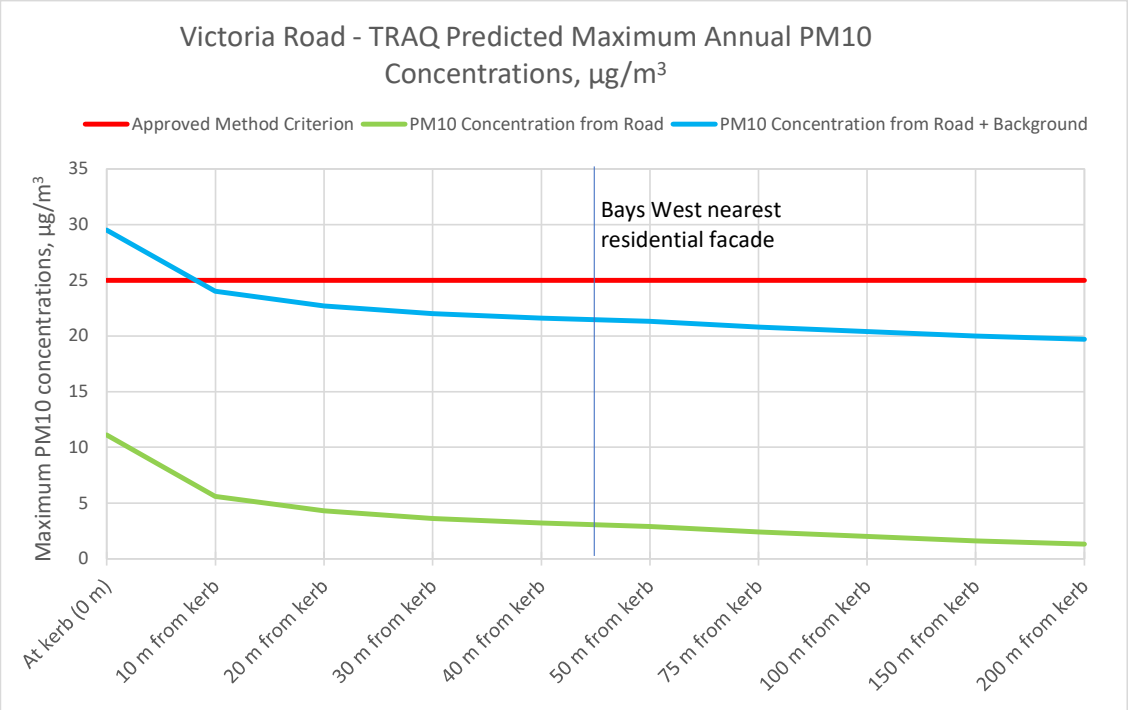

Figure 17 – TRAQ predicted Victoria Road maximum annual average PM_{10} concentrations at incremental distances

3.4.2 Port Facilities

The surrounding port facilities associated with White Bay and Glebe Island are summarised in Figure 18. White Bay port area consists of five operating berths (berths 2 to 6) currently used as lay-up berth and cruise passenger terminal. Glebe Island port area has four berths. Berths 1 and 2 are used as common user berth, berth 7 is currently used for Gypsum Resources Australia and Sugar Australia, and berth 8 is currently used for Cement Australia. A review of each of these sources and the potential to impact air quality at the Project Site is discussed below.

Figure 18 – Surrounding Port Facilities

White Bay Cruise Terminal

The White Bay Cruise Terminal (WBCT) is currently situated approximately a kilometre north-east of the proposed residential premises within the Bays West precinct, and operates under the Port Authority of New South Wales (Port Authority). Air quality impacts from cruise ships are generated from diesel engines used while the ships are in transit and manoeuvring into berth and while at berth, using both propulsion engine and auxiliary engines, respectively. Diesel-electric power generator configuration are often used in the modern cruise ships for more fuel-efficiency. The main air pollutants associated with cruise ships engines are nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), carbon dioxide (CO_2) and hydrocarbons (HC).

Pervious air quality studies have been undertaken to assess the air quality impacts from WBCT using dispersion modelling techniques. The initial assessment undertaken by SKM[4] in 2010 showed that the proposed operation of WBCT was unlikely to cause exceedances of the air quality assessment criteria for NO_2, PM_{10} and SO_2 at the nearest sensitive receivers in Balmain, which are much closer to the WBCT than the proposed Bays West precinct.

A more recent air quality assessment (2017)[5] was undertaken to validate the air quality impact assessment outcomes presented within the SKM study in 2010. The outcomes of the 2017 study have further suggested that the cumulative air quality impacts of NO_2, SO_2 and PM_{10} from the WBCT as assessed in 2010 remain valid, and are considered to provide an accurate representation of current impacts, with some conservatism noting lower emission rates for SO_2 now regulated under the 2016 low sulphur (0.1% vs. modelled 2.4%) regulation[6].

Further, monitoring undertaken by Port Authority of NSW, as discussed in Section 3.2, indicates that the recorded SO_2 and $PM_{2.5}$ concentrations for all averaging periods are all under the Approved Methods criteria, during all cruise ship days. Occasional exceedances of 24-hour average $PM_{2.5}$ concentrations were recorded due to the influence from bushfire and hazard reduction burn activities in the region (refer to Figure 19 and Figure 22).

Based on the above findings, the operation of the WBCT is not anticipated to significantly impact local air quality at the proposed presidential premises within the Bays West precinct.

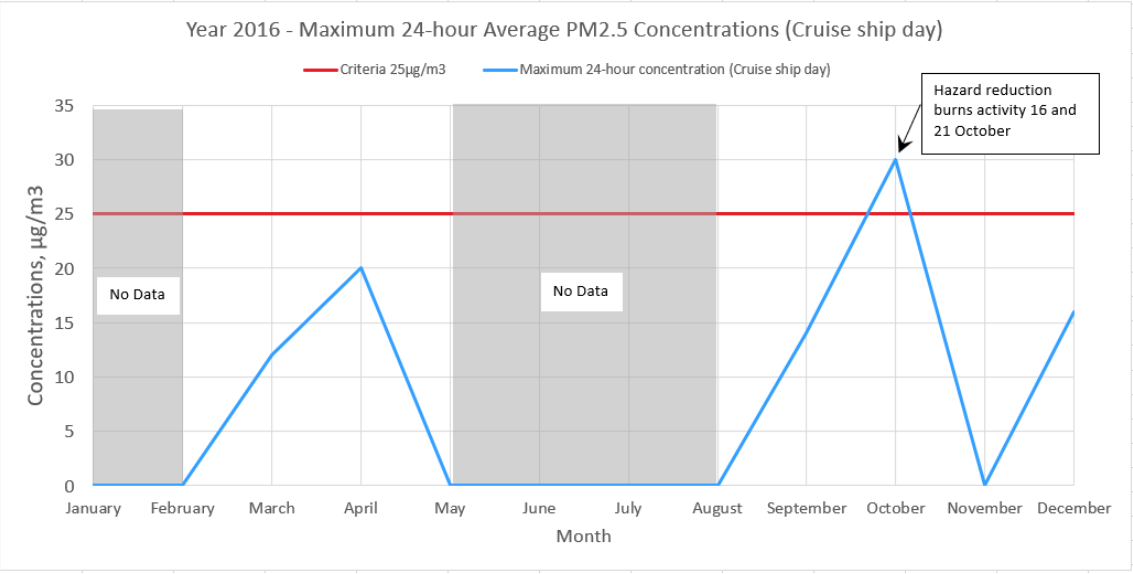

Figure 19 – 2016 air quality monitoring results for maximum $PM_{2.5}$ concentrations during cruise ship days

[4] SKM, 2010. *White Bay Passenger Terminal – Air Quality Assessment*. Sinclair Knight Merz, 29 September 2010.

[5] Jacob, 2017. *White Bay Cruise Terminal – Air Quality Assessment*. Document No. 5. 28 March 2017.

[6] Australian Government, 2018. Marine Notice 6/2018 – *Limitation of sulphur emissions from cruise vessels while at berth in Sydney Harbour*. Australian Maritime Safety Authority. 2018. This supersedes Marine Notice 2016/21.

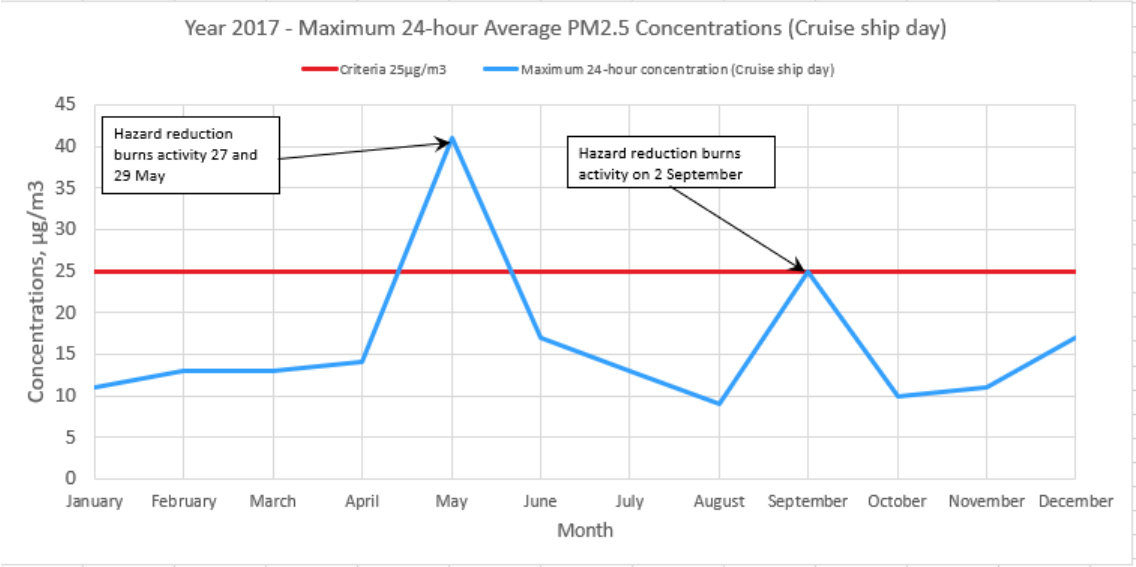

Figure 20 – 2017 air quality monitoring results for maximum $PM_{2.5}$ concentrations during cruise ship days

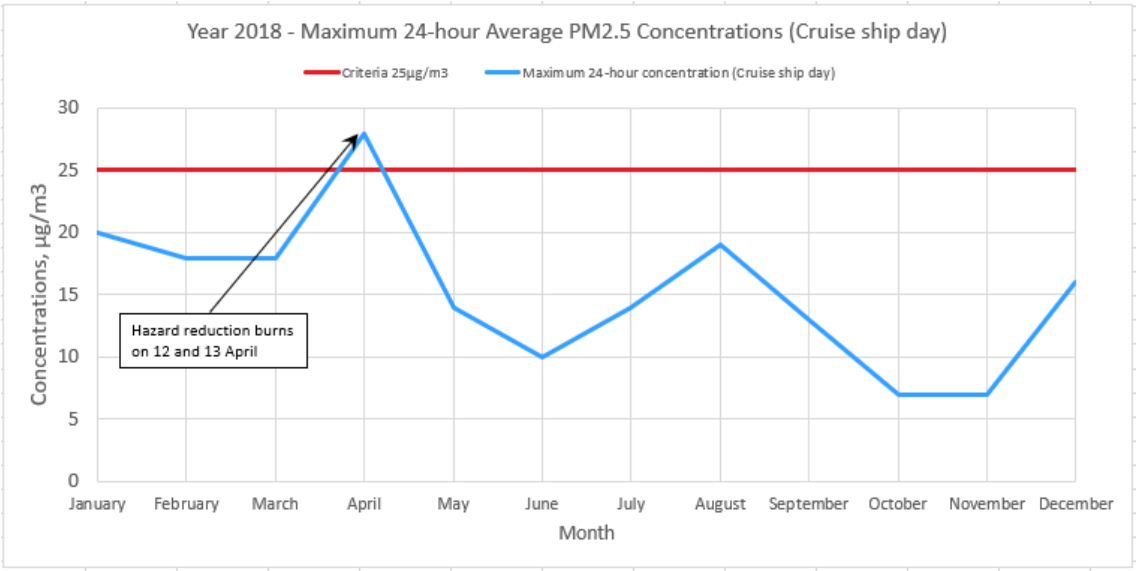

Figure 21 – 2018 air quality monitoring results for maximum $PM_{2.5}$ concentrations during cruise ship days

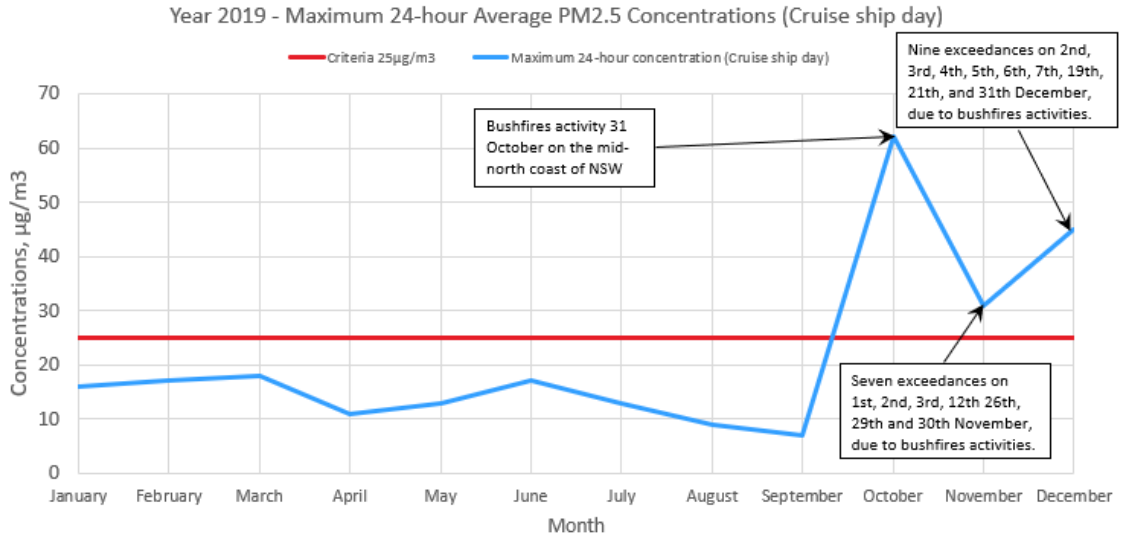

Figure 22 – 2019 air quality monitoring results for maximum $PM_{2.5}$ concentrations during cruise ship days

Cement Australia

Cement Australia is currently operating their bulk cement storage facility in Glebe Island silos, which is located directly adjacent to the eastern boundary of the Bays West precinct. There is currently limited information pertaining to the detailed operation performed within the Cement Australia facility in Glebe Island. However, the cement industry is a source of air pollution generating nitrogen oxides (NOx), sulphur dioxides (SO), dust and carbon monoxide (CO). In instances where sensitive land-uses are proposed to be built in proximity to industrial facilities such as a cement works, a separation distance would normally be recommended to maintain amenity at the sensitive land use.

In the absence of a local guideline, the EPA Victoria Publication 1518: *Recommended Separation Distances for Industrial Residual Air Emissions – Guideline* (EPA Victoria, 2013) provides advice on the recommended separation distance between industrial land uses that emit air emissions and sensitive land uses such as residential areas. The guidance aims to protect human health and wellbeing, local amenity and aesthetic enjoyment of ensuring adequate distances are maintained to reduce the need for intense mitigation measures and offsite impacts.

The EPA Victoria Publication 1518 recommends the following separation distances for cement-related facilities:

- Cement manufacturing, involving production of cement from clays or limestone in either a furnace or a kiln to produce cement clinker, suggesting:
  - 250 m buffer for <5,000 tonnes per year production,
  - 500 m buffer for between 5,000 and 150,000 tonnes per year, and
  - 1,000 m buffer for >150,000 tonnes per year production.
- Cement clinker grinding, involving grinding of cement clinker, clays or limestone materials, recommending:
  - 250 m buffer for <150,000 tonnes per year production, and
  - 500 m buffer for >150,000 tonnes per year.

The proposed Bays West precinct, including any residential development, lies within these recommended separation distances, even for smaller production facilities.

A review of publicly available information indicates that Cement Australia has been operating a cement distribution terminal at Glebe Island since early 1990s. Up to 400,000 and 500,000 tonnes[7] of cement powder (equivalent to 30 to 35 ship loads) are brought into the terminal annually by specialised cement powder ships. The cement is pumped from the ship to the 16 westernmost silos of the silo complex (shown in location "C", in Figure 18), with discharge time averaged about 30 hours.

Cement tankers then enter the Glebe Island precinct via James Craig Road, connecting to Sommerville Road to enter the cement silo facility. The tankers fill over weighbridges which then depart along Sommerville Road again and leave the facility via the same entrance point along James Craig Road.

As the current operation of the Cement Australia facility at Glebe Island silos is a storage facility, with enclosed bulk material during both storage and transport, it is not expected to significantly impact local air quality at the proposed Bays West precinct and that the above separation distances are unlikely to be applicable. However, it is recommended that more detailed information on the operation of this Cement Australia facility be sought to confirm the above preliminary understandings, and to ensure that there would

[7] NSW Government, 2012. Major Projects – Cement Australia Comments – Interim Facility Glebe Island, 12 December 2012. (https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-318%2120191129T044903.312%20GMT).

not be any residual air quality impact risk to the Bays West precinct as a result of the operation of the facility, prior to detailed development assessment.

Gypsum Resources Australia

Gypsum Resources Australia (GRA) currently operates a gypsum storage facility capacity of approximately 28,000 tonnes and discharges cargo at Glebe Island berth 7. There is currently limited information pertaining to the detailed operation performed within the GRA facility in Glebe Island. Hence, it is recommended that more detailed information on the operation of this GRA facility be sought to determine the air quality impact risk to the Bays West precinct development, prior to detailed development assessment.

Operations of other White Bay Berths

There are occasional shipping operations associated with the other White Bay berths (e.g. berths 2-4), with limited information in the public domain. The air emissions associated with these berths' operations would vary from ships' diesel engines used while the ships are in transit or at berth, as well as fugitive emissions from material handling.

Whilst it is expected that the contribution of any shipping activities to local air quality in the area is likely to be captured in the air quality monitoring data in Balmain (corner of Grafton and Adolphus streets), it is recommended that more detailed information on the operation of these White Bay berths 2 to 4 be sought to determine the air quality impact risk to the Bays West precinct development, prior to detailed development assessment.

3.5 Future Air Pollution Sources

Future sources that have the potential to influence local air quality at the Project Site in the future are:

- M4-M5 Link Rozelle Interchange tunnel ventilations
- Western Harbour Tunnel ventilation at Rozelle Interchange
- Potential future industrial sites within the port area.

3.5.1 Transportation

WestConnex M4-M5 Link – Rozelle Interchange Tunnel Ventilation

The nearest tunnel ventilation stacks to the proposed Bays West precinct are those associated with the WestConnex M4-M5 Link – Rozelle Interchange project, which include tunnel ventilation stacks at the Rozelle Rail Yards, approximately 450 m to the west of the Bays West precinct. The M4-M5 Link tunnel ventilation facility at Rozelle includes two ventilation stacks, namely: a ventilation supply facility at the Rozelle West motorway operations complex and a ventilation exhaust facility at the Rozelle East motorway operations complex. Refer to Figure 23 (denoted by 'M4-M4 Link/ICL') and Figure 24 for location of the tunnel ventilations.

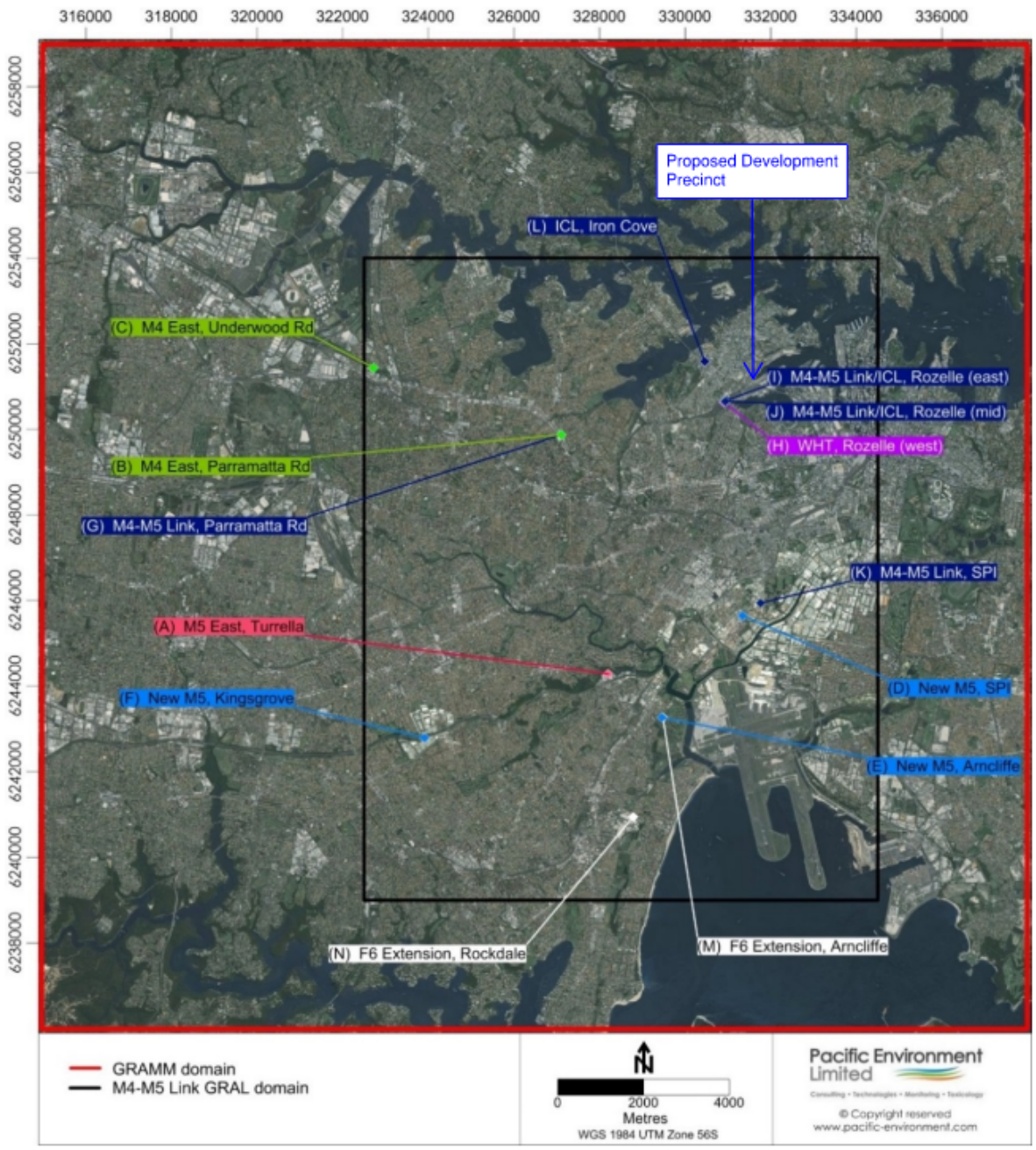

Figure 23 – Locations of tunnel ventilations surrounding the Bays West precinct

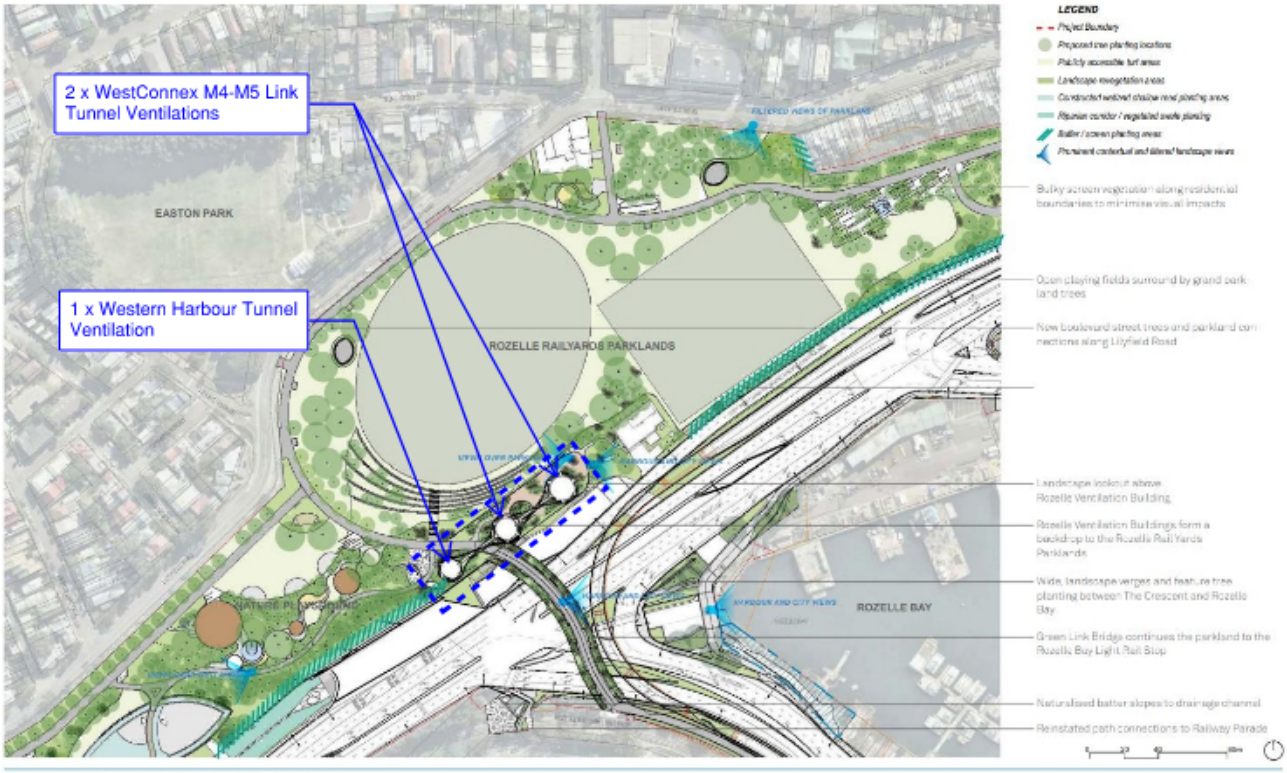

Figure 24 – Detail tunnel ventilation locations at Rozelle Rail Yard

A review of the WestConnex M4-M5 Link Environmental Impact Statement (2017)[8] shows that the assessed relevant pollutants (NO_2, PM_{10} and $PM_{2.5}$) are as below:

- The maximum 1-hour NO_2 concentration from the tunnel ventilations are predicted to be relatively low (<10 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 28(Appendix B), assuming $NO_x = NO_2$ concentrations.
- The annual mean NO_2 concentration from the tunnel ventilations are predicted to be relatively low (<0.6 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 29 (Appendix B), assuming $NO_x = NO_2$ concentrations.
- The maximum 24-hour PM_{10} concentration from the tunnel ventilations are predicted to be relatively low (~0.6 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 30 (Appendix B).
- The annual mean PM_{10} concentration from the tunnel ventilations are predicted to be relatively low (~0.1 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 31 (Appendix B).
- The maximum 24-hour $PM_{2.5}$ concentration from the tunnel ventilations are predicted to be relatively low (<0.6 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 32 (Appendix B).
- The annual mean $PM_{2.5}$ concentration from the tunnel ventilations are predicted to be relatively low (<0.1 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 33 (Appendix B).

Based on the above findings, the operation of the WestConnex M4-M5 Link Rozelle Interchange tunnel ventilation stacks is anticipated to be insignificant and therefore would not impact local air quality at the proposed Bays West precinct.

[8] WestConnex, 2017. *M4-M5 Link Environmental Impact Statement – Appendix I: Technical Working Paper: Air quality – Main report,* August 2017

Western Harbour Tunnel

The Western Harbour Tunnel project also includes tunnel ventilation stacks located within the same proximity to the WestConnex M4-M5 Link tunnel ventilation, which is at Rozelle Rail Yards (refer to Figure 24). A review of the Western Harbour Tunnel Environmental Impact Statement (2020)[9] shows that the assessed relevant pollutants (NO_2, PM_{10} and $PM_{2.5}$) are as below, inclusive of all stages of the WestConnex, Sydney Gateway and F6 Extension highway projects completed. This means that the contribution from the M4-M5 link discussed above, is included in the results discussed below:

- The maximum 1-hour NO_2 concentration from the tunnel ventilations are predicted to be relatively low (~25 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 34 (Appendix C), assuming $NO_x = NO_2$ concentrations.
- The annual mean NO_2 concentration from the tunnel ventilations are predicted to be relatively low (~1 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 35 (Appendix C), assuming $NO_x = NO_2$ concentrations.
- The maximum 24-hour PM_{10} concentration from the tunnel ventilations are predicted to be relatively low (~1 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 36 (Appendix C).
- The annual mean PM_{10} concentration from the tunnel ventilations are predicted to be relatively low (~0.14 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 37 (Appendix C).
- The maximum 24-hour $PM_{2.5}$ concentration from the tunnel ventilations are predicted to be relatively low (<0.8 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 38 (Appendix C).
- The annual mean $PM_{2.5}$ concentration from the tunnel ventilations are predicted to be relatively low (<0.1 µg/m^3) at the proposed Bays West precinct, based on the contour plot in Figure 39 (Appendix C).

Based on the above findings, the operation of the Western Harbour Tunnel ventilation stacks is anticipated to be insignificant and therefore would not impact local air quality at the proposed Bays West precinct.

"The Bays" Metro Station

Sydney Metro West is currently expanding their rail capacity between Greater Parramatta and the Sydney CBD. As part of the rail expansion, among other proposed stations, an underground station has been confirmed at The Bays, which is located at the Bays West precinct.

Construction of The Bays underground station would generate emissions to air associated with the dust generated from construction clearing and demolition, excavation, materials handling, stockpiling and compaction activities, as well as wind erosion of stored materials and exposed surfaces[10]. However, it is understood that the construction of The Bays station will be completed prior to the Bays West precinct development, and therefore there will be no air quality risk associated from the construction of The Bays Station. Due to the underground nature of the station, and the fact that metro trains will be electric, the operation of The Bays Station is also not expected to significantly impact local air quality at the Bays West precinct.

[9] Roads and Maritime Services, 2020. *Western Harbour Tunnel and Warringah Freeway Upgrade – Technical working paper: Air quality*, January 2020.

[10] NSW Government, 2021. *Sydney Metro West Environmental Impact Statement: Major civil construction between The Bays and Sydney CBD – Chapter 19: Air quality*. October 2021. (https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-19238057%2120211027T225343.547%20GMT).

3.5.2 Industries

Port Multi-User Facility and Hanson Concrete Batching Plant

Currently the Port Authority is proposing the construction and operation of a multi-used import, storage and distribution facility for sand and other bulk construction materials (herein referred to as 'the Multi-User facility') on its site at Glebe Island. The Multi-User facility project has been proposed to support the growing need for the importation of critical construction materials into Sydney. The air emissions associated with the Multi-User facility potentially includes shipping emissions (using low sulphur based fuel) and fugitive emissions from materials handling and vehicles.

Within the same port vicinity, Hansen's aggregate handling facility and a concrete batching plant (CBP) (refer below in Figure 25 to Figure 27) located adjacent to the Multi-Users facility have recently been approved[11]. The Hanson facility would potentially generate emissions to air from shipping related activities as well as dust emissions from batching activities and fugitive emissions from materials handling and vehicles.

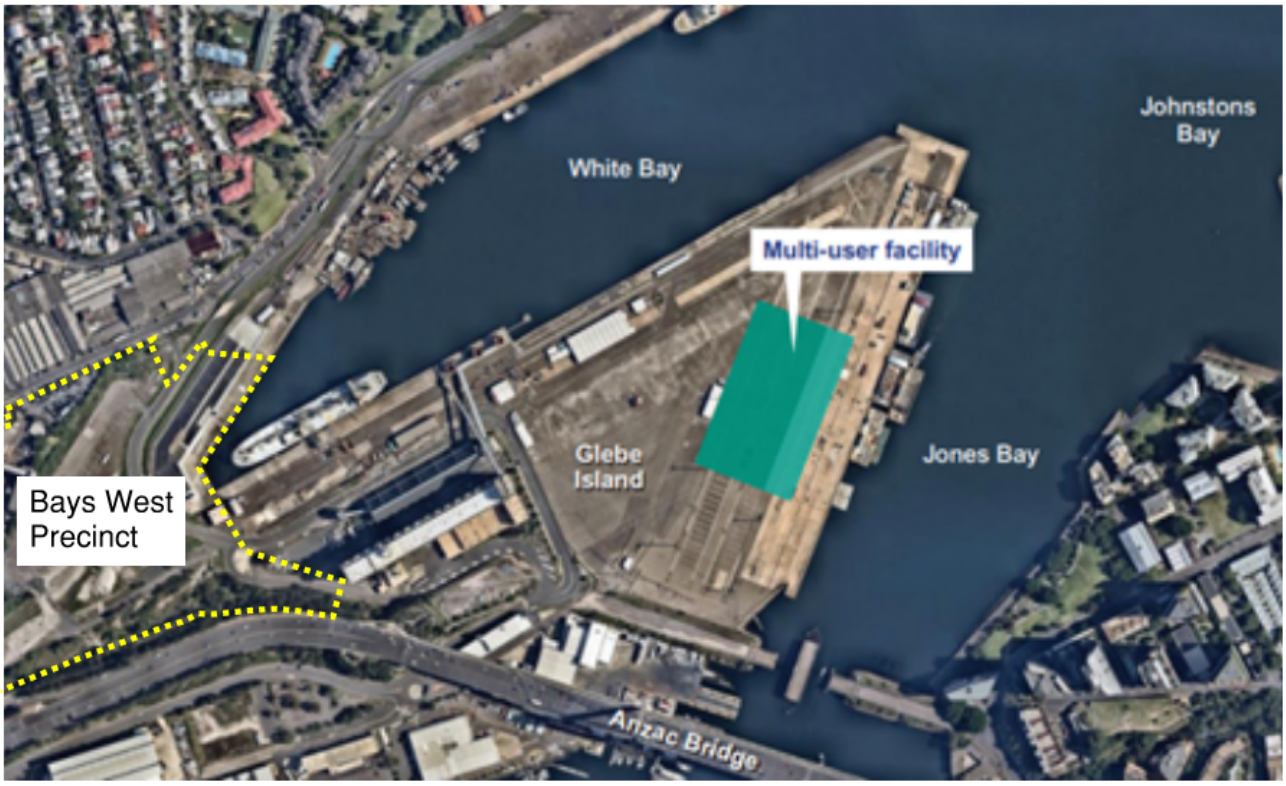

Figure 25 – Location of the proposed Port's Multi-Users facility (Source: Port Authority of NSW, 2019)[12]

[11] https://www.planningportal.nsw.gov.au/major-projects/projects/glebe-island-concrete-batching-plant-and-aggregate-handling-facility

[12] https://www.portauthoritynsw.com.au/media/3840/muf-factsheet.pdf

Figure 26 – Location of the proposed Hanson concrete batching plant (Source: AECOM, 2019)[13]

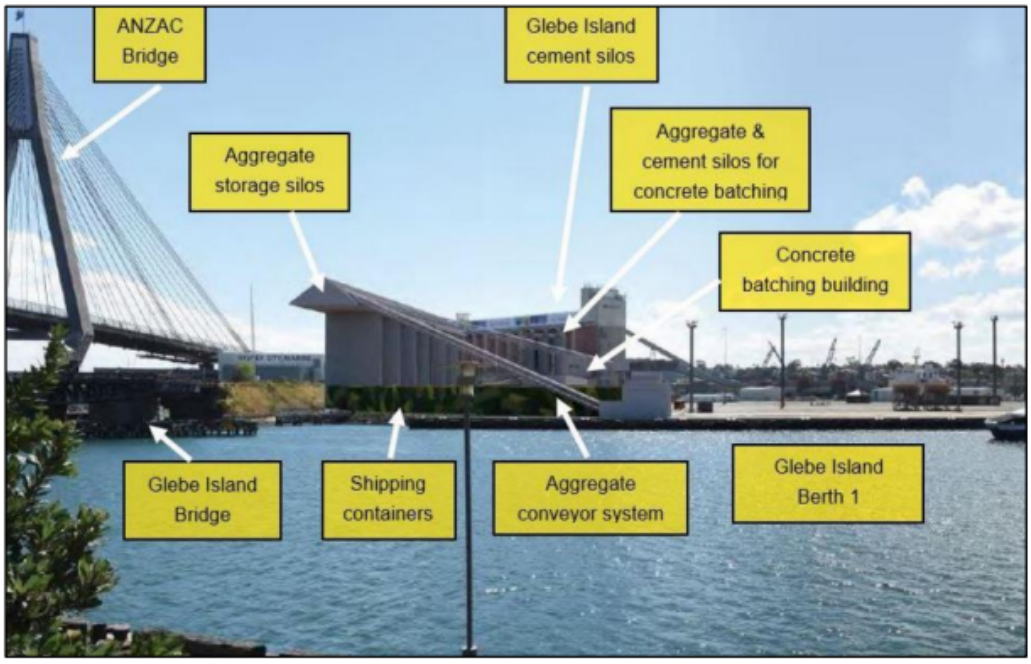

Figure 27 – Site Layout of the proposed Hanson concrete batching plant (Source: Hanson Heidelberg Cement Group, 2021)[14]

[13] https://www.portauthoritynsw.com.au/media/3835/rts-report-final.pdf

[14] https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/transcripts-and-material/2021/glebe-island/210517_applicant-presentation.pdf

The contribution impact of the Hanson CBP was assessed in more detailed in ERM Report (2020)[15], which showed minor air quality impact risk to the surrounding receivers as well as at the Bay West precinct. Further, a review of the *Glebe Island Berth 1 & 2 Multi-User Facility and Ship Emissions – Air Quality Impact Assessment* (AECOM, 2018)[16] has been undertaken to determine the potential cumulative air quality impact risk from these two (the Multi-User and Hanson CBP) facilities. The air quality report has assessed potential cumulative air pollutant impact from both facilities (but does not include surrounding sources), at nearby sensitive receivers with the nearest being located at Pyrmont, approximately 170 m to the southeast of the facilities (closer than the Bays West proposed residential), as well as at Balmain and Rozelle suburbs. The assessment outcomes showed that predicted PM_{10} and $PM_{2.5}$ concentrations were found to be marginally below the Approved Methods. The predicted maximum NO_2 concentrations were found to be well below the Approved Methods criteria, and occurred at the residence along Glebe Point Road (south of the Multi-User facility).

Based on these assessment outcomes, there is the potential for this future source to impact PM_{10} and $PM_{2.5}$ levels at the Bays West precinct but that there is a low risk of elevated NO_2 concentration levels within the Bays West precinct, at the proposed residential premise.

Further review of the Port Authority of NSW: *Glebe Island multi-user facility* factsheet (2019) however has indicated that air quality-related concerns raised in the Review of Environmental Factors (REF) will be mitigated by the following mitigation strategy being implemented to minimise ship emissions and dust pollution associated with the facility:

- Ships using the facility will be required to use low-sulphur fuels
- Each commercial operator will be required to develop and implement an Air Quality Management Plan
- Conveyors belts will be covered
- Handling and loading of materials into trucks will be undertaken inside building
- Building slots will enable direct receival of goods into building
- A maximum of two building slots would be open at any one time during ship unloading
- Dust control measures will be incorporated inside the building
- Visual surveillance of material loading and handling activities will be undertaken to ensure dust emissions are minimised.

[15] ERM, 2020. Hanson Glebe Island Concrete Batching Plant AQIA – Technical Addendum: Dispersion Modelling Sensitivity Analysis, Ref: 22201, Date: 21 October 2020. (https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=RFI-3816%2120210118T214321.090%20GMT)

[16] AECOM, 2018. *Glebe Island Berth 1 & 2 Multi-User Facility and Ship Emissions – Air Quality Impact Assessment,* 10 December 2018.

3.6 Cumulative Environmental Air Quality Impact

The identified air pollution sources in Sections 3.4 and 3.5 cumulatively contribute to local air quality at the proposed Bays West precinct. While for most sites individually, predicted pollutant concentrations are predicted to be below air quality criteria as outlined above, there are some sources that impact the area proposed for residential development more than others. Key sources that impact this area are heavily trafficked roads (Anzac Bridge and Victoria Road) and the proposed Port Multi-User Facility and Hanson Concrete Batching Plant.

This review has shown that there are elevated particulate matter concentrations across the Bays West precinct, but in particular for residential development, that could present a high air quality impact risk for residents' amenity and health. If residential development is to be proposed, it is recommended that a detailed cumulative air quality assessment be undertaken using dispersion modelling to confirm predicted pollutant concentrations at the facades of proposed residential buildings in relation to the air quality criteria to ensure the suitability of the air quality environment within the Bays West precinct.

4. Summary

This air quality report provides a high-level review of the draft Masterplan with consideration of potential impacts from the surrounding environment on proposed residential dwellings located to the south-west of the precinct.

While a detailed quantitative assessment has not been carried out, the following observations and recommendations are made:

- The area for proposed residential development is exposed to high levels of existing environmental air pollution, from existing road traffic (ANZAC Bridge and Victoria Road). An indicative calculation using the TfNSW TRAQ indicated that levels of particulate matter concentrations would pose a high risk of exceeding air quality criteria which would impact amenity for proposed residential premises. Further, Air pollutants from both the adjacent ANZAC Bridge and Victoria Road will be predominantly carried downwind toward the precinct due to the southerly and north-westerly prevailing winds.
- The operation of the existing WBCT is not expected to pose any significant air quality impact risk to the proposed Bays West precinct. The low sulphur fuel content regulation has further reduced the air quality impact risk from the cruise ship engines during manoeuvring or at berth.
- There is currently little information pertaining to the operation of the adjacent Cement Australia. However, based on the publicly available information, the operation of Cement Australia facility at Glebe Island silos is not expected to result in significant air quality impact risk to the proposed Bays West precinct, as it is currently understood to be used as a storage facility with enclosed bulk material during both storage and transport. However, it is recommended that more detailed information on the operation of this Cement Australia facility be sought prior to detailed development assessment, to confirm the above preliminary understandings, and to ensure that there would not be any residual or cumulative air quality impact risk to the Bays West precinct as a result of the operation of the facility.
- Similarly to other nearby industries such as Gypsum Resources Australia and other shipping activities associated with White Bay berths 2 to 4, due to limited publicly information available, it is recommended that more detailed information on the operation of this port activities be sought prior to detailed development assessment, to determine the potential air quality impact risk to the Bays West precinct development.
- The future operations of the tunnel ventilation stacks associated with WestConnex M4-M5 Link and Western Harbour Tunnel projects are not anticipated to result in significant air quality impact at the proposed Bays West precinct.
- The air quality impact of the proposed future port activities, such as the Multi-Users and Hanson concrete batching plant facilities at Glebe Island has indicated that there would be low risk of elevated NO_2 concentration levels exceeding Approved Methods criteria within the Bays West precinct, however particulate matter concentrations are elevated and could be at risk of exceeding the air quality criteria. Hence, further analysis will be required at detailed development assessment stage.
- The operations of the identified individual sources surrounding the Bays West precinct are anticipated to have a cumulative impact to the air environment, potentially affecting users' amenity within the Bays West precinct such as the proposed residential premises. It is recommended that a detailed cumulative air quality assessment be undertaken to confirm predicted pollutant concentrations at the facades of proposed residential buildings in relation to the air quality criteria to ensure the suitability of the air quality environment within the Bays West precinct, prior to detailed development assessment.

While there is no specific policy or guidance document to determine the suitability of land for residential development, potential exceedances of the air quality criteria as discussed above highlight a potential risk of pollutant concentrations impacting health and amenity of users/residents within a development.

If residential development is to be pursued, it is recommended that a detailed cumulative air quality assessment be undertaken using dispersion modelling to confirm predicted pollutant concentrations at the

facades of proposed residential buildings in relation to the air quality criteria to ensure the suitability of the air quality environment within the Bays West precinct. This has the potential to show exceedances of the air quality criteria, and therefore further mitigation measures would be required to make sure pollutant concentrations at proposed dwellings are minimised as far as practicable and preferably below the air quality criteria. Mitigation measure options are limited however would likely include mechanical ventilation options (with air intakes located away from localised emission sources) and minimising opportunities for natural ventilation using polluted air. It is likely that these mitigation measures may also need to be applied to other sensitive receivers within the Bays West Precinct, such as offices and medical facilities where proposed.

Appendix A

Port Authority NSW - SO_2 and $PM_{2.5}$ Background Concentration Monitoring Data

Table 5 – Port Authority NSW - Monitored background air quality at Balmain (2016)

Pollutant	Averaging Period	Background Monitoring Concentration, µg/m³												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
Sulphur dioxide (SO_2)	10-min	-	-	64	28	-	-	-	30	86	71	-	42	86
	1-hour	-	-	46	9	-	-	-	25	51	39	-	24	51
	24-hour	-	-	6	1	-	-	-	4	18	8	-	2	18
$PM_{2.5}$	24-hour	-	-	15	22	-	-	-	19	16	31	-	15	31

Table 6 – Port Authority NSW - Monitored background air quality at Balmain (2017)

Pollutant	Averaging Period	Background Monitoring Concentration, µg/m³												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
Sulphur dioxide (SO_2)	10-min	124	125	145	47	12	53	24	44	113	54	52	86	145
	1-hour	58	48	71	19	7	39	10	32	63	20	30	55	71
	24-hour	8	8	6	4	1	9	3	6	6	3	5	6	9
$PM_{2.5}$	24-hour	11	13	13	15	68	20	21	48	29	10	11	19	68

Table 7 – Port Authority NSW - Monitored background air quality at Balmain (2018)

Pollutant	Averaging Period	Background Monitoring Concentration, µg/m³												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
Sulphur dioxide (SO_2)	10-min	84	198	131	22	12	112	7	3	13	33	120	51	198
	1-hour	74	81	81	32	22	55	22	40	61	117	47	40	117
	24-hour	7	12	11	7	5	5	6	6	12	44	4	6	44
$PM_{2.5}$	24-hour	20	18	21	28	35	16	20	20	14	21	17	16	35

Table 8 – Port Authority NSW - Monitored background air quality at Balmain (2019)

Pollutant	Averaging Period	Background Monitoring Concentration, µg/m³												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
Sulphur dioxide (SO_2)	10-min	21	179	39	36	42	79	65	59	36	35	42	54	179
	1-hour	17	58	36	22	33	29	28	44	27	23	21	36	58
	24-hour	4	14	10	8	11	9	8	10	6	6	6	9	11
$PM_{2.5}$	24-hour	19	17	21	31	26	21	18	19	14	62	44	89	89

Table 9 – Port Authority NSW - Monitored background air quality at Balmain (2020)

Pollutant	Averaging Period	Background Monitoring Concentration, µg/m³												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
Sulphur dioxide (SO_2)	10-min	18	14	22	11	10	6	9	19	35	11	11	15	35
	1-hour	16	12	18	10	7	5	9	18	26	9	9	10	26
	24-hour	8	7	9	7	4	3	7	6	8	4	3	3	9
$PM_{2.5}$	24-hour	117	21	13	22	22	26	28	28	16	39	25	50	117

Table 10 – Port Authority NSW - Monitored background air quality at Balmain (2021)

Pollutant	Averaging Period	Background Monitoring Concentration, µg/m³												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
Sulphur dioxide (SO_2)	10-min	17	33	13	11	19	20	30	40	39	-	24	18	40
	1-hour	15	30	11	9	12	17	21	28	35	-	19	17	35
	24-hour	6	10	8	6	6	7	8	8	9	-	6	7	10
$PM_{2.5}$	24-hour	12	10	13	31	28	18	18	19	20	-	8	9	31

Appendix B

WestConnex M4-M5 Link Rozelle Interchange Tunnel Ventilation – Air Pollutant Dispersion Contour Plots

Figure 28 – Contour plot of maximum one hour NO_x concentration for ventilation outlets only (year 2033)

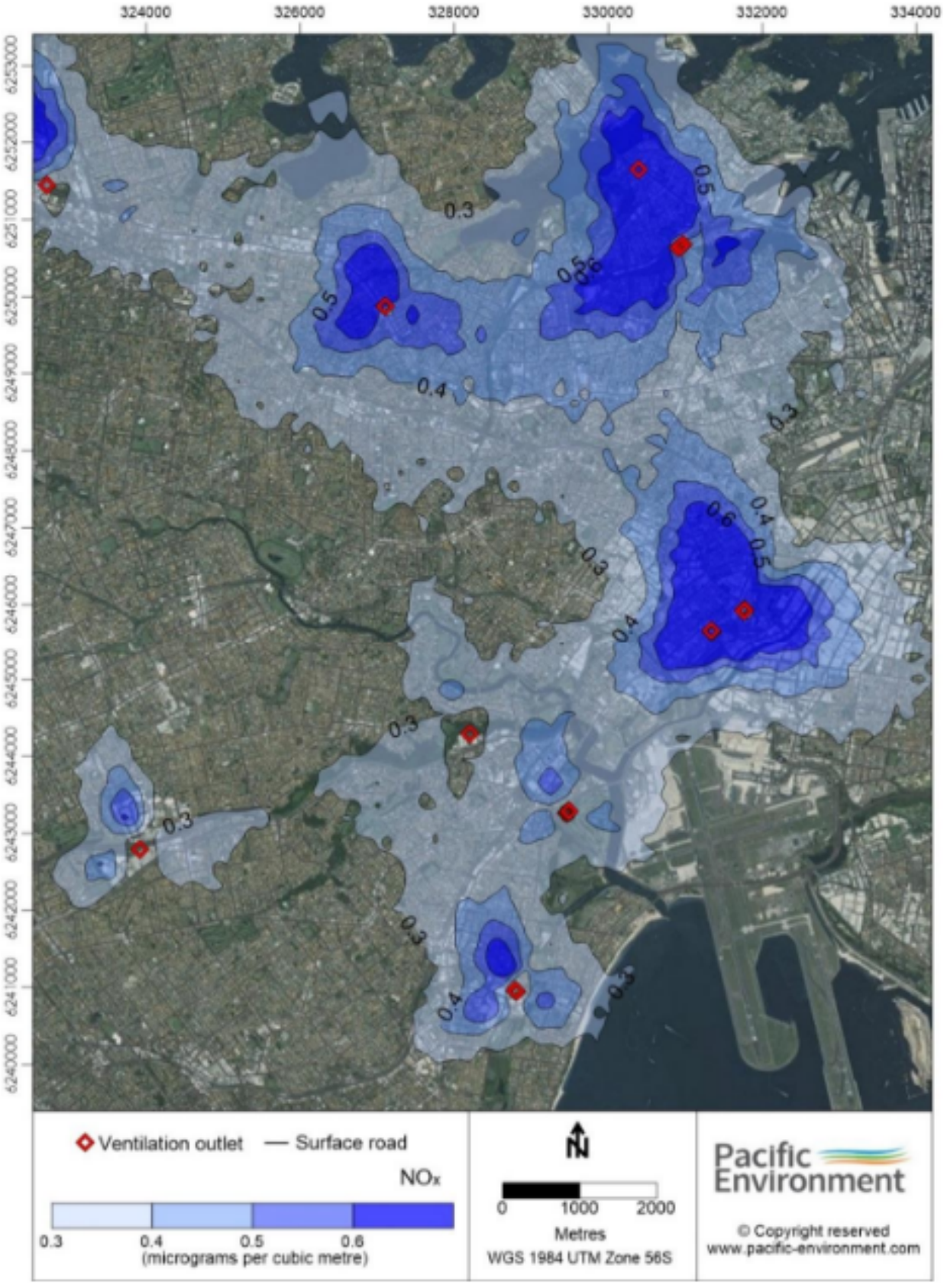

Figure 29 – Contour plot of annual mean NO_x concentration for ventilation outlets only (year 2033)

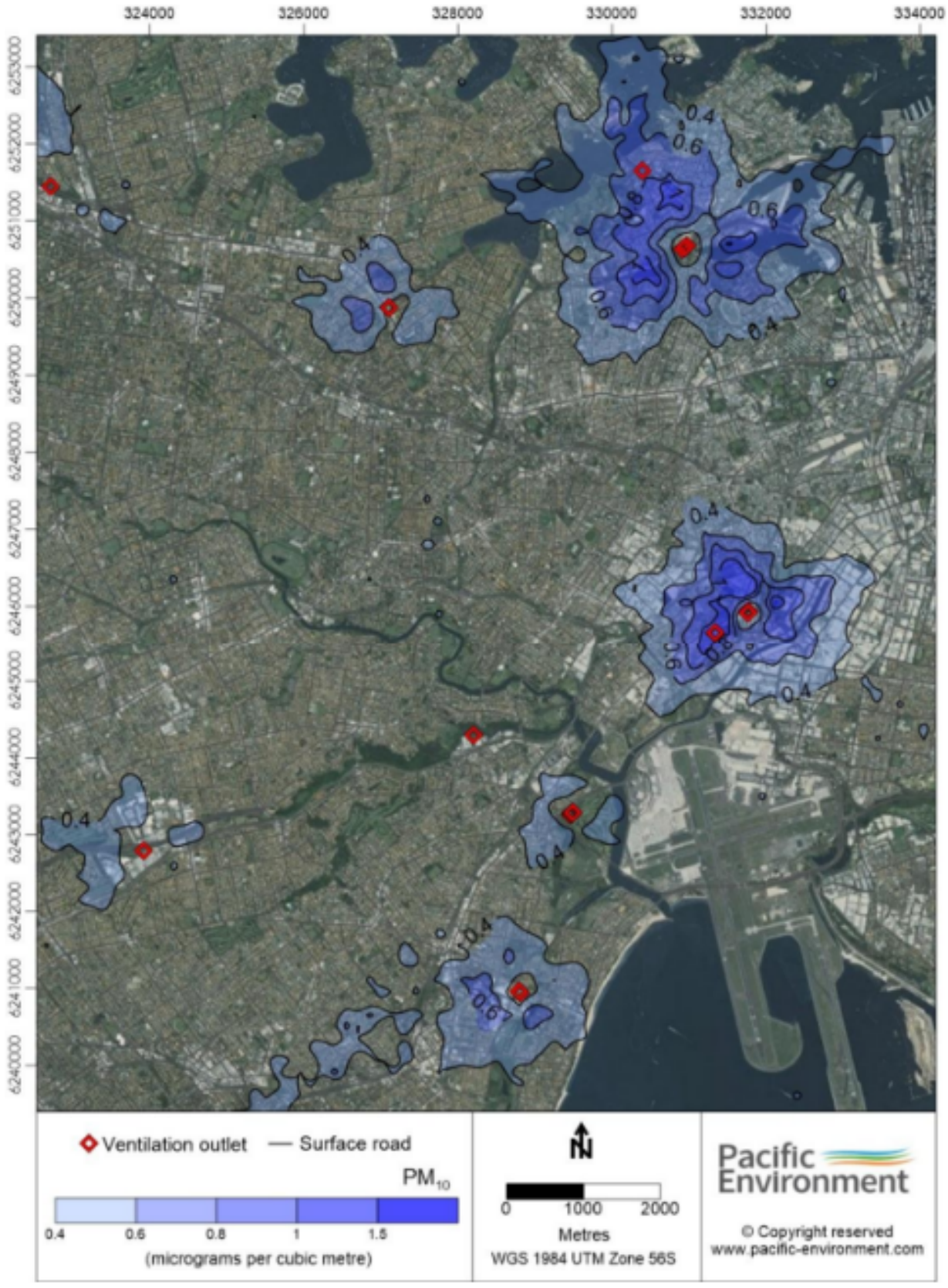

Figure 30 – Contour plot of maximum 24 hour PM_{10} concentration for ventilation outlets only (year 2033)

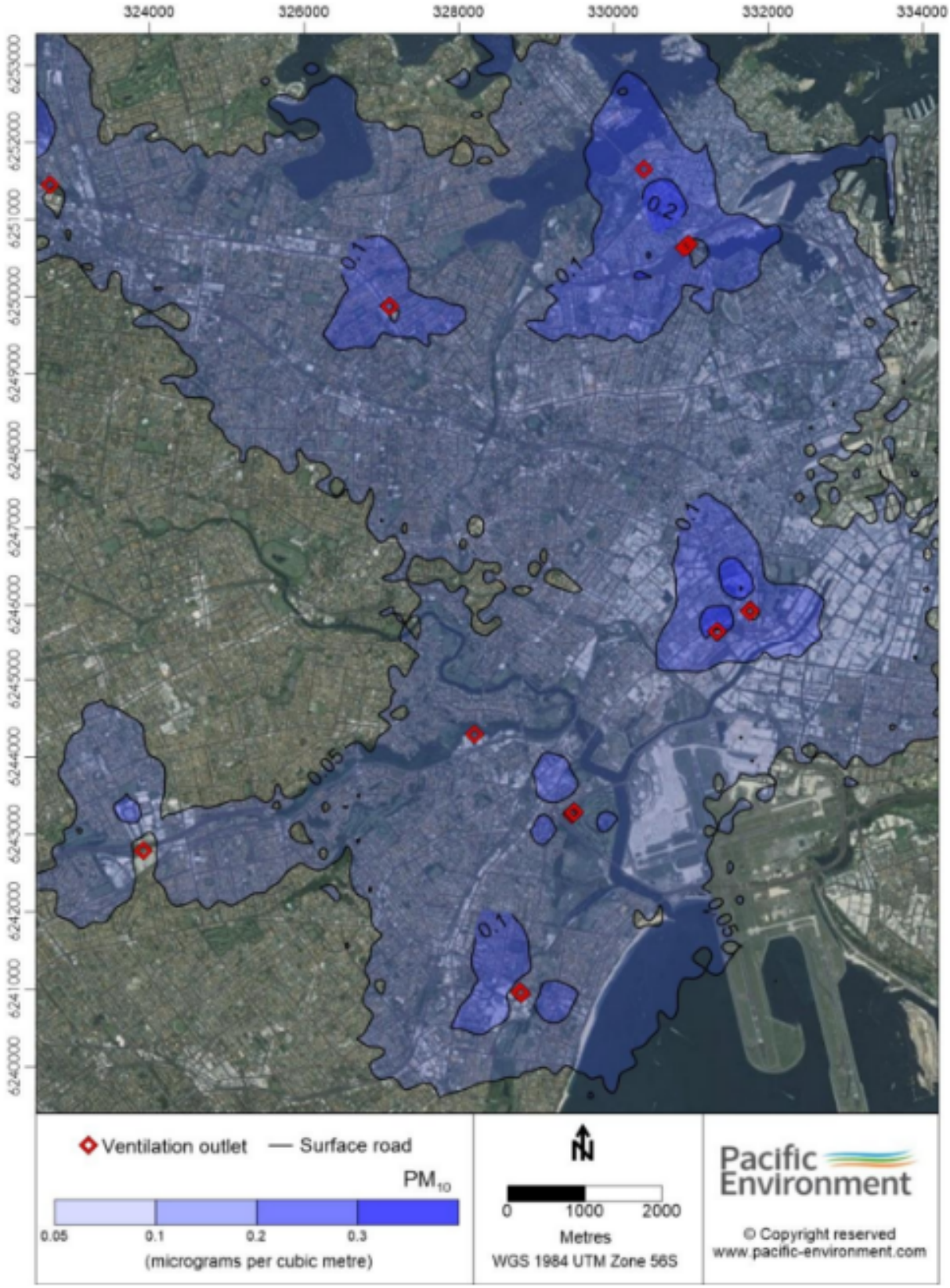

Figure 31 – Contour plot of annual mean PM_{10} concentration for ventilation outlets only (year 2033)

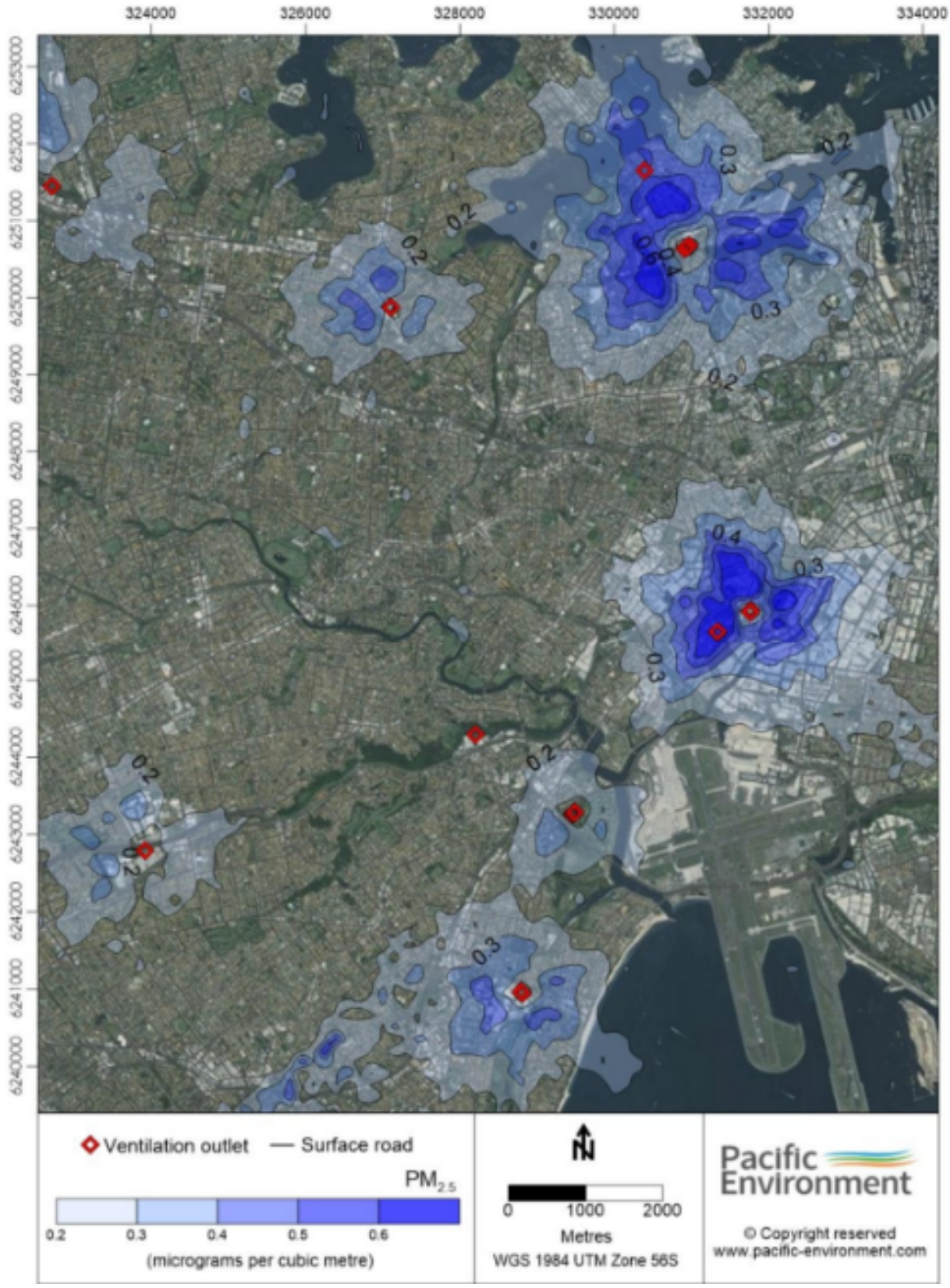

Figure 32 – Contour plot of maximum 24 hour $PM_{2.5}$ concentration for ventilation outlets only (year 2033)

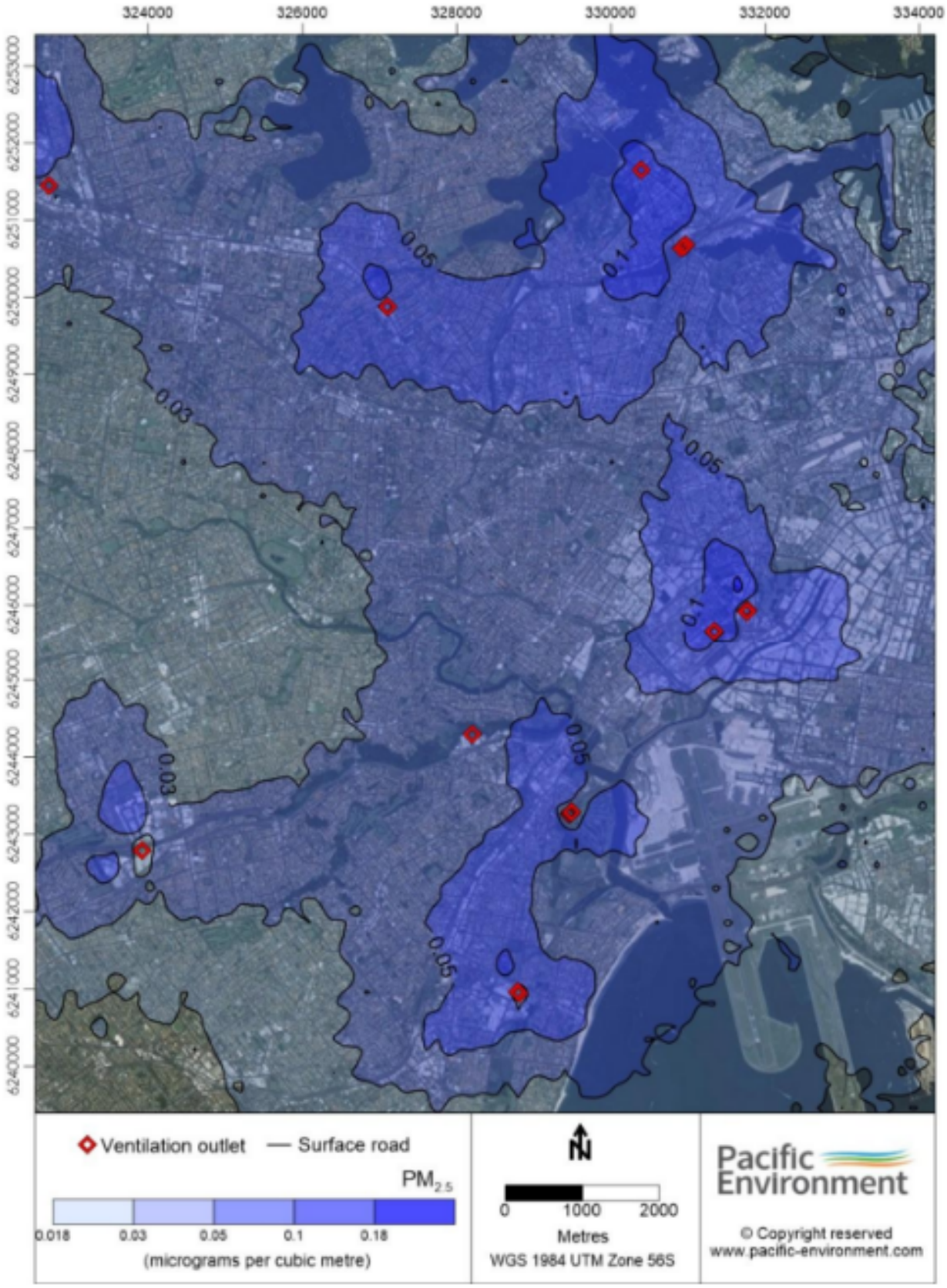

Figure 33 – Contour plot of annual mean $PM_{2.5}$ concentration for ventilation outlets only (year 2033)

Appendix C

Western Harbour Tunnel Ventilation – Air Pollutant Dispersion Contour Plots

Figure 34 – Local contour plot of maximum 1-hour NO_x for Rozelle Interchange (year 2037)

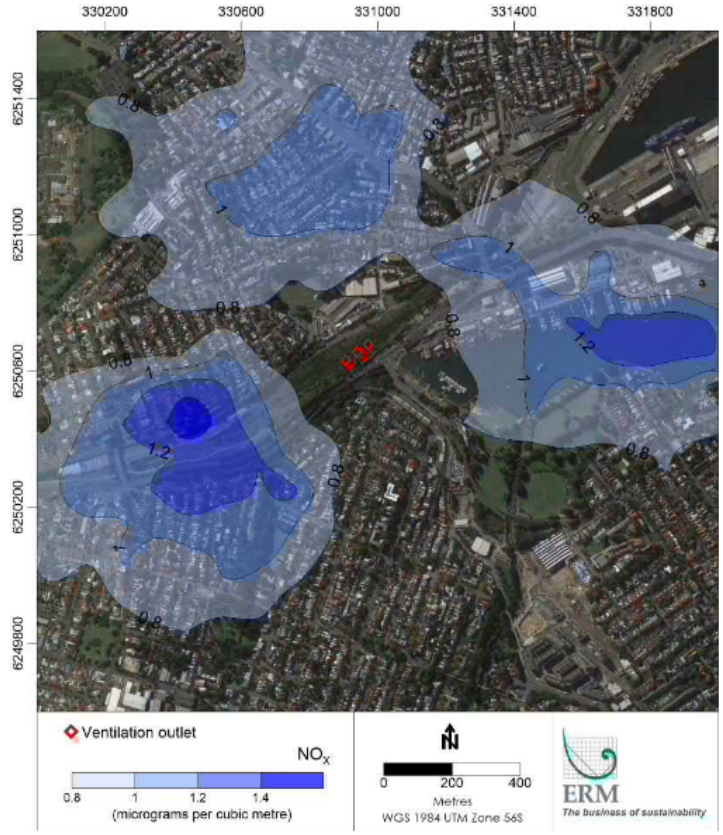

Figure 35 – Local contour plot of annual mean NO_x for Rozelle Interchange (year 2037)

Figure 36 – Local contour plot of maximum 24-hour PM_{10} for Rozelle Interchange (year 2037)

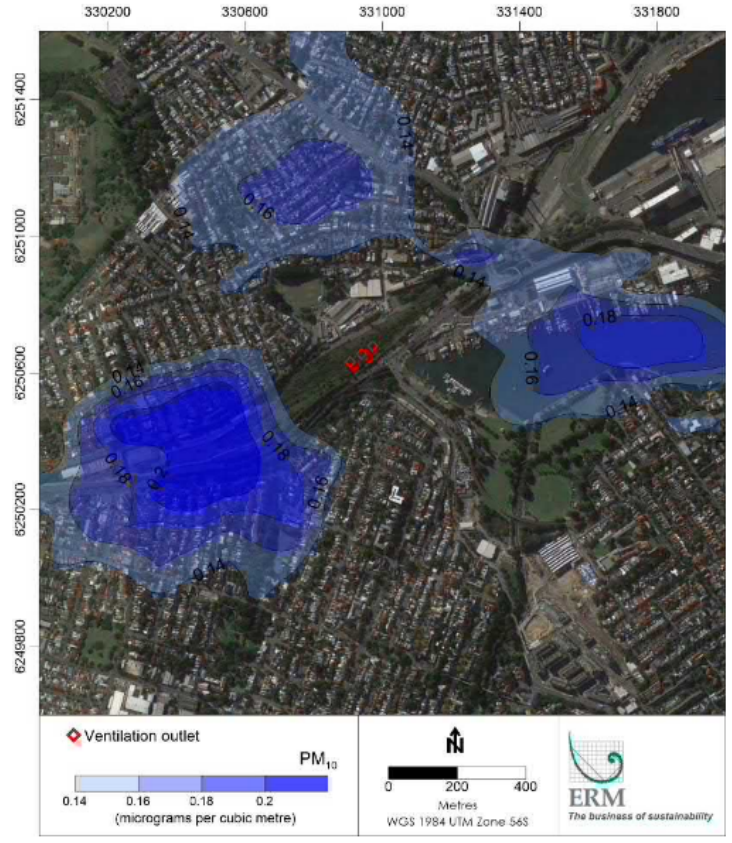

Figure 37 – Local contour plot of annual mean PM_{10} for Rozelle Interchange (year 2037)

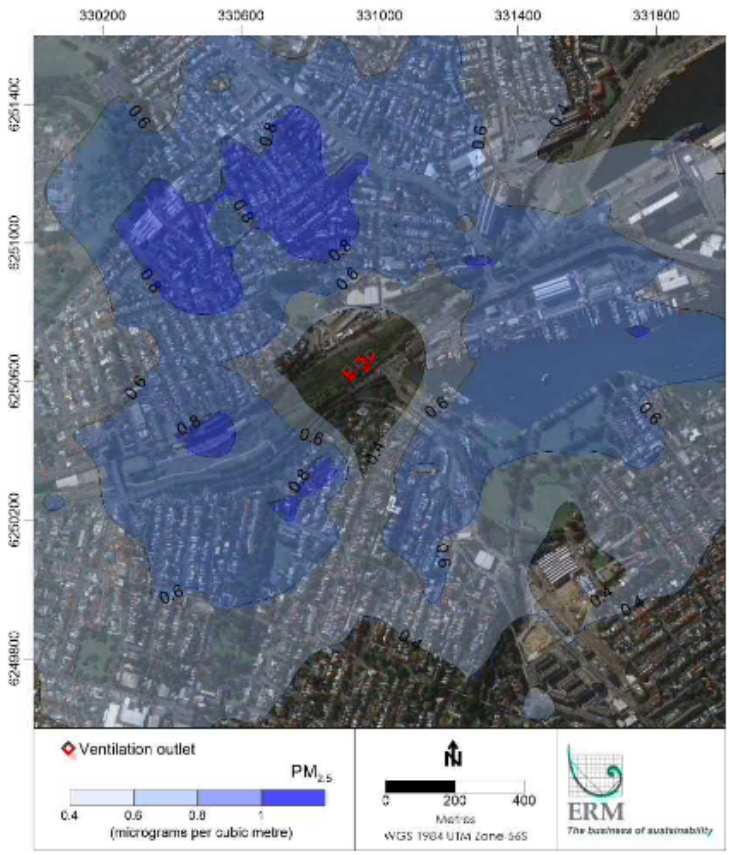

Figure 38 – Local contour plot of maximum 24-hour $PM_{2.5}$ for Rozelle Interchange (year 2037)

Figure 39 – Local contour plot of annual mean $PM_{2.5}$ for Rozelle Interchange (year 2037)