Sydney International Speedway

Environmental Impact Statement

Technical Paper 4
Air Quality

Sydney International Speedway

Air Quality Impact Assessment

Technical Paper 4 | Final

July 2020

Sydney Metro

Sydney International Speedway

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Contents

Executive Summary

Background

The NSW Government has committed to relocating speedway racing to Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports, creating a true motorplex for the NSW motorsport racing community. The new Sydney International Speedway (the project) would provide the community and racing supporters a unique sporting facility that would cater for local, regional, national, and international racing events while continuing to support the growth of speedway racing in NSW.

The new speedway would be located alongside the existing Sydney Dragway to the north and east and Sydney Motorsports Park (operated by the Australian Racing Drivers' Club) to the north.

The Western Sydney Parklands Trust, in association with the NSW Office of Sport is leading a masterplanning process for Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports, with opportunities to share infrastructure and coordinate events across the three venues. This masterplan sets the context for the planning of the new Sydney International Speedway, which is the subject of this Technical Paper.

The *Secretary's Environmental Assessment Requirements* (SEARs) (No. SSI 10048 issued May 2020) for the project identified dust (particulate matter in the form of Total Suspended Particles [TSP], deposited dust, and fine particles (particles with an aerodynamic diameter less than 10 and 2.5 microns [PM_{10} and $PM_{2.5}$])) arising from construction and operation of the project as a key area requiring assessment. Consistent with the SEARs, an assessment of air quality has been completed in accordance with the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (the Approved Methods), (New South Wales Environment Protection Authority, 2016) to identify and evaluate the potential for dust related impacts from the proposed activities, and develop feasible and reasonable management and mitigation measures.

Key features of the existing environment

A review of available information was completed to characterise key features of the existing environment. Aerial imagery was reviewed to identify sensitive receivers around the project. The last five calendar years of meteorological data collected by the Bureau of Meteorology (BoM) at Horsley Park Airport as well as air quality and meteorological data collected at the Prospect station operated by the Department of Planning, Industry and Environment (DPIE) were reviewed to identify a representative assessment year.

From this review 2017 was identified as a representative meteorological year for the purpose of the assessment. However, in 2017, daily PM_{10} and $PM_{2.5}$ concentrations exceeded the NSW EPA's impact assessment criteria. Considering this, it was determined that the assessment would need to demonstrate "that no additional exceedances of the impact assessment criteria would occur as a result of the proposed activity and that best management practices would be implemented to minimise emissions of air pollutants as far as is practical" as per the Approved Methods.

Estimation of emissions to air

The rate of potential dust emissions from sources and activities during construction of the project were estimated using emissions factors developed locally, contained in "Emission Estimation Technique Manual for Mining" (NPI, 2012) and by the United States Environmental Protection Agency (US EPA).

Potential emissions during motorsport racing events were estimated using monitoring data gathered by Sydney Metro from the existing Sydney Speedway facility at Clyde. A model of the monitored racing event was developed using AUSPLUME to back-calculate emission rates. Emissions from wind erosion when the track would not be in use were estimated using guidance from NPI (2012).

Assessment of impacts

The computer-based air dispersion model, known as CALPUFF, was used to predict potential changes in air quality during the construction and operational phases of the project. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used the dust emission estimates to predict changes in air quality at surrounding sensitive receivers including the Sydney Dragway.

The main conclusions of the assessment for representative residential receivers were:

- The EPA's annually averaged impact assessment criteria for PM_{10}, $PM_{2.5}$, TSP and deposited dust would not be exceeded during construction and operation
- There would be no additional days where the EPA's daily PM_{10} impact assessment criterion of 50 µg/m^3 would be exceeded at the identified representative sensitive receivers during construction or operation
- There would be no additional days where the EPA's daily $PM_{2.5}$ impact assessment criterion of 25 µg/m^3 would be exceeded at the identified representative sensitive receivers during construction or operation.

Understanding that operation at the adjacent Sydney Dragway may also be sensitive to dust emitted from the project, levels were also predicted at this location. The criteria in the Approved Methods are not intended to be used for the purpose of evaluating whether 'safe operation' at the Sydney Dragway may be affected, and in the absence of suitable guidance, worst-case results, without the presence of mitigation measures were presented.

In relation to the potential for dust from construction of the project to impact on the operations of Sydney Dragway, the construction contractor would be required to monitor and manage dust conditions on the project site and the adjacent Sydney Dragway site. The Sydney International Speedway operator would be responsible for management and mitigation of dust during events to achieve compliance with dust trigger levels at the adjacent Sydney Dragway.

Conclusion and mitigation

The assessment found that, based on dispersion modelling carried out in accordance with regulatory guidelines, the project would not result in unacceptable changes to local air quality. Still, consistent with the EPA's Approved Methods, best-practice controls were identified.

During construction, the mitigation measures included the use of water sprays during the loading and unloading of materials, and regular watering of haulage routes, exposed areas and stockpiles, as well as the scaling of activities in response to adverse meteorological and background air quality conditions.

During operations, a variety of mitigation measures were identified to control dust emissions to limit the potential for impacts at Sydney Dragway. These included recommendations regarding the placement of a dust screen, track materials selection and maintenance, event coordination and monitoring to establish a baseline for safe operational dust levels at Dragway.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to assess potential air quality impacts for the Sydney International Speedway in accordance with the scope of services set out in the contract between Jacobs and the Sydney Metro. That scope of services, as described in this report, was developed with Sydney Metro.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Sydney Metro and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Sydney Metro (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Sydney Metro, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and Sydney Metro. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

1.1 Sydney International Speedway

The NSW Government has committed to relocating speedway racing to Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports, creating a true motorplex for the NSW motorsport racing community. The new speedway would provide the community and racing supporters a unique sporting facility that would cater for local, regional, national, and international racing events while continuing to support the growth of speedway racing in NSW.

The new speedway would be located alongside the existing Sydney Dragway to the north and east and the Sydney Motorsports Park (operated by the Australian Racing Drivers' Club) to the north.

Western Sydney Parklands Trust, in association with the NSW Office of Sport, is leading a masterplanning process for Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports, with opportunities to share infrastructure and coordinate events across the three venues. This masterplan sets the context for the planning of the new Sydney International Speedway, which is the subject of this Technical Paper.

As part of delivering Sydney Metro West - the city's next big underground railway, the existing government land currently used for speedway racing is required for a future stabling and maintenance facility. The project is planned to be constructed and operational prior to the closure of the current speedway.

The project site is located on land owned and managed by Western Sydney Parklands Trust. Sydney Metro is applying for State significant infrastructure approval and is proposing to build the project on behalf of and pursuant to arrangements with Western Sydney Parklands Trust.

Section 5.12(4) of the *Environmental Planning and Assessment Act 1979* provides for the declaration of specified development on specified land as State significant infrastructure. A declaration is being sought for the Sydney International Speedway as State significant infrastructure under Sections 5.12(4) of the EP&A Act. Schedule 4 of *State Environmental Planning Policy (State and Regional Development) 2011* will be amended to include Sydney International Speedway.

1.1.1 Location

The project would be located within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports which sits within the Blacktown Local Government Area (LGA) in the Central River City sub-region of Greater Sydney, about six kilometres south-west of the Blacktown City Centre, and 32 kilometres west of the Sydney Central Business District. The location of the project is shown on **Figure 1-1**.

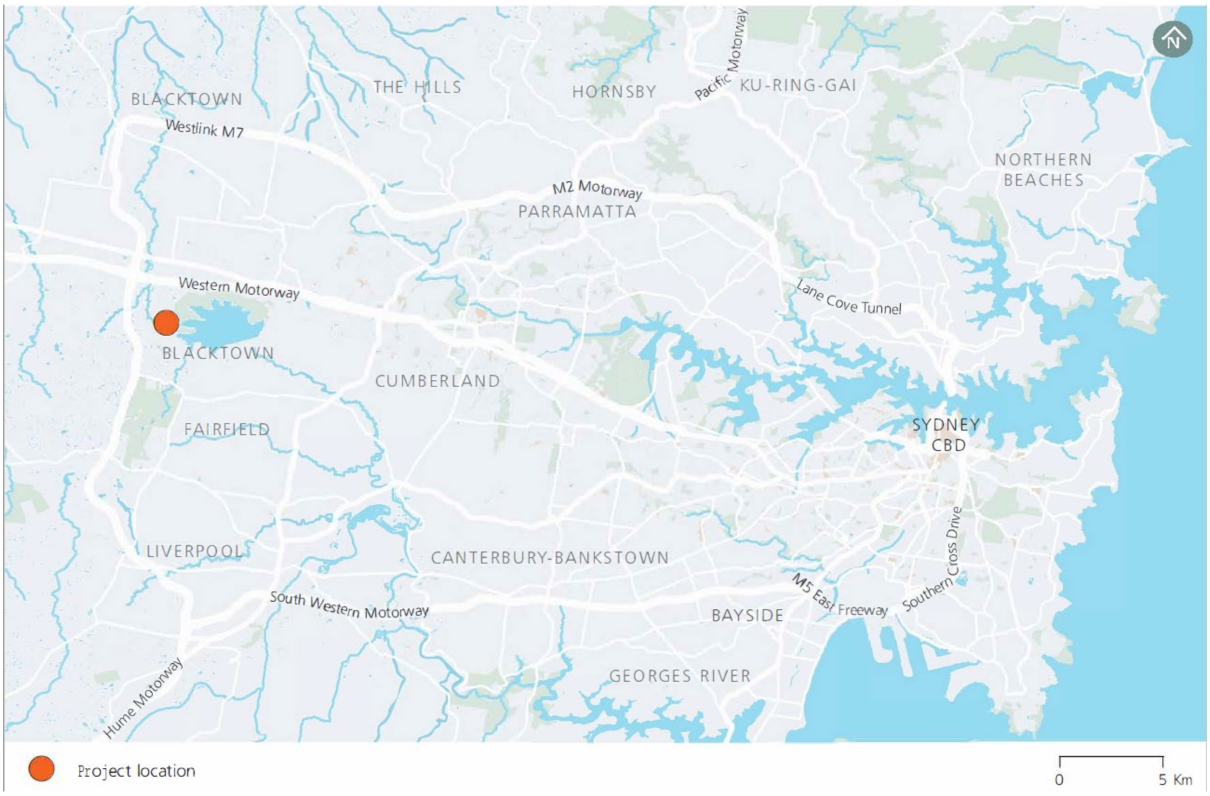

Figure 1-1 Location of the project

1.1.2 Local context of the project

The footprint of the project site is about 21 hectares. The Western Motorway (M4 Motorway) is about 1.4 kilometres north, and the Westlink M7 is about 1.2 kilometres west of the project. Industrial and commercial developments are located to the north and west of these major roads. Prospect Nature Reserve, which contains Prospect Reservoir, is about 150 metres east of the project. The local context of the project is shown on **Figure 1-2**.

Sixteen precincts have been identified within the Western Sydney Parklands, each with its own character and land uses, infrastructure, issues and opportunities. The project would be situated within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports. The project is bounded by Ferrers Road to the north-west, Ferrers Road and vegetation as part of Western Sydney Parklands in the west, the Warragamba Pipeline to the south and the Austral Bricks Horsley Park Brickworks located further south. Other motorsport operators within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports include Sydney Dragway immediately to the north and east and Sydney Motorsports Park (operated by the Australian Racing Drivers' Club) to the north. A full list of stakeholders is provided in Chapter 4 (Stakeholder and community engagement) of the Sydney International Speedway Environmental Impact Statement.

Other businesses in the vicinity include:

- The SUEZ Eastern Creek Resource Recovery Park, about 1.1 kilometres west of the project
- Global Renewables waste processing facility, about 650 metres west of the project.

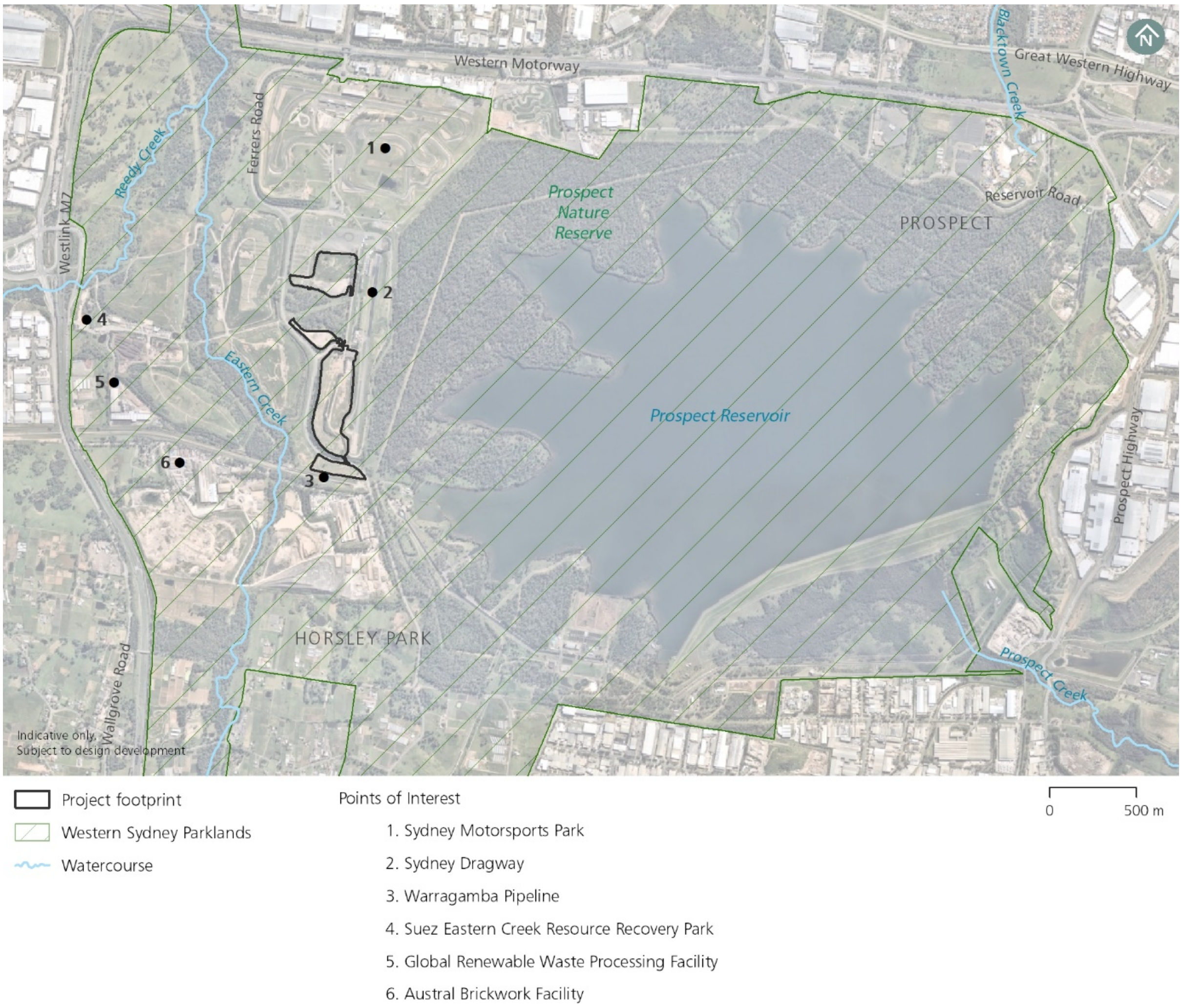

Figure 1-2 Local context of the project

1.1.3 Overview of the project

Once complete, the project would include world class racing infrastructure in the form of a clay-based racetrack benchmarked to national and international best practice for both speedway vehicles and motorcycles. To facilitate the use of the speedway racetrack, the following ancillary racing infrastructure would be constructed:

- New vehicle access to the raceway area via an existing intersection off Ferrers Road
- A racing competitor's pit area, comprising around 150 parking bays for race vehicles and their tenders, including 20 bays for heavy vehicles transporting racing vehicles to and from the speedway and viewing platforms for pit crews
- Workshops/garages and track-side operational support areas to be used by pit crews.

High quality event support infrastructure provided to maximise the spectator experience at speedway events would comprise:

- A grandstand with the capacity to seat around 3750 spectators
- Ticketing and entryway structures
- Spectator facilities, including terraced seating for up to a total of around 7000 spectators, public amenities, corporate boxes, provision for food and beverage operators together with merchandise outlets

- Dedicated parking provided for spectators, visitors and users of the Sydney International Speedway, available for use by other motorsport operators by agreement
- Dedicated parking for Sydney Dragway to replace the existing spectator parking areas which would form part of the Sydney International Speedway project site. The new Sydney Dragway parking would be available for use by other motorsport operators by agreement

Operational support infrastructure would be provided to enable the operation of the Sydney International Speedway. Such infrastructure would include:

- Public safety including fencing and fire safety systems
- Communications including a fibre optic network (to suit internet broadcasting bandwidth and PA/AV provisions), signage and large broadcasting screens
- Services including the provision of stormwater, drainage and flooding, utilities and lighting.

The operational site layout is shown on **Figure 1-3.** Operation would also include maintenance activities required to support the project.

Construction of the project is expected to take around 13 months to complete. The following construction activities would be carried out:

- Clearing, earthworks and levelling
- Landforming works
- Establishment of carparks
- Construction of racing and event support infrastructure
- Utilities connections, landscaping and finishing works.

Further detail on the project is provided in Chapter 5 (Project description) of the Sydney International Speedway Environmental Impact Statement.

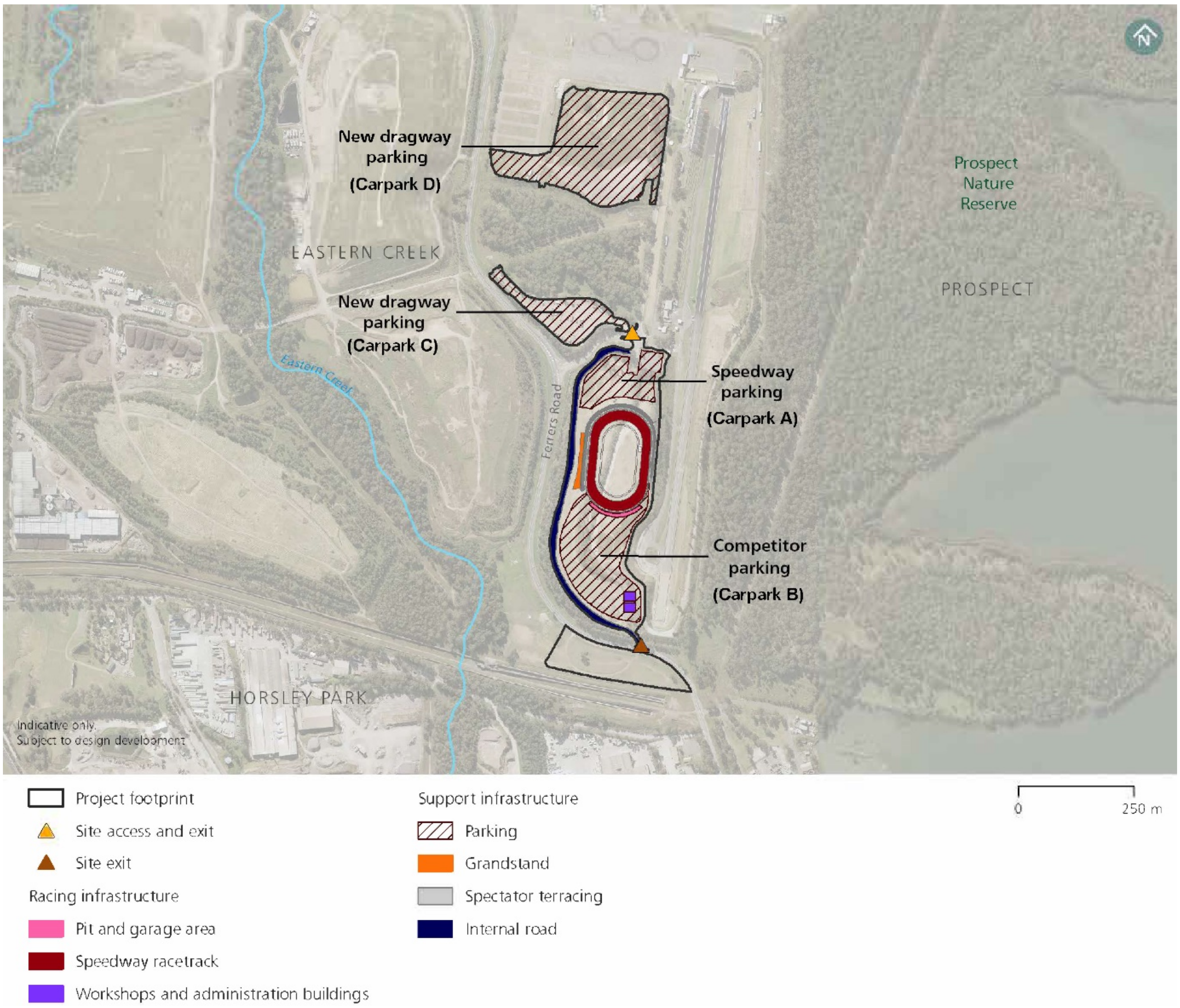

Figure 1-3 Project overview

1.2 Purpose and scope of this report

This technical paper is one of several technical papers that form part of the Environmental Impact Statement. The purpose of this technical paper is to assess the potential for air quality impacts during the construction and operation of the project. In doing so, it responds directly to the Secretary's Environmental Assessment Requirements outlined in **Section 1.3**.

The objectives of the air quality impact assessment was to:

- Describe the project setting, proposed activities and potential air quality issues
- Establish suitable air quality assessment criteria
- Describe the existing environment including surrounding receivers, terrain, meteorology and ambient air quality conditions
- Estimate emissions to air associated with the project
- Explain the methods used to predict potential air quality impacts
- Present and discuss predicted potential impacts
- Identify management and mitigation measures.

1.3 Secretary’s Environmental Assessment Requirements

The Secretary’s Environmental Assessment Requirements were issued for Sydney International Speedway on 19 May 2020. The requirements specific to air quality and where these requirements are addressed in this technical paper are outlined in **Table 1-1**.

Table 1-1 Secretary's Environmental Assessment Requirements – air quality

Reference	Requirement	Where addressed
2.6.1	The proponent must undertake an air quality impact assessment (AQIA) for construction and operation of the project in accordance with the current guidelines	**This report**
2.6.2	The proponent must ensure the AQIA includes the following: a) Identification of receivers sensitive to changes in air quality likely to result from construction or operation;	**Section 4.1**
	b) The source and intensity of emissions during construction and operation that could reduce air quality in the vicinity;	**Section 5**
	c) demonstrated ability to comply with the relevant regulatory framework; and	**Section 7**
	d) appropriate measures to avoid, minimise and/or mitigate potential impacts during construction and operation	**Section 8**
2.6.3	The proponent must assess the impacts of dust generation during construction and operation, including impacts affecting the safe operation of the adjacent drag strip and how the design has responded to address identified impacts, including any proposed mitigation measures.	**Section 7**

The Secretary’s Environmental Assessment Requirements refer to the further investigations and assessments as identified in the Sydney International Speedway Scoping Report (Sydney Metro, 2020). Where these requirements are addressed in this technical paper are outlined in **Table 1-2**.

Table 1-2 Further investigations and assessments as identified in the Sydney International Speedway Scoping Report

Further investigations and assessments	Where addressed
Identification and description of the background air quality environment based on a desktop assessment and review of existing information	**Section 4.4**
Identification of sensitive receivers for air quality, and weather conditions and activities that have the potential to impact air quality conditions	**Section 4.1 and Section 4.3**
Identification of sources of air emissions during construction and operation of the project	**Section 1.4**
Estimation of the intensity of the potential emissions to air resulting from construction and operation of the project, based on guidance in Emission Estimation Technique Manual for Mining (for implications relating to exposed earth), US EPA’s Compilation of Air Pollutant Emission Factors (AP-42), and NSW Environment Protection Authority’s motor vehicle emissions inventory	**Section 5**
Prediction of potential changes in air quality conditions using the intensity of emissions identified from guidance as an input to CALPUFF dispersion modelling for construction and operation of the project, and a comparison of the results of the modelling against criteria established in accordance with the Environment Protection Authority’s Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2016).	**Section 6**
Identification of appropriate measures to avoid, minimise and/ or mitigate potential impacts to air quality during construction and operation	**Section 7**

1.4 Key air quality-related matters

Potential air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. The project has the potential to generate emissions to air during both construction and operations. During construction, the primary air quality risk would be dust generated from materials excavation, handling, transport and placement, as well as from wind erosion of stored materials and exposed surfaces resulting in potential temporary impacts at surrounding sensitive receivers. The term dust refers to particulate matter in the form of Total suspended particles (TSP), deposited dust, particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}), and finer particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). At surrounding sensitive receivers uncontrolled dust has the potential to result in health and nuisance impacts. Excessive deposited dust also has the potential to affect 'safe operation' at the adjacent Sydney Dragway.

Exhaust emission from the combustion of fossil fuels in construction plant and equipment represent another air quality risk during construction. The primary pollutants associated with plant exhaust emissions include carbon monoxide (CO), oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), volatile organic compounds (VOCs) and sulfur dioxide (SO_2) (depending on fuel sulfur content).

Once constructed, there would be several sources of emissions to air from operations at the Sydney International Speedway including:

- Dust resulting from motorsport racing events and wind erosion when not in use
- Exhaust emissions from the combustion of fossil fuels in race vehicles
- Odours arising during refuelling activities and fuel storage during racing events.

Exhaust emissions from non-road vehicles including racing vehicles are not regulated in NSW, and there are no specific criteria to complete a quantitative assessment for non-road vehicles. Additionally, the quantity of methanol fuel stored at the facility would be limited to the amount that would be combusted in racing vehicles during an event. Given that fuel used by speedway vehicles typically cause lower levels of exhaust gases compared to public road vehicles and the existing background levels are well below threshold levels it is not expected that exhaust emissions from racing activities would present an issue. Dust from speedway racing and management of the track would represent the primary operational air quality risk and is the focus of this Air Quality Impact Assessment.

2. Policy setting and assessment criteria

Typically, air quality is quantified by the concentrations of air pollutants in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, as identified above in **Section 1.4**, the air pollutants most relevant to the project is dust including TSP, deposited dust and particulate matter (PM_{10} and $PM_{2.5}$).

The Environment Protection Authority (EPA) has developed impact assessment criteria for these pollutants. These criteria, as well as requirements for completing air quality impact assessments are listed in the document, 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (the Approved Methods), (NSW EPA, 2016). Most of the EPA criteria are drawn from national standards for air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPM). These criteria are reproduced below in **Table 2-1**.

Table 2-1 EPA impact assessment criteria

Substance	Averaging time	Percentile	Criterion	Source [1]
Particulate matter (PM_{10})	24-hour	100^{th}	50 µg/m^3	DoE (2016)
	Annual	-	25 µg/m^3	DoE (2016)
Particulate matter ($PM_{2.5}$)	24-hour	100^{th}	25 µg/m^3	DoE (2016)
	Annual	-	8 µg/m^3	DoE (2016)
Particulate matter (TSP)	Annual	-	90 µg/m^3	NHMRC (1996)
Deposited dust	Annual (maximum increase)	-	2 g/m^2/month	NERDDC (1998)
	Annual (maximum total)	-	4 g/m^2/month	NERDDC (1998)
Nitrogen dioxide (NO_2)	1-hour	100^{th}	246 µg/m^3	NEPC (1998)
	Annual	-	62 µg/m^3	NEPC (1998)
Carbon monoxide (CO)	15-minute	100^{th}	100 mg/m^3	WHO (2000)
	1-hour	100^{th}	30 mg/m^3	WHO (2000)
	8-hour	100^{th}	10 mg/m^3	NEPC (1998)
Sulfur dioxide (SO_2)	10-minutes	100^{th}	712 µg/m^3	NHMRC (1996)
	1-hour	100^{th}	570 µg/m^3	NEPC (1998)
	24-hour	100^{th}	228 µg/m^3	NEPC (1998)
	Annual	100^{th}	60 µg/m^3	NEPC (1998)
Benzene	1-hour	99.9^{th}	29 µg/m^3	GoV (2001)
Formaldehyde	1-hour	99.9^{th}	20 µg/m^3	GoV (2001)

[1] Sources:

Department of Environment, 2016. *National Environment Protection (Ambient Air Quality) Measure – as amended*

National Health and Medical Research Council, 1996. Ambient Air Quality Goals Recommended by the National Health and Medical Research Council

National Energy Research Development and Demonstration Council, 1998. Air Pollution from Surface Coal Mining: Measurement, Modelling and Community Perception

National Environment Protection Council, 1998. *Ambient Air – National Environment Protection Measure for Ambient Air Quality*

World Health Organisation, 2000. WHO Air Quality Guidelines for Europe, 2nd Edition

Government of Victoria, 2001. State Protection Policy (Air Quality Management), No. S 240

The EPA air quality assessment criteria for all of the pollutants listed above except benzene and formaldehyde relate to the total concentration of air pollutant in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. Further discussion of background levels in the study area is provided in **Section 4.4** and **Section 4.5.**

In situations where background levels are elevated, the proponent must "demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical" (EPA, 2016).

The assessment has also considered how dust from the project may impact on the operations at the adjacent Sydney Dragway through deposition on the drag strip. The criteria above from the EPA's Approved Methods are intended to protect from human health and nuisance effects at locations with near-continuous occupation (e.g. "dwelling, school, hospital, office or public recreational area"). These criteria are not intended to be used for the purpose of evaluating whether 'safe operation' at the Sydney Dragway may be affected.

Dust monitoring stations would be installed on the Dragway site during the period up to the commencement of Sydney International Speedway operations to gather data to establish a baseline for safe operational dust levels at Dragway. The threshold beyond this baseline that still provides safe Dragway operations would be determined, and that threshold level would be the requirement to which the project construction contractor and Sydney International Speedway operator would be required to manage.

Considering this, predicted results at the Sydney Dragway have been presented without any comment regarding compliance. Measures to limit dust levels at the Sydney Dragway during construction and operation are also included in **Section 7**.

3. Assessment approach

3.1 Overview

This assessment has followed the EPA's Approved Methods which specifies how assessments based on the use of air dispersion models should be completed. The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources, and the model predictions have been compared with relevant air quality criteria. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions.

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model. The model comprises meteorological modelling as well as dispersion modelling, both of which are described below.

3.2 Meteorological modelling

The air dispersion model used for this assessment, CALPUFF, requires information on the meteorological conditions in the modelled region. This information is typically generated by the meteorological pre-processor, CALMET, using surface observation data from local weather stations and upper air data from radio-sondes or numerical models, such as the CSIRO's prognostic model known as TAPM (The Air Pollution Model). CALMET also requires information on the local land-use and terrain. The result of a CALMET simulation is a year-long, three-dimensional output of meteorological conditions that can be used as input to the CALPUFF air dispersion model.

Meteorological data collected in 2017 from the Bureau of Meteorology (BoM) Horsley Park and Department of Planning, Industry and Environment (DPIE) Prospect surface stations and upper air data generated by TAPM at the location of the BoM Horsley Park were used to initialise the CALMET model. The meteorological modelling followed the guidance of TRC Environmental Corporation (2011) and adopted the "observations" mode. Key setup details for TAPM and CALMET are listed in Table 3-1 and Table 3-2 respectively.

Table 3-1 TAPM setup details

Aspect	Value(s)
Model version	4.0.5
Number of grids (spacing)	4 (30 kilometres, 10 kilometres, 3 kilometres, 1 kilometre)
Number of grids point	35 x 35 x 25
Year(s) of analysis	2017, with one "spin-up" day.
Centre of analysis	33°49' S, 150°52' E
Terrain data source	Shuttle Research Topography Mission (SRTM), 30 metres resolution
Land use data source	Default
Meteorological data assimilation	BoM Horsley Park and DPIE Prospect surface stations Radius of influence = 2.5 kilometres. Number of vertical levels for assimilation = 4. Quality factor = 1

Table 3-2 CALMET setup details

Aspect	Value(s)
Model version	6.334
Run mode	"observations" mode
Terrain data source(s)	NASA SRTM 1 second 30 metre resolution dataset
Land-use data source(s)	Digitized from aerial imagery and classified as 'urban/industrial', 'water', 'forest' and 'agricultural/rural' categories specified in "CALPUFF Modelling System Version 6 User Instructions", (TRC, 2011). This is displayed in **Appendix C**.
Meteorological grid domain	10 kilometres x 10 kilometres
Meteorological grid resolution	0.1 kilometres
Meteorological grid dimensions	101 x 101 x 11
Meteorological grid origin	297.700 kilometres E, 6250.750 kilometres N. MGA Zone 56
Surface meteorological inputs	BoM Horsley Park and DPIE Prospect stations for observations of wind speed and wind direction. TAPM for temperature, relative humidity, air pressure, ceiling height and cloud cover.
Upper air meteorological inputs	Upper air data file for the location of BoM Horsley Park derived by TAPM Biased towards surface observations (-1, -0.8, -0.8, -0.4, -0.2, 0, 1, 1, 1, 1, 1)
Simulation length	8760 hours (1 Jan 2017 to 31 Dec 2017)
R1, R2	0.1, 0.5
RMAX1, RMAX2	3, 20
TERRAD	5

3.3 Dispersion modelling

Ground-level concentration and deposition levels due to the identified emission sources have been predicted using the air dispersion model known as CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap, and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME and ISCST3) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long-range transport and near calm conditions. CALPUFF can model the effect of emissions entrained into the thermal internal boundary layer that forms over land, both through fumigation and plume trapping. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments (EPA, 2016).

The modelling was performed using the emission estimates from **Section 5** and using the meteorological information provided by the CALMET model, described in **Section 3.2**. Predictions were made at 640 discrete receivers (including the five nearby representative sensitive receivers shown in **Figure 4-1**) to allow for contouring of results. The locations of the model receivers are shown in **Appendix D**. Sources of emissions during construction and operations were positioned as displayed above in Figure 5-1 and Figure 5-4 respectively.

4. Existing environment

4.1 Surrounding land use and receivers

The local context of the project is described in **Section 1.1.2** and shown on **Figure 1-2**.

The nearest residential receivers are located around one kilometre to the south in the suburb of Horsley Park. The nearest medical or educational facility is located about 2.5 kilometres from the project site (Horsley Park Public School).

Consultation with Sydney Dragway, located adjacent to the project site, has identified airborne dust from Sydney International Speedway depositing on Dragway as a key issue for concern for the safe operations of Dragway events.

Five representative sensitive receivers representing the nearest residential receiver in different directions from the project were identified for the purpose of the assessment. Details of these locations are listed below in Table 4-1 and shown on **Figure 4-1**.

Table 4-1 Surrounding representative sensitive receivers

Receiver ID	Receiver type	Approximate co-ordinates UTM MGA 55		Approximate elevation (m)	Approximate distance from the project (metres)	Approximate orientation from the project
		Easting (m)	Northing (m)			
R01	Residential	302579 m E	6254291 m N	72 m	1,100 m	South
R02	Residential	301529 m E	6254782 m N	76 m	1,200 m	Southwest
R03	Residential	301637 m E	6258555 m N	46 m	2,100 m	Northwest
R04	Residential	305690 m E	6257492 m N	95 m	2,900 m	Northeast
R05	Residential	303806 m E	6253794 m N	79 m	1,800 m	Southeast

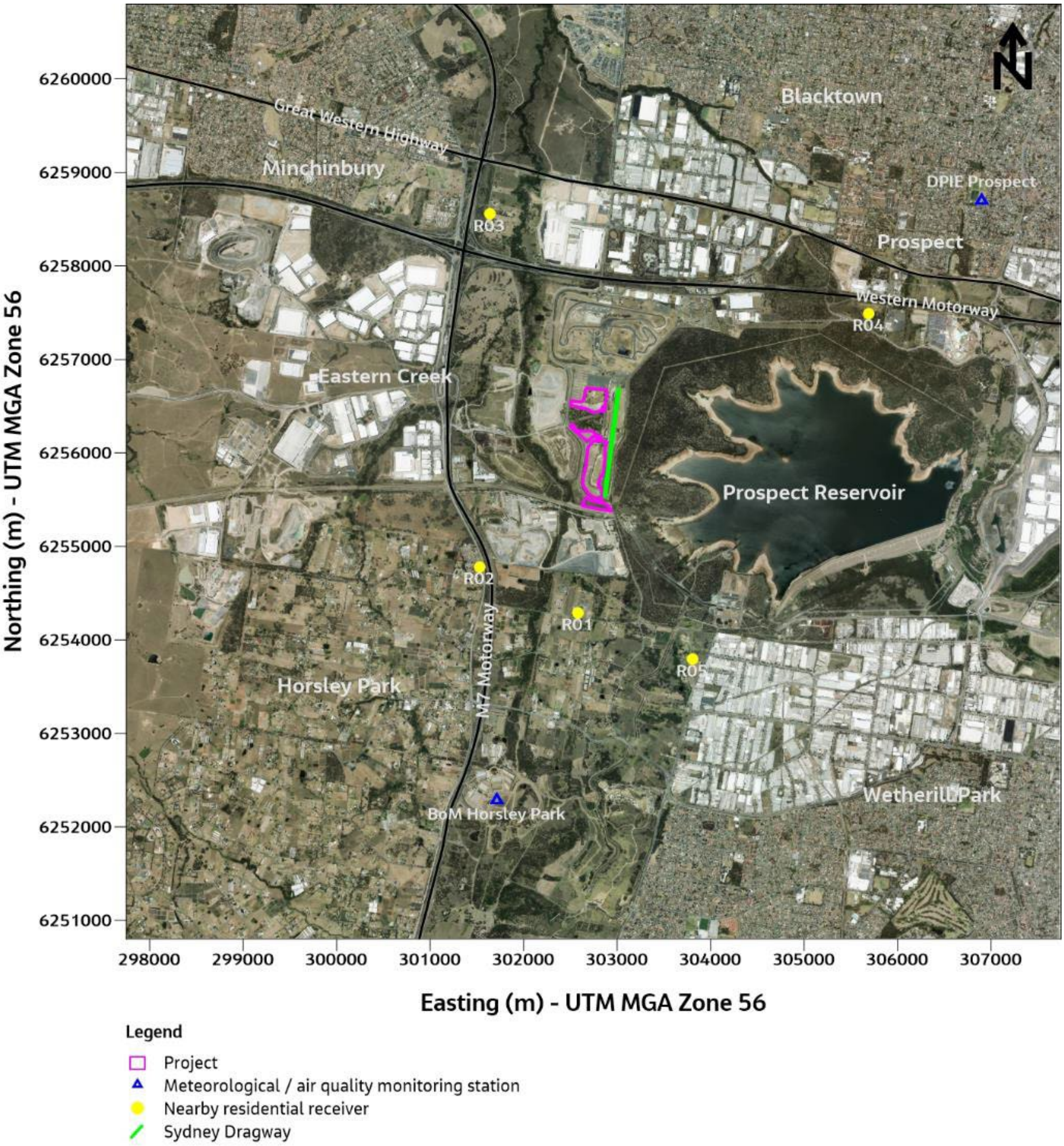

Figure 4-1 Project setting

4.2 Terrain

A three-dimensional schematic of terrain features around the project is shown below in **Figure 4-2**. As displayed, elevations within approximately 10 kilometres of the project range from 0 to 150 metres above sea level. Elevations at the project site range between approximately 60 and 80 metres. As listed above in **Table 4-1**, the identified representative receivers R01, R02 and R05 are at locations with about the same elevation as the project site. R02 is located on lands lower than the project (at approximately 46 metres), and R04 is higher (96 metres).

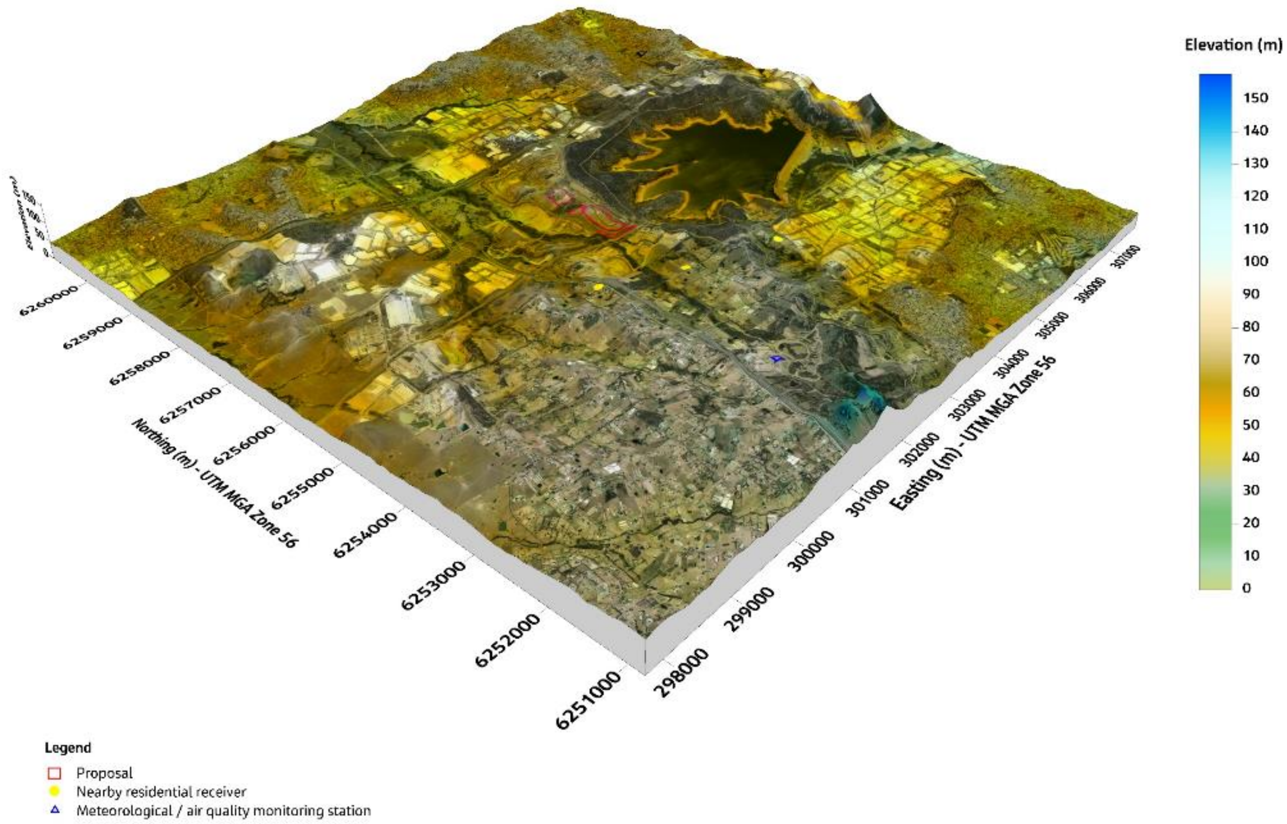

Figure 4-2 Three-dimensional schematic of project setting

4.3 Meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse and to aid in the selection of a suitable representative year for consideration in the assessment of air quality for the project. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature, atmospheric stability class and mixing layer height. For air quality assessments, a minimum one year of hourly data is usually required, which means that almost all possible meteorological conditions, including seasonal variations, are considered in the model simulations.

Although there is no on-site meteorological station at the project, there are two nearby stations operated by the Bureau of Meteorology (BoM) and Department of Planning, Industry and Environment (DPIE) (see Figure 4-1). Details of these stations are summarised below in Table 4-2, including their locations relative to the project. The meteorological/air quality monitoring stations are shown on Figure 4-1.

Table 4-2 Details of nearby meteorological stations

Station	Operated by	Approximate co-ordinates UTM MGA 56		Elevation (metres) Australian height datum (AHD)	Approximate distance (kilometres) and direction from the project
		Easting (m)	Northing (m)		
Horsley Park, No. 067119	BoM	302011 m E	6252415 m S	99 metres AHD	3.5 kilometres to the south southwest
Prospect, William Lawson Park	DPIE	306745 m E	6258646 m S	66 metres AHD	4.7 kilometres to the northeast

Meteorological data from five recent years (2015 to 2019) have been analysed to identify trends from year-to-year and to identify a representative year for use in the dispersion modelling. Table 4-3 shows the statistics reviewed as part of this analysis from the data collected at BoM's Horsley Park and DPIE's Prospect automatic weather stations.

Table 4-3 Annual meteorological statistics from BoM Horsley Park, No. 067119 and DPIE Prospect, William Lawson Park automatic weather stations (2015 to 2019)

Statistic	BoM Horsley Park, No. 067119					DPIE Prospect, William Lawson Park				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Per cent complete (%)	96.7	96.8	99.2	99.5	100	99.6	99.7	99.5	99.3	98.3
Mean wind speed (m/s)	2.0	2.0	2.2	2.2	2.1	1.7	1.8	1.8	1.9	1.8
99th percentile wind speed (m/s)	6.3	6.4	6.6	7.0	6.9	5.3	6.1	5.9	6.3	6.3
Percentage of calms (%)	20.4	21.6	18.9	17.7	18.8	14.4	14.4	13.8	13.4	14.9
Percentage of winds >6 m/s (%)	1.5	1.6	2.3	3.0	2.4	0.4	1.1	0.9	1.2	1.3

The following trends were observed over the years reviewed:

- BoM Horsley Park:
  - Capture rates of 96.7 per cent or more of recordable hours
  - Consistent mean wind speeds with recorded values ranging between 2.0 and 2.2 metres per second
  - 99th percentile wind speeds (i.e. wind speeds only exceeded one percent of the time) also being consistent, ranging between 6.3 and 7.0 metres per second
  - Percentage occurrence of calm conditions (i.e. when wind speeds were recorded less than 0.5 metres per second) ranging between 18.6 and 20.8 per cent
  - Percentage of high-speed winds (i.e. speeds greater than 6 metres per second) ranging between 1.4 and 3.0 per cent.

- DPIE Prospect:
  - Capture rates of 98.3 per cent or more of recordable hours
  - Consistent mean wind speeds with recorded values ranging between 1.7 and 1.9 metres per second
  - 99th percentile wind speeds also being consistent, ranging between 5.3 and 6.3 metres per second
  - Calm conditions occurring between 13.4 and 14.9 per cent of the time; and
  - Percentage of high-speed winds ranging between 0.4 and 1.3 per cent.

Annual and seasonal wind roses were developed which are displayed in **Appendix A** for further analysis to identify representative year for modelling. The key observations for both stations are summarised below:

- BoM Horsley Park:
  - Annual: Winds blowing from the southwest most common (occurring approximately eight to 12 per cent of the time) for all five years
  - Summer: Winds from the southeast and east northeast occurring most frequently, with calm conditions occurring between 17 per cent and 22 per cent of the time
  - Autumn: South-westerly winds most frequent with winds blowing from the north also common. Calm conditions occurring 19 per cent to 26 per cent of the time
  - Winter: Winds blowing from the west southwest and southwest occurring most frequently, with calm conditions occurring 17 per cent to 22 per cent of hours
  - Spring: Winds from the southwest, north and east-southeast taking place most often. The frequency of calm conditions ranged between 17 per cent and 22 per cent.
- DPIE Prospect:
  - Annual: Comparable to the annual trends observed at BoM Horsley Park, although calm conditions were recorded less frequently, around 14 per cent of the time
  - Summer: Similar to the annual trends observed at BoM Horsley Park, with calm conditions being recorded around 10 to 14 per cent of hours.
  - Autumn: Comparable to the annual trends observed at BoM Horsley Park although with a higher frequency of winds recorded blowing from the west northwest (around eight per cent of the time)
  - Winter: Similar to the annual trends observed at BoM Horsley Park, with calm conditions being recorded around 14 to 18 per cent of hours.
  - Spring: Comparable to the annual trends observed at BoM Horsley Park, although calm conditions were recorded less frequently, around 10 to 14 per cent of the time.

Considering the consistency of these observations as well as the statistics displayed in Table 4-3, none of the five years were excluded as being an unsuitable representative meteorological year. Background air quality trends outlined below in **Section 4.4** were therefore reviewed to identify a suitable representative year for the purpose of the assessment.

4.4 Background air quality

4.4.1 Overview

To provide a comprehensive assessment of impacts against the relevant air quality criteria (see **Section 2**), it is necessary to have information or estimates of the existing air quality conditions. Although there is no air quality monitoring carried out at or directly around the project site, DPIE operates an air quality monitoring station at Prospect, 4.7 kilometres to the northeast. Table 4-4 identifies the pollutants associated with the project that are measured at the station.

Table 4-4 Pollutants monitored at DPIE Prospect

DPIE air quality monitoring station	Pollutant				
	Particulate matter as PM_{10}	Particulate matter as $PM_{2.5}$	Nitrogen dioxide (NO_2)	Carbon monoxide (CO)	Sulfur dioxide (SO_2)
Prospect, William Lawson Park	✓	✓	✓	✓	✓

The quality or level of completeness is an important factor in determining whether data are suitable for the purpose of representing background air quality conditions in the environmental around a project. Generally, a data capture rate of 90 per cent or more is considered acceptable, taking into account periods of servicing, calibration and maintenance. Data capture rate information is available for DPIE's Prospect station and is summarised below in Table 4-5.

Table 4-5 DPIE Prospect data capture rate

Year	DPIE Prospect				
	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2
2015	95.8%	91.0%	93.8%	87.9%	93.8%
2016	99.1%	97.1%	94.2%	92.3%	92.3%
2017	98.9%	94.7%	93.6%	92.2%	94.3%
2018	99.1%	94.8%	86.4%	84.0%	86.2%
2019	99.1%	92.4%	91.6%	90.4%	94.6%

As listed, data for 90 per cent or more of hours were collected for all pollutants over all five years reviewed, except for CO in 2015, and NO_2, CO and SO_2 in 2018 when capture rates ranging between 84.0 per cent and 87.9 per cent. This indicates that there may be background data completeness-related issues for 2015 and 2018.

The measured data are discussed by pollutant in further detail below in **Section 4.4.2** to **Section 4.4.5**.

4.4.2 Particulate matter as PM_{10}

Continuous PM_{10} measurements are collected at DPIE's Prospect station. A time-series graph of daily concentrations from 2015 to 2019 is displayed below in **Figure 4-3**. The NSW EPA's daily impact assessment criterion of 50 µg/m³ is also displayed.

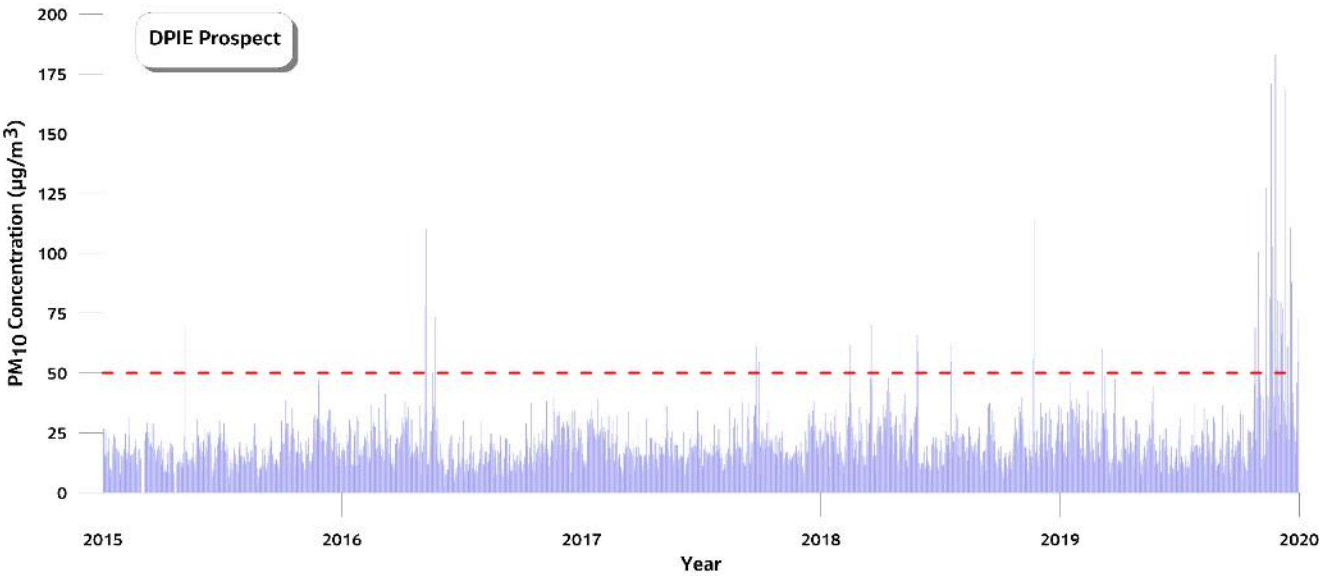

Figure 4-3 Measured 24-hour average PM_{10} concentrations at DPIE Prospect, 2015 to 2019

As shown, from 2015 to 2019 there were several instances where daily PM_{10} concentrations, from all sources, exceeded the EPA criteria of 50 µg/m³. Table 4-6 summarises these results. As evident in Table 4-6 there was a higher frequency of exceedances in 2019 compared with previous years. A high number of these occurred in the fourth quarter, corresponding to an unprecedented fire season, causing a significant deterioration in air quality throughout Central and Eastern Australia. This is reflected in the higher annual average PM_{10} concentration in 2019 (26 µg/m³) above the EPA's annual criterion of 25 µg/m³. Levels were measured below this criterion in 2015 to 2018.

Table 4-6 Summary of PM_{10} measurement statistics at DPIE Prospect

Year	DPIE Prospect	Criterion
Maximum 24-hour average in µg/m³		
2015	69	50
2016	110	
2017	61	
2018	113	
2019	183	
Number of days above 24-hour average criteria (50 µg/m³)		
2015	1	0
2016	4	
2017	2	
2018	8	
2019	24	

Year	DPIE Prospect	Criterion
Annual average in µg/m^3		
2015	18	25 (only applicable from 20 Jan 2017 onwards)
2016	19	
2017	19	
2018	22	
2019	26	

4.4.3 Particulate matter as $PM_{2.5}$

$PM_{2.5}$ is also monitored at the Prospect air quality monitoring station. Figure 4-4 shows a time-series of daily measurements collected from 2015 to 2019. The 25 µg/m^3 NSW EPA daily impact assessment criterion is also displayed.

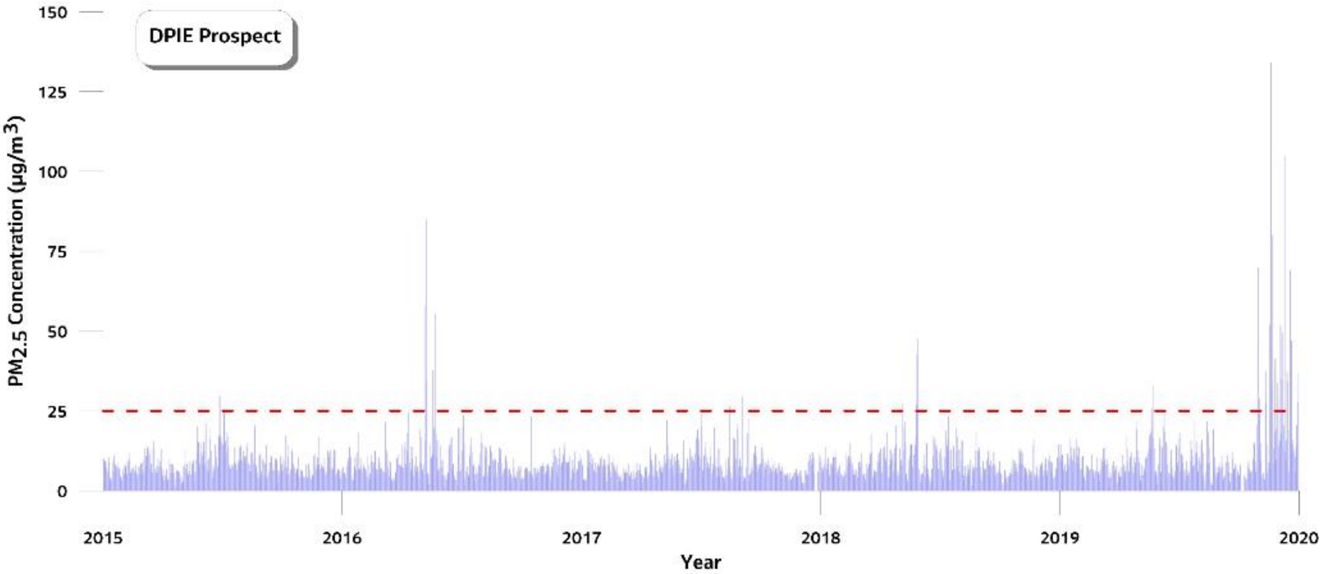

Figure 4-4 Measured 24-hour average $PM_{2.5}$ concentrations at DPIE Prospect, 2015 to 2019

As for $PM_{2.5}$, there were several days from 2015 to 2019 where $PM_{2.5}$ concentrations exceeded the NSW EPA's 25 µg/m^3 impact assessment criterion. Table 4-7 summarises these results. Maximum daily $PM_{2.5}$ concentrations were recorded several times higher (134 µg/m^3) than the EPA's impact assessment criterion (25 µg/m^3) during the 2019/20 Australian bushfires. Annual $PM_{2.5}$ concentrations were at or near the criterion value of 8 µg/m^3 in 2015, 2017 and 2018, and were measured above this value in 2016 and 2019.

Table 4-7 Summary of $PM_{2.5}$ measurement statistics at DPIE Prospect

Year	DPIE Prospect	Criterion
Maximum 24-hour average in µg/m^3		
2015	30	25 (only applicable from 20 Jan 2017 onwards)
2016	85	
2017	30	
2018	48	
2019	134	

Year	DPIE Prospect	Criterion
Number of days above 24-hour average criteria (25 µg/m³)		
2015	1	0
2016	5	
2017	3	
2018	4	
2019	24	
Annual average in µg/m³		
2015	8.2	8 (only applicable from 20 Jan 2017 onwards)
2016	8.7	
2017	7.7	
2018	8.5	
2019	111.9	

4.4.4 Total suspended particles (TSP) and deposited dust

Total suspended particles (TSP) and deposited dust are not monitored at the DPIE's station at prospect. A review of public information identified that between late 2015 and mid-2018 both pollutants were measured at a number of private monitors around Holcim Australia's Regional Distribution Centre at Rooty Hill. This property is located approximately five kilometres to the north of the project site. Measurements were collected approximately 300 metres to the south of the facility at Blacktown International Sportspark. Annually averaged TSP and deposited dust results reported for the two completed years of monitoring (2016 and 2017) are summarised below in Table 4-8 and Table 4-9 respectively. These data indicate that TSP concentrations and deposited dust levels have not exceeded relevant EPA criteria.

Table 4-8 2016 and 2017 reported annual TSP, near Holcim Australia's Regional Distribution Centre, Rooty Hill

Year	Reported annual TSP (µg/m³)	Criterion (µg/m³)
	PM10 2, Blacktown Sports Centre	
2016	26	90
2017	40	

Table 4-9 2016 and 2017 reported annual deposited dust, near Holcim Australia's Regional Distribution Centre, Rooty Hill

Year	Measured annual deposited dust (g/m²/month)	Criterion (g/m²/month)
	DDG 2, Blacktown Sports Centre	
2016	3.2	4
2017	1.7	

4.4.5 Nitrogen dioxide (NO_2), carbon monoxide (CO) and sulfur dioxide (SO_2)

Hourly measurements of NO_2, CO and SO_2 are collected at the DPIE Prospect air quality station. Statistics from these measurements as relevant to the averaging times listed in the EPA's approved Methods (see **Section 2**) are summarised below in **Table 4-10**. As shown, NO_2, CO and SO_2 concentrations around the project were measured well below (i.e. less than 50%) the impact assessment criteria for all five years reviewed. It can be inferred that NO_2, CO and SO_2 are not key air quality issues for the project and these pollutants were not considered further in the assessment.

Table 4-10 Summary of NO_2, CO and SO_2 measurement statistics at DPIE Prospect

Year	DPIE Prospect	Criterion
Nitrogen dioxide (NO_2): Maximum 1-hour average in µg/m³		
2015	100	246
2016	100	
2017	113	
2018	96	
2019	92	
Nitrogen dioxide (NO_2): Annual average in µg/m³		
2015	20	62
2016	18	
2017	18	
2018	17	
2019	16	
Carbon monoxide (CO): Maximum 1-hour average in mg/m³		
2015	2	30
2016	2	
2017	2	
2018	2	
2019	6	
Carbon monoxide (CO): Maximum 8-hour average in mg/m³		
2015	<1	10
2016	2	
2017	1	
2018	1	
2019	3	
Sulfur dioxide (SO_2): Maximum 1-hour average in µg/m³		
2015	71	570
2016	55	
2017	60	
2018	66	
2019	55	
Sulfur dioxide (SO_2): Maximum 24-hour average in µg/m³		
2015	8	228
2016	10	
2017	26	
2018	13	
2019	11	

Year	DPIE Prospect	Criterion
Sulfur dioxide (SO_2): Annual average in µg/m^3		
2015	1	60
2016	2	
2017	2	
2018	2	
2019	2	

4.5 Selection of a representative assessment year and establishment of background air quality conditions

As concluded in **Section 4.3**, none of the five years reviewed exhibited meteorological trends or were affected by quality issues that would make them unsuitable for the purpose of the air quality impact assessment for the project. Background air quality measurement data available for key pollutants as relevant to the project were reviewed in **Section 4.4.2** to **Section 4.4.5** above. The data identified that 2019 was unsuitable on the basis of conditions having been significantly affected by the Australian bushfires in the fourth quarter of the year; that is, an extraordinary year. Considering that deposited dust data were only available for 2016 and 2017, that there were quality issues with regards to NO_2, CO and SO_2 (i.e. less than 90% capture rates) in 2015 and 2018 and that 2017 exhibited comparable meteorological and ambient air quality trends, the 2017 calendar year was selected as the representative assessment year, with the background air quality concentrations in Table 4-11 applied.

Table 4-11 Adopted background air quality conditions

Pollutant	Averaging time	Adopted value	Justification	NSW EPA impact assessment criterion
Particulate matter as PM_{10}	24-hour	2017 daily values	Time-varying data collected at DPIE Prospect, 2017	50 µg/m^3
	Annual	19 µg/m^3	2017 annual average, DPIE Prospect, 2017	25 µg/m^3
Particulate matter as $PM_{2.5}$	24-hour	2017 daily values	Time-varying data collected at DPIE Prospect	25 µg/m^3
	Annual	7.7 µg/m^3	2017 annual average, DPIE Prospect	8 µg/m^3
Particulate matter, TSP	Annual	40 µg/m^3	Reported 2017 annual average, Blacktown Sports Centre	90 µg/m^3
Deposited dust	Annual	1.7 g/m^2/ month	Reported 2017 annual average, Blacktown Sports Centre	4 g/m^2/ month

As identified, the 24-hour averaged PM_{10} and $PM_{2.5}$ concentrations were measured at or exceeding the NSW EPA's impact assessment criteria. Consistent with the Approved Methods, an assessment demonstrating "that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical" was identified as being required.

5. Emissions to air

5.1 Construction

5.1.1 Emissions during construction

Activities associated with the construction of the project have the potential to generate dust emissions. Estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing the construction staging plan developed for the project and identifying the location and intensity of dust-generating activities. Operational parameters have been combined with emissions factors developed both locally and by the United States Environmental Protection Agency (US EPA).

The emission factors used for this assessment have been drawn largely from the following sources:

- 'Emission Estimation Technique Manual for Mining' (NPI, 2012); and
- AP 42 (US EPA, 1985 and updates).

Estimated TSP, PM_{10} and $PM_{2.5}$ emissions to air (in kilograms per year (kg/y)) during construction of the project are listed by source/activity below in Table 5-1. **Appendix A** provides details of the dust emission calculations; including the reference calculations applied, assumptions, emission controls and allocation of emissions to modelled locations.

Table 5-1 Estimated emissions to air, construction

Source/activity	Estimated annual emissions (kg/y)		
	TSP	PM_{10}	$PM_{2.5}$
Stage 1 - Clearing and stripping (Dozer)	1,159	245	58
Stage 1 - Earthworks (Dozer)	3,478	736	174
Stage 1 - Earthworks (Scraper)	2,881	725	144
Stage 1 - Earthworks (Grader)	556	249	28
Stage 1 - Earthworks (Excavator loading trucks)	328	155	16
Stage 1 - Earthworks (trucks unloading to stockpiles)	652	234	33
Stage 1 - Earthworks (Haulage, unsealed)	8,109	2,393	243
Stage 1 - Earthworks (Haulage, sealed)	2,177	418	101
Stage 2 - Earthworks (Dozer)	583	123	29
Stage 2 - Earthworks (Grader)	140	62	7
Stage 2 - Earthworks (Excavator loading trucks)	24	11	1
Stage 2 - Earthworks (trucks unloading to stockpiles)	40	14	2
Stage 2 - Earthworks (Haulage, unsealed)	593	175	18
Stage 2 - Earthworks (Haulage, sealed)	159	31	7
Stage 3 - Earthworks (Dozer)	559	118	28
Stage 3 - Earthworks (Grader)	134	60	7
Stage 3 - Earthworks (Excavator loading trucks)	18	8	1
Stage 3 - Earthworks (trucks unloading to stockpiles)	30	11	1
Stage 3 - Earthworks (Haulage, unsealed)	434	128	13
Stage 3 - Earthworks (Haulage, sealed)	117	22	5
Wind erosion (exposed areas)	7,118	3,559	356
Wind erosion (stockpiles)	978	489	49
Total	**30,265**	**9,969**	**1,322**

The main intent of the inventory is to capture the most significant emission sources that may affect off-site air quality. Not every source will be captured. However, the contribution of emissions from sources not identified will be captured in the assumed background levels and these data have been added to the predicted contributions.

The sources of emissions listed above in Table 5-1 were represented in the dispersion model by a series of volume sources. These sources were positioned at the locations shown in **Figure 5-1** as identified below in Table 5-2 based on the construction methodology information provided for the project.

Emissions from these sources/activities were evaluated as occurring:

- during standard hours of construction (7am to 6pm); and
- where works could take place outside standard construction hours.

For the standard hours assessment scenario, wind-erosion of exposed areas/stockpiled materials were set to take place on a 24-hour basis.

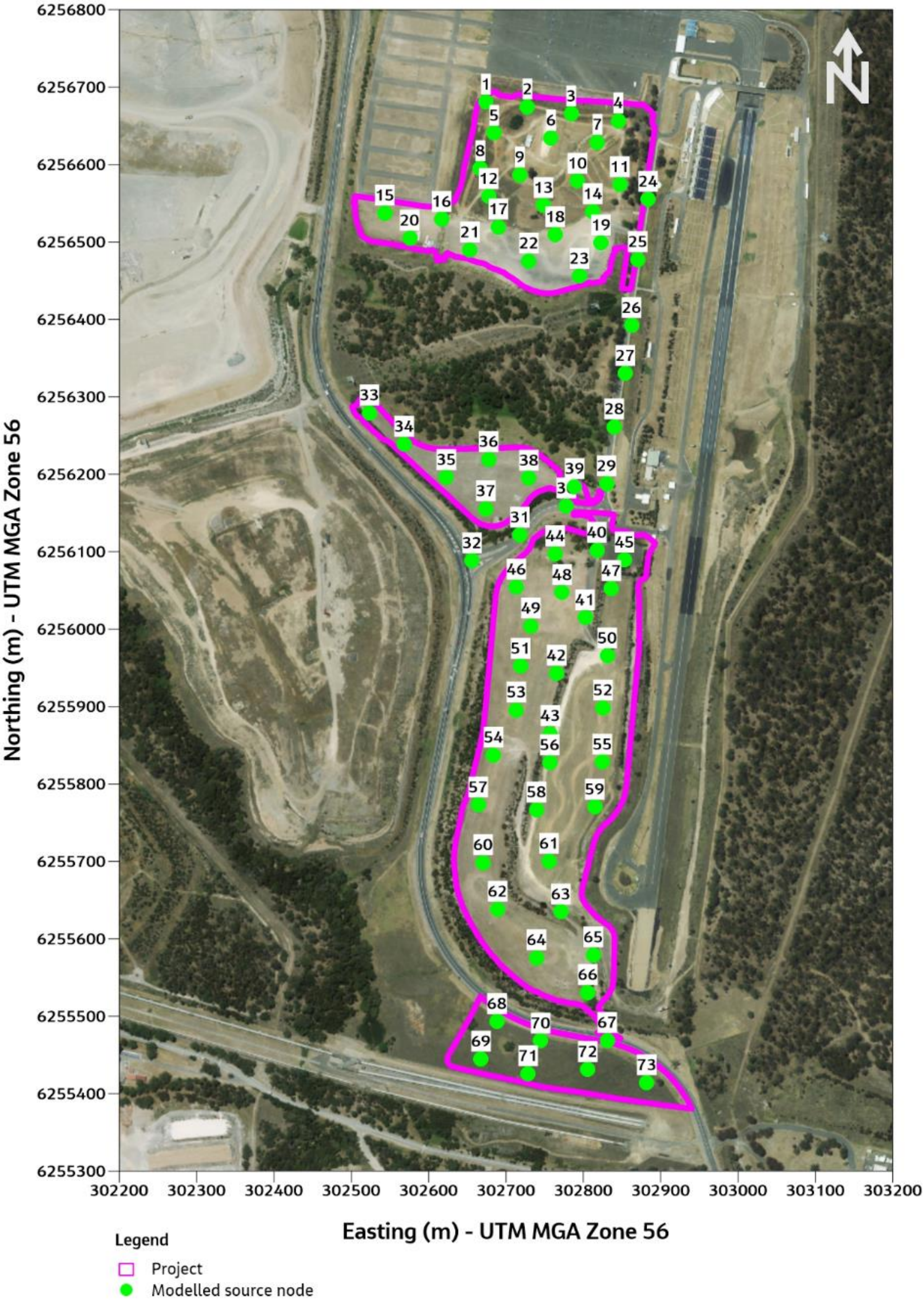

Figure 5-1 Construction dust modelling locations

Table 5-2 Source locations, construction

Source/activity	Locations where activities were modelled
Stage 1 - Clearing and stripping (Dozer)	1 to 24, 33 and 34, 36 and 39 to 73
Stage 1 - Earthworks (Dozer)	1 to 14, 16 to 24, 33 and 34, 39 to 43, 45 to 59 and 61 to 67
Stage 1 - Earthworks (Scraper)	1 to 14, 16 to 24, 33 and 34, 39 to 43, 45 to 59 and 61 to 67
Stage 1 - Earthworks (Grader)	1 to 14, 16 to 24, 33 and 34, 39 to 43, 45 to 59 and 61 to 67
Stage 1 - Earthworks (Excavator loading trucks)	1 to 14, 16 to 24, 33 and 34, 39 to 43, 45 to 59 and 61 to 67
Stage 1 - Earthworks (trucks unloading to stockpiles)	15, 36, 44, 60 and 68 to 73
Stage 1 - Earthworks (Haulage, unsealed)	9 to 11, 13, 17, 20, 34 and 35, 38 to 43, 58, 61, 63, 66 and 70
Stage 1 - Earthworks (Haulage, sealed)	25 to 32
Stage 2 - Earthworks (Dozer)	41 and 49 to 67
Stage 2 - Earthworks (Grader)	41 and 49 to 67
Stage 2 - Earthworks (Excavator loading trucks)	41 and 49 to 67
Stage 2 - Earthworks (trucks unloading to stockpiles)	60 and 68 to 73
Stage 2 - Earthworks (Haulage, unsealed)	41 to 43, 58, 61, 63, 66 and 70
Stage 2 - Earthworks (Haulage, sealed)	29 to 32 and 40
Stage 3 - Earthworks (Dozer)	41 and 49 to 67
Stage 3 - Earthworks (Grader)	41 and 49 to 67
Stage 3 - Earthworks (Excavator loading trucks)	41 and 49 to 67
Stage 3 - Earthworks (trucks unloading to stockpiles)	60 and 68 to 73
Stage 3 - Earthworks (Haulage, unsealed)	41 to 43, 58, 61, 63, 66 and 70
Stage 3 - Earthworks (Haulage, sealed)	29 to 32 and 40
Wind erosion (exposed areas)	1 to 15, 17 to 23, 33 to 35, 37 to 43, 45 to 59 and 61 to 67
Wind erosion (stockpiles)	16, 36, 44, 60 and 68 to 73

5.1.2 Emission controls, construction

Standard practice dust management controls were applied in the construction emissions inventory listed above in **Table 5-1**. Efficiency factors from these controls were applied consistent with guidance presented in Table 4 of NPI, 2012 (reproduced below in **Table 5-3**).

Table 5-3 Emission control measures, construction

Source/activity	Control measure	Control efficiency (%)	Reference
Unloading materials to stockpiles	Water sprays	70	(NPI, 2012), Table 4
Hauling materials in trucks	Watering of haulage routes	75	(NPI, 2012), Table 4
Wind erosion from stockpiles and exposed surfaces	Watering	50	(NPI, 2012), Table 4

5.2 Operations

5.2.1 Emissions during motorsports racing activities

Section 1.4 above identifies dust from motorsport racing and from wind erosion when the track is not in use as the primary air quality related risk during operation. Guidance for estimating dust emissions from vehicle movements along unpaved roads are presented in the United States Environmental Protection Agency's 'Compilation of Air Pollutant Emission Factors' (AP-42). The source conditions used in developing the emission factors presented in AP-42 involved vehicles weighing 1.5 tons or more and for speeds ranging between 8 and 88 kilometers per hour (US EPA, 2006). The maximum weight of the motorsport vehicles to be used at the facility is approximately 0.623 tons, with estimated vehicle speeds of around 260 kilometres per hour. This indicates that the expected operations at the Sydney International Speedway would be outside the range of conditions that the estimation techniques in AP-42 were developed. An alternative emission estimation approach was therefore considered.

Monitoring of dust generated during motorsport racing activities was completed recently (2020) at the existing motorsports facility located at Wentworth Street, Clyde NSW. Considering the potential issues associated with the use of guidance from the US EPA's AP-42 as outlined above, the monitoring data collected by Sydney Metro during the 25 January 2020 racing event were used to back-calculate emissions from racing activities during the event. This involved developing a model, using the AUSPLUME air dispersion model, to represent the monitored 25 January 2020 racing event. Receivers were placed at the upwind and two downwind air quality monitoring locations, and sources representing race vehicles were placed around the track as displayed below in Figure 5-2.

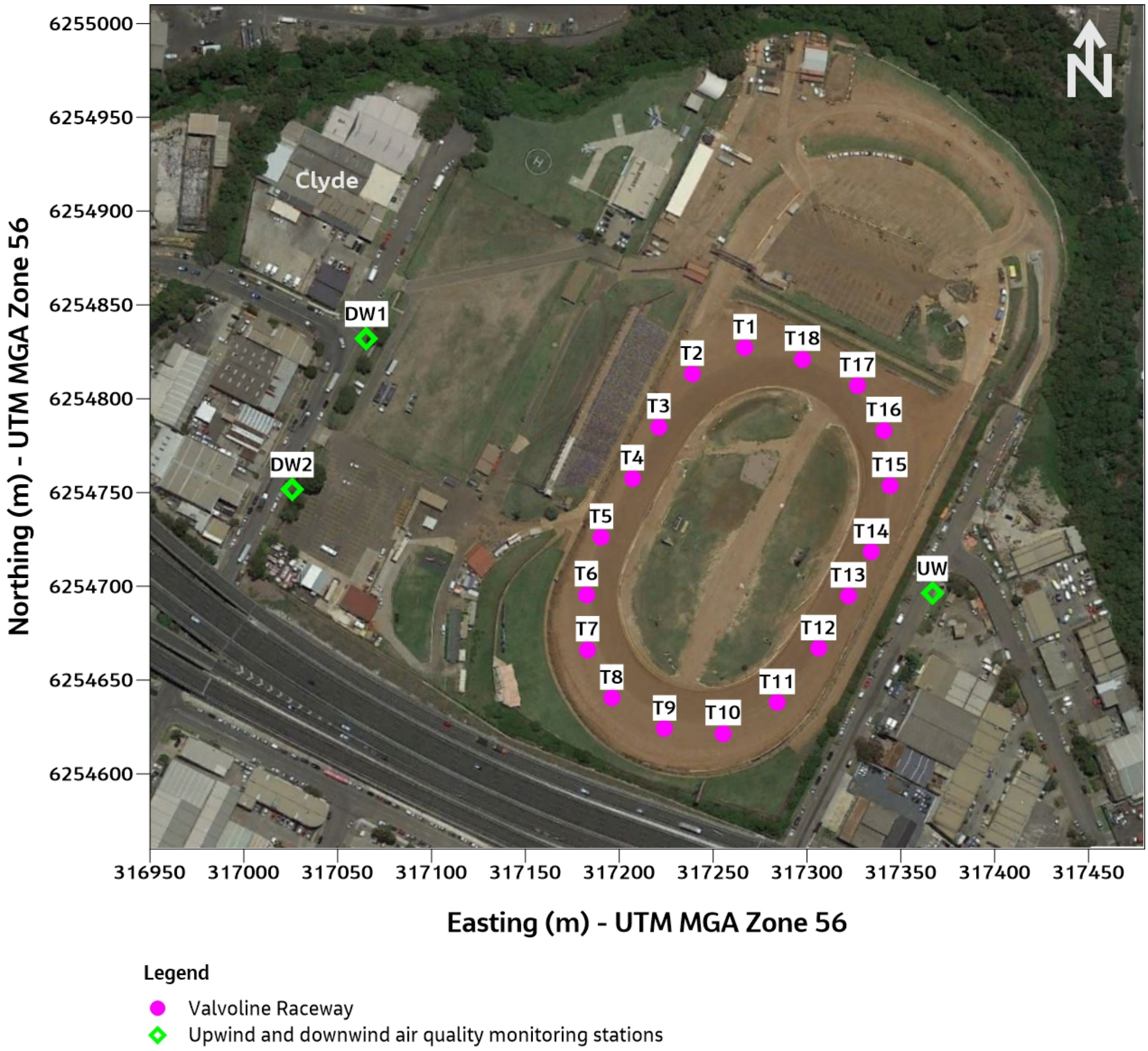

Figure 5-2 AUSPLUME model setup for 25 January 2020 Sydney Speedway event

Meteorology during the race event was applied in the model, and flat terrain conditions were assumed, which is generally the case for the area displayed. A constant PM_{10} emission factor of 1 gram per second was applied at each track source node and the resulting concentrations were predicted at the downwind location relevant for the period of the race (DW1 to 8pm, DW2 after 8pm). The emission factor was then determined by scaling the one gram per second constant emission factor so that the resulting PM_{10} concentration at the downwind monitor matched the difference between the maximum downwind station PM_{10} concentration and the corresponding estimated PM_{10} concentration at the upwind station for each hour. These data points are displayed below in Figure 5-3. As shown, it was not possible to complete this analysis for the hours ending 4pm, 5pm and 10pm when upwind PM_{10} concentrations were at or above the measured downwind concentrations.

Hourly PM_{10} concentrations at the upwind and downwind stations for this calculation were estimated from the 1-minute data (refer to Figure 5-3) using the power law estimation technique presented in the 'AUSPLUME Gaussian Plume Dispersion Model Technical User Manual', (Victorian EPA, 2000).

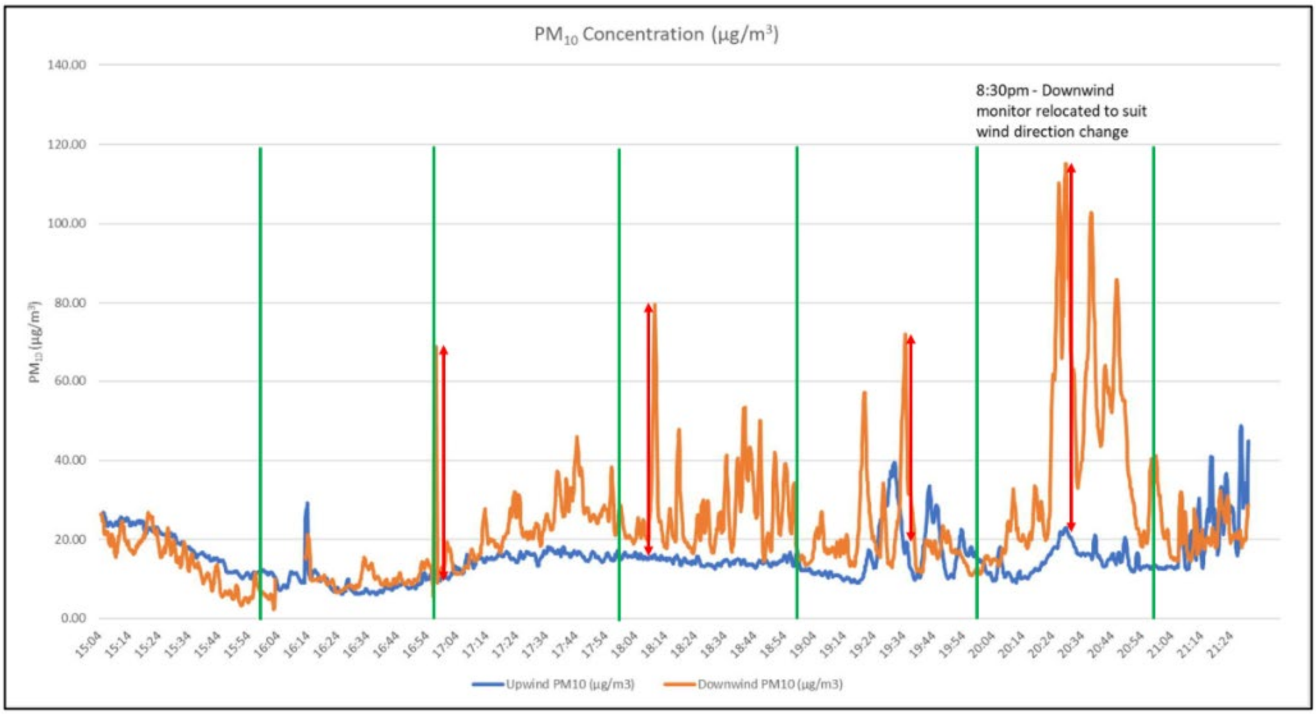

Figure 5-3 Data applied in analysis

Using this approach, the following emission rates in Table 5-4 were estimated.

Table 5-4 Estimated PM_{10} motorsport event emission rates

Hour ending	Estimated PM_{10} emission rate per node (grams per second)
18	0.0234
19	0.0519
20	0.0138
21	0.0252
Maximum	**0.0519**
Average	**0.0286**
Median	**0.0243**

Considering the following anticipated number of events, duration per event and hours per event day, **Table 5-5** below lists estimated annual TSP, PM_{10} and $PM_{2.5}$ emissions from motorsports racing on an annual basis:

- 52 events per year
- An average of 2 race days per event noting that some events occur over a single day, with larger events lasting 3 days
- Up to approximately seven hours of racing per race day (3pm to 10pm).

Guidance from the US EPA's AP-42 was used to estimate TSP (3.5 times PM_{10}) and $PM_{2.5}$ (0.1 times PM_{10}) emission rates from the back-calculated PM_{10} values. Maximum, average and median estimated TSP, PM_{10} and $PM_{2.5}$ emission rates from motorsports activities are summarized below in Table 5-5.

Table 5-5 Estimated annual TSP, PM_{10} and $PM_{2.5}$ emission rates from motorsports racing activities

Scenario	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Maximum	8,569	2,448	245
Average	4,718	1,348	135
Median	4,012	1,146	115

5.2.2 Emissions from wind erosion when the track is not in use

Emissions to air during operations would also arise from wind erosion when the track is not in use. Guidance from sections 1.1.17 and 1.1.18 of 'Emission Estimation Technique Manual for Mining' (NPI, 2012) was used to estimate these emissions. Table 5-6 lists annual TSP, PM_{10} and $PM_{2.5}$ emissions from this source as well as the emission factors and variables used to estimate these values.

Table 5-6 Estimated annual TSP, PM_{10} and $PM_{2.5}$ emission rates from wind erosion when the track is not in use

Annual emissions (kg/y)			Emission factor (kg/ha/y)			Variable				
TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	Area (ha)	% wind speed > 5.4 m/s	No. days rainfall > 0.25 mm	Silt content (%)	Control factor (%)
847	424	42	823	411	41	1.03	2.24	85	10	0

Area (ha) – total track area between inside and outside track perimeters

% wind speed greater than 5.4% – Estimated for the approximate location of the project from CALMET using PRTMET

No. days rainfall > 0.25 mm – BoM Horsley Park, 2017

Silt content (%) – Default value, (NPI, 2012)

5.2.3 Summary

As for construction, operational emissions sources were represented in the dispersion model as a series of volume sources. These sources were positioned at the locations shown below in Figure 5-4. The worst-case estimated TSP, PM_{10} and $PM_{2.5}$ emissions to air from motorsports racing events listed in Table 5-5 above were applied, along with the emissions from wind erosion when the track is not in use as listed in Table 5-6.

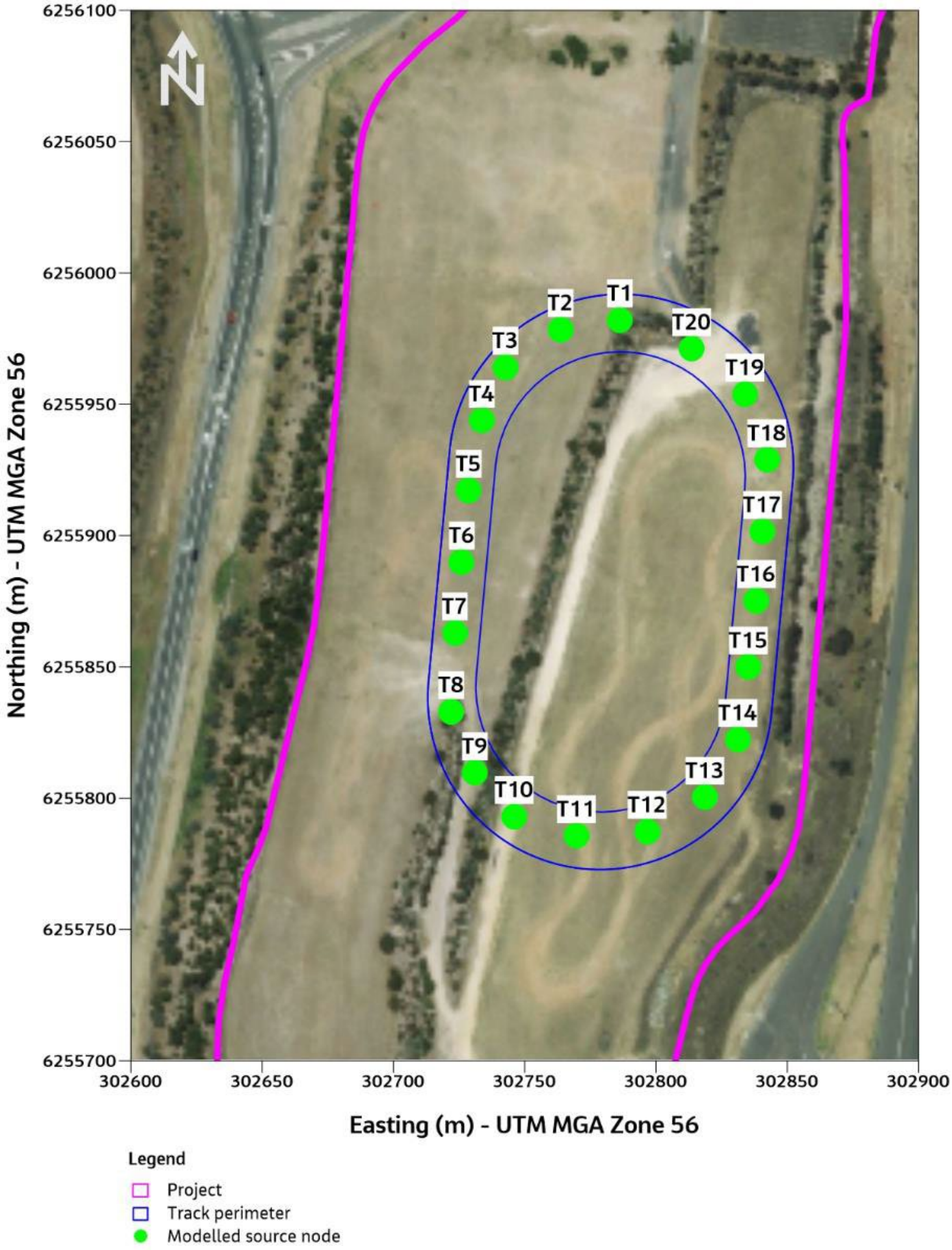

Figure 5-4 Operational dust modelling locations

6. Assessment of potential impacts

6.1 Overview

This section presents and discusses the results of the assessment by phase of the project (construction and operations), and classification of particulate matter (PM_{10}, $PM_{2.5}$, TSP and deposited dust). The significance of the predictions was assessed by evaluating the cumulative (i.e. background plus change as a result of the project) concentrations and levels against the criteria and guidance from the EPA's Approved Methods presented in **Section 2**.

6.2 Construction

6.2.1 Particulate matter as PM_{10}

Table 6-1 below summarises the predicted annual PM_{10} contributions from the project during construction as well as estimated cumulative (background plus project contribution) concentrations at the nearest sensitive receivers identified in Figure 4-1. The range of predictions at the adjacent drag racing facility are also listed noting that the impact assessment criteria from the EPA's Approved Methods would not apply at this location, with project specific trigger levels to be developed using dust monitoring data.

Table 6-1 Predicted annual PM10 concentrations (µg/m3), construction

Receiver	Predicted project contribution (µg/m^3)		Background (µg/m^3)	Cumulative (µg/m^3)		Criterion (µg/m^3)
	Construction 7 am to 6 pm	Construction 24-hours		Construction 7 am to 6 pm	Construction 24-hours	
R1	0.1	0.1	19	19.1	19.1	25
R2	<0.1	0.1		<19.1	19.1	
R3	<0.1	0.1		<19.1	19.1	
R4	<0.1	0.1		<19.1	19.1	
R5	<0.1	0.1		<19.1	19.1	
Sydney Dragway	Up to 2.0	Up to 6.2		21.0	25.2	-

As Table 6-1 shows, it was predicted that annually averaged PM_{10} concentrations would remain below the EPA's impact assessment criterion (25 µg/m^3) at surrounding sensitive receivers during construction. Concentrations up to 21 µg/m^3 were predicted at the Sydney Dragway where construction activities were completed during standard hours. Concentrations up to 25.2 µg/m^3 were predicted for the 24-hour construction assessment scenario.

Regarding daily averaged PM_{10}, there were two instances where background concentrations exceeded the EPA's criteria in 2017 (see Table 4-6). Consistent with guidance presented in the Approved Methods it was reviewed whether the project would cause additional days of exceedance at surrounding sensitive receivers. This review is presented below in Table 6-2.

Table 6-2 Review of change in number of days with PM_{10} concentrations exceeding 50 (µg/m³), construction

Receiver	Number of exceedances per year (existing)	Maximum project 24-hour contribution during construction (µg/m³)		Number of exceedances per year		Change in number of exceedances per year	
		Construction 7 am to 6 pm	Construction 24-hours	Construction 7 am to 6 pm	Construction 24-hours	Construction 7 am to 6 pm	Construction 24-hours
R1	2	0.7	0.9	2	2	0	0
R2		0.5	0.6	2	2	0	0
R3		0.4	0.7	2	2	0	0
R4		0.3	0.5	2	2	0	0
R5		0.3	0.4	2	2	0	0
Sydney Dragway		Up to 8.4	Up to 17.3	-	-	-	-

As listed, it was predicted that the project would not result in any additional days where PM_{10} concentrations were above 50 µg/m³ at the identified representative sensitive receiver locations. Contributions up to 8.4 µg/m³ and 17.3 µg/m³ were predicted at the Sydney Dragway (standard and 24-hour construction hours respectively).

Annual and 24-hour averaged PM_{10} contributions predicted from the project during construction are displayed as contour plots in **Appendix E**.

6.2.2 Particulate matter as $PM_{2.5}$

Predicted annual $PM_{2.5}$ contributions from the project during construction and the resulting cumulative concentration at each of the nearby sensitive receivers identified in Figure 4-1 are summarised below in Table 6-3.

Table 6-3 Predicted annual $PM_{2.5}$ concentrations (µg/m³), construction

Receiver	Predicted project contribution (µg/m³)		Background (µg/m³)	Cumulative (µg/m³)		Criterion (µg/m³)
	Construction 7 am to 6 pm	Construction 24-hours		Construction 7 am to 6 pm	Construction 24-hours	
R1	0.01	0.03	7.7	7.71	8	8
R2	<0.01	0.02		<7.71	7.9	
R3	<0.01	0.02		<7.71	7.9	
R4	<0.01	0.02		<7.71	7.9	
R5	<0.01	0.01		<7.71	7.9	
Sydney Dragway	Up to 0.3	Up to 1.1		8	8.8	-

As listed, annual $PM_{2.5}$ were predicted to remain below the EPA's 8 µg/m³ impact assessment criterion at the identified surrounding representative sensitive receiver locations. Annually averaged $PM_{2.5}$ concentrations during construction were also not expected to exceed the EPA's criterion at the Sydney Dragway when works were carried out during standard hours. For 24-hour construction activities, concentrations up to 8.8 µg/m³ were predicted at Sydney Dragway.

As identified above in **Section 4.4.3** there were three instances in 2017 (year of assessment) when daily $PM_{2.5}$ concentrations exceeded the EPA's 25 µg/m^3 impact assessment criterion. As such it was reviewed whether the project could result in additional days of exceedance at these receivers. The results of this review are summarised below in Table 6-4.

Table 6-4 Review of change in number of days with $PM_{2.5}$ concentrations exceeding 25 (µg/m^3), construction

Receiver	Number of exceedances per year (existing)	Maximum project 24-hour contribution during construction (µg/m^3)		Number of exceedances per year		Change in number of exceedances per year	
		Construction 7 am to 6 pm	Construction 24-hours	Construction 7 am to 6 pm	Construction 24-hours	Construction 7 am to 6 pm	Construction 24-hours
R1	3	0.1	0.2	3	3	0	0
R2		0.1	0.1	3	3	0	0
R3		0.1	0.1	3	3	0	0
R4		<0.1	0.1	3	3	0	0
R5		0.1	0.1	3	3	0	0
Sydney Dragway		Up to 1.6	Up to 3.3	-	-	-	-

As listed above, it was predicted that the project would not result in any additional days where $PM_{2.5}$ concentrations were above 25 µg/m^3 at the identified representative sensitive receiver locations. Contributions up to 1.6 and 3.3 µg/m^3 were predicted at the Sydney Dragway (standard and 24-hour construction hours respectively).

Annual and 24-hour averaged $PM_{2.5}$ contributions predicted from the project during construction are displayed as contours in **Appendix E**.

6.2.3 Total suspended particulates (TSP)

Predicted annual TSP contributions from the project during construction at the identified representative receivers are listed below in Table 6-5. As displayed, it was predicted that the project would not cause cumulative annual TSP concentrations exceeding the EPA's 90 µg/m^3 impact assessment criterion. Annually averaged TSP contributions up to 4.5 and 11.7 µg/m^3 (standard and 24-hour construction hours respectively) were predicted at the Sydney Dragway from the project during construction.

Table 6-5 Predicted annual TSP concentrations (µg/m^3), construction

Receiver	Predicted project contribution (µg/m^3)		Background (µg/m^3)	Cumulative (µg/m^3)		Criterion (µg/m^3)
	Construction 7 am to 6 pm	Construction 24-hours		Construction 7 am to 6 pm	Construction 24-hours	
R1	0.1	0.1	40	40.1	40.1	90
R2	<0.1	0.1		<40.1	40.1	
R3	<0.1	0.1		<40.1	40.1	
R4	<0.1	<0.1		<40.1	<40.1	
R5	<0.1	<0.1		<40.1	<40.1	
Sydney Dragway	Up to 4.5	Up to 11.7		44.5	51.7	-

Annual TSP contributions predicted from the project during construction are displayed as contours in **Appendix E**.

6.2.4 Deposited dust

Deposited dust levels at surrounding receiver locations from the project during construction are summarised below in Table 6-6. As listed, levels were predicted to remain well below the EPA's the 4 g/m²/month impact assessment criterion. This was also predicted to be the case at the adjacent Sydney Dragway.

Table 6-6 Predicted deposited dust (g/m²/month), construction

Receiver	Predicted project contribution (g/m²/month)		Background (g/m²/month)	Cumulative (g/m²/month)		Criterion (g/m²/month)
	Construction 7 am to 6 pm	Construction 24-hours		Construction 7 am to 6 pm	Construction 24-hours	
R1	0.01	0.01	1.7	1.71	1.71	4
R2	0.01	0.01		1.71	1.71	
R3	0.01	0.01		1.71	1.71	
R4	<0.01	<0.01		<1.71	<1.71	
R5	0.01	0.01		1.71	1.71	
Sydney Dragway	Up to 0.5	Up to 0.9		2.2	2.6	-

Deposited dust contributions predicted during the construction of the project are also displayed as contours in **Appendix E**

6.3 Operations

6.3.1 Particulate matter as PM_{10}

Table 6-7 below summarises the predicted annual PM_{10} contributions from the project at surrounding receiver locations during operations. The range of predictions at the adjacent drag racing facility are also listed noting that the impact assessment criteria from the EPA's Approved Methods would not apply at this location.

Table 6-7 Predicted annual PM_{10} concentrations (µg/m³), operations

Receiver	Predicted project contribution (µg/m³)	Background (µg/m³)	Cumulative (µg/m³)	Criterion (µg/m³)
R1	0.1	19	19.1	25
R2	0.1		19.1	
R3	<0.1		<19.1	
R4	<0.1		<19.1	
R5	<0.1		<19.1	
Sydney Dragway	Up to 6.6		25.6	-

As Table 6-7 shows, during operation of the project it was predicted that annually averaged PM_{10} concentrations would remain below the EPA's impact assessment criterion (25 µg/m³) at the identified surrounding representative sensitive receivers. Concentrations up to 25.6 µg/m³ were predicted at the Sydney Dragway.

Regarding daily averaged PM_{10}, there were two instances where background concentrations exceeded the EPA's criteria in 2017 (see Table 4-6). Consistent with guidance presented in the Approved Methods it was reviewed whether the operation of the project would cause additional days of exceedance at surrounding sensitive receivers. This review is presented below in Table 6-8.

Table 6-8 Review of change in number of days with PM_{10} concentrations exceeding 50 (µg/m³), operations

Receiver	Number of exceedances per year (existing)	Maximum project 24-hour contribution during operations (µg/m³)	Number of exceedances per year	Change in number of exceedances per year
R1	2	1.0	2	0
R2		0.9	2	0
R3		0.4	2	0
R4		0.3	2	0
R5		0.6	2	0
Sydney Dragway	-	Up to 41.1	-	-

As listed, it was predicted that during operations, the project would not result in any additional days where PM_{10} concentrations were above 50 µg/m³ at the identified representative sensitive receiver locations. Contributions up to 41 µg/m³ were predicted at the adjacent Sydney Dragway.

6.3.2 Particulate matter as $PM_{2.5}$

Predicted annual $PM_{2.5}$ contributions from the project during operations and the resulting cumulative concentration at each of the nearby sensitive receivers identified in Figure 4-1 are summarised below in Table 6-9.

Table 6-9 Predicted annual $PM_{2.5}$ concentrations (µg/m³), operations

Receiver	Predicted project contribution (µg/m³)	Background (µg/m³)	Cumulative (µg/m³)	Criterion (µg/m³)
R1	0.01	7.7	7.71	8
R2	0.01		7.71	
R3	<0.01		<7.71	
R4	<0.01		<7.71	
R5	<0.01		<7.71	
Sydney Dragway	Up to 0.7		8.4	-

As listed, annual $PM_{2.5}$ were predicted to remain below the EPA's 8 µg/m³ impact assessment criterion at the identified surrounding representative sensitive receiver locations. Concentrations up to 8.4 µg/m³ were predicted at the Sydney Dragway.

As identified above in **Section 4.4.3** there were three instances in 2017 (year of assessment) when daily $PM_{2.5}$ concentrations exceeded the EPA's 25 µg/m³ impact assessment criterion. As such it was reviewed whether operation of the project could result in additional days of exceedance at these receivers. The results of this review are summarised below in Table 6-10.

Table 6-10 Review of change in number of days with $PM_{2.5}$ concentrations exceeding 25 (µg/m³), operations

Receiver	Number of exceedances per year (existing)	Maximum project 24-hour contribution during operations (µg/m³)	Number of exceedances per year	Change in number of exceedances per year
R1	3	0.1	3	0
R2		0.1	3	0
R3		0.1	3	0
R4		<0.1	3	0
R5		0.1	3	0
Sydney Dragway	-	Up to 4.2	-	-

As listed above, it was predicted that operation of the project would not result in any additional days where $PM_{2.5}$ concentrations were above 25 µg/m³ at the identified representative sensitive receiver locations. Daily $PM_{2.5}$ contributions up to 4.2 µg/m³ were predicted at the Sydney Dragway.

6.3.3 Total suspended particulates (TSP)

Predicted annual TSP contributions from the project during operations at the identified representative receivers are listed below in Table 6-11. As displayed, it was predicted that the project would not cause cumulative annual TSP concentrations exceeding the EPA's 90 µg/m³ impact assessment criterion. Annually averaged TSP contributions up to 15.6 µg/m³ were predicted at the Sydney Dragway from the project during construction.

Table 6-11 Predicted annual TSP concentrations (µg/m³), operations

Receiver	Predicted project contribution (µg/m³)	Background (µg/m³)	Cumulative (µg/m³)	Criterion (µg/m³)
R1	<0.1	40	<40.1	90
R2	0.1		40.1	
R3	<0.1		<40.1	
R4	<0.1		<40.1	
R5	<0.1		<40.1	
Sydney Dragway	Up to 15.6		55.6	-

6.3.4 Deposited dust

Deposited dust levels at surrounding receiver locations from the project during operations are summarised below in Table 6-12. As listed, levels were predicted to remain well below the EPA's 4 g/m²/month impact assessment criterion. As during construction, this was also predicted to be the case at the adjacent Sydney Dragway.

Table 6-12 Predicted deposited dust (g/m^2/month), operations

Receiver	Predicted project contribution (g/m^2/month)	Background (g/m^2/month)	Cumulative (g/m^2/month)	Criterion (g/m^2/month)
R1	<0.01	1.7	<1.71	4
R2	0.01		1.71	
R3	<0.01		<1.71	
R4	<0.01		<1.71	
R5	<0.01		<1.71	
Sydney Dragway	Up to 1.2		2.9	-

7. Management and monitoring

7.1 Construction

As presented above in **Section 6.2**, the assessment found that the EPA's annually averaged impact assessment criteria were able to be met at the identified representative sensitive receiver locations. Consistent with section 5.1.3 of the Approved Methods, for environments where background air quality conditions are already elevated and where it has been demonstrated that there would be no attributable additional exceedances of the EPA's impact assessment criteria, best practice management practices are to be implemented to "minimise emissions of air pollutants as far as practical". As identified in **Table 5-3** above in **Section 5.1.2**, measures to control emissions would be applied to all sources of emissions to air associated with the project. The implementation of these controls is considered reasonable best-practice. These, along with other standard practice measures have been reproduced below in **Table 7-1**.

Table 7-1 Dust management measures during construction, standard measures

Reference	Issue/impact	Mitigation measure	Applicable location
AQ1	Dust generation during construction	The following best-practice dust management measures would be implemented during all construction works: • Apply water sprays during the loading and unloading of materials • Regularly wet-down exposed and disturbed areas including stockpiles and haulage routes, especially during dry weather • Adjust the intensity of activities based on measured and observed dust levels and weather forecasts • Minimise the amount of materials stockpiled and position stockpiles away from surrounding receivers • Regularly inspect dust emissions and apply additional controls as required	All
AQ2	Exhaust emissions from the combustion of fossil fuels during construction	Plant and equipment would be maintained in a proper and efficient manner.	All

In relation to the potential for dust from the project to impact on the operations of Dragway, the construction contractor would be required to monitor and manage dust conditions on the project site and the adjacent Sydney Dragway. This would include:

- Dust monitors at the adjacent Sydney Dragway to acquire and measure baseline dust levels
- Installation of two real-time dust monitors within the construction area, prior to construction commencing, to monitor dust generated from the project site that might impact the dragstrip. These monitors would also be used to monitor dust during Sydney International Speedway operations
- An on-site meteorological station sited in accordance with Australian/New Zealand Standard (AS/NZS) 3580.1.1:2016 - Methods for sampling and analysis of ambient air – Part 1.1: Guide to siting air monitoring equipment (AS/NZS 3580.1.1:2016) to assist with the interpretation of dust monitoring results.

If during construction, the monitors indicate potential impact on the dragstrip during or in the lead-up to a Dragway event, construction works would cease until the project site is appropriately treated. Construction works which generate dust would not take place during a Dragway event.

An Air Quality Management Plan would be developed and implemented to minimise the generation of dust and set trigger values to enable the project site to be managed in a proactive manner as well as a reactive manner. The contractor would continuously monitor, and regularly sample during construction, dust levels at the project site and at Sydney Dragway with measurement and testing reports made available to Sydney Metro, Sydney Dragway and Western Sydney Parklands Trust.

During construction, four permanent dust monitoring stations would be installed at Sydney Dragway to monitor, measure and report baseline dust levels during the period up to commencement of operations. The data gathered would be used to establish a baseline for safe operational dust levels at Sydney Dragway.

7.2 Operations

It was also determined that operation of the project would not result in concentrations/levels of particulate matter (including TSP and deposited dust) exceeding the EPA's annually averaged impact assessment criteria at the identified representative sensitive receiver locations. For 24-hour averaged PM_{10} and $PM_{2.5}$ it was determined that there would be no additional exceedances of the EPA's impact assessment criteria at these locations noting that there were already instances where background levels already exceeded these levels.

The racetrack design, layout and operational procedures include dust control and mitigation measures to minimise dust generation and offsite settlement, including:

- Vegetation along the boundary between the Sydney International Speedway racetrack and Sydney Dragway
- Installation of dust screens to reduce windspeed and migration of dust
- Curation of the track including water suppression during race events and potentially combining the clay used in the track with additives, which would minimise the mobilisation of dust during the use of the racetrack.

During construction, four real-time dust monitoring stations would be installed on the Sydney Dragway site during the period up to commencement of operations and would monitor, measure and report the Dragway baseline dust level. Subject to final review, the monitors would likely include at least one adjacent to the Dragway racing area, one adjacent to the Dragway's timing marker and one adjacent to the Dragway braking area.

The maximum allowable ground level dust deposition rate would be determined based on the results of dust monitoring, dispersion modelling and discussions with the Dragway operator. Based on the deposition rates of concern, two to three trigger values would be developed which would then be used to manage dust generation from operations of the Sydney International Speedway.

During operation of the Sydney International Speedway, dust levels at the speedway site and the Dragway would be required to be continuously monitored and regularly sampled on speedway event days, with measurement and testing reports made available to the Dragway operator and Western Sydney Parklands Trust. The position of two real-time operational dust monitors would be finalised during track testing ahead of full Sydney International Speedway operations. This monitoring would be used to establish the Sydney International Speedway dust trigger level. The on-site meteorological station that would be established during construction would be permanent, and maintained for use during operation of the project.

The Sydney International Speedway operator would be responsible for management and mitigation of dust to achieve compliance with the dust trigger level.

The Sydney International Speedway operator would be required to ensure compliance with the above obligations through the implementation of:

- A Dust Mitigation and Control Plan
- A Rectification Action Plan (in the event of a breach)
- Sydney Dragway dragstrip dust level monitoring and reporting
- Adoption of approved track curation and preparation procedures
- Use and maintenance of approved track material
- Conducting and reporting of annual track condition audits
- Repair and maintenance of natural and engineered physical barriers.

In the event the dust trigger level is exceeded, then the Sydney International Speedway would cease to operate until the operator completes all necessary action to rectify the breach and perform a test that it can comply with its dust control obligations.

8. Conclusion

An assessment was completed to evaluate potential changes in air quality from the construction and operation of the Sydney International Speedway with the Western Sydney Parklands Precinct 5: Eastern Creek Motor Sports NSW. Consistent with the requirements of the SEAR's, this assessment was completed in accordance with the guidance presented in the EPA's Approved Methods and considered key emissions to air during construction and operation of the project.

As part of the assessment, key features of the existing environment were determined including the identification of surrounding sensitive receivers; prevailing meteorology; and background local air quality conditions. Using aerial imagery five receivers representing the nearest sensitive receivers in different directions from the project were identified. Meteorological and ambient air quality data collected at nearby monitors operated by BoM, DPIE and Holcim over the last five calendar years were reviewed and this process identified 2017 as being a representative year for the purpose of the assessment.

Using locally (NPI, 2012) and internationally (US EPA AP-42) developed emissions factors, and factors developed using monitoring data from an existing speedway facility, emission rates were estimated and applied in the CALPUFF dispersion model to predict the potential for air quality impacts during the construction and operation of the project. This assessment determined that the project would not result in unacceptable changes to local air quality. Specifically, it was predicted that:

- The EPA's annually averaged impact assessment criteria for PM_{10}, $PM_{2.5}$, TSP and deposited dust would not be exceeded at surrounding sensitive receivers during construction and operations
- There would be no additional days where the EPA's daily PM_{10} impact assessment criterion of 50 µg/m^3 would be exceeded at the identified representative sensitive receivers during construction or operations
- There would be no additional days where the EPA's daily $PM_{2.5}$ impact assessment criterion of 25 µg/m^3 would be exceeded at the identified representative sensitive receivers during construction or operations.

PM_{10}, $PM_{2.5}$, TSP and deposited dust levels during construction and operation were predicted also at Sydney Dragway, although results were not compared against the impact assessment criteria from the Approved Methods noting that these are not intended to be used for the purpose of evaluating whether 'safe operations' may be affected. Project specific dust management criteria would be developed for Dragway based on dust monitoring, with the construction contractor and Sydney International Speedway operator required to limit dust deposition on Dragway within agreed levels.

Still, measures consistent with best practice are recommended to control emissions to air during both phases of the project. During construction this includes the use of water sprays during the loading and unloading of materials, regular watering of haulage routes, exposed areas and stockpiles, and the scaling of activities in response to adverse meteorological and background air quality conditions.

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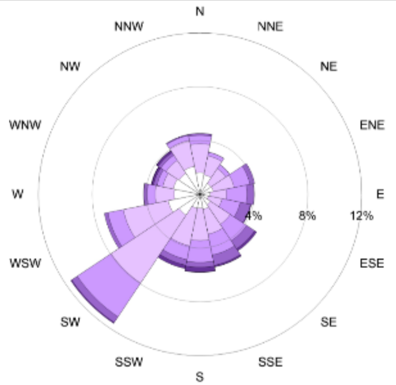
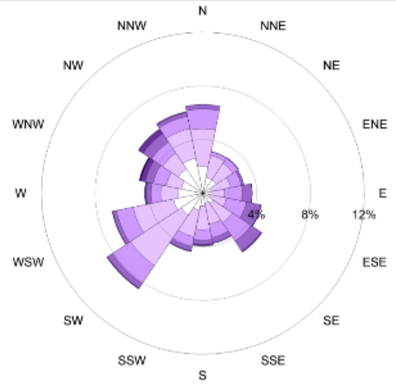
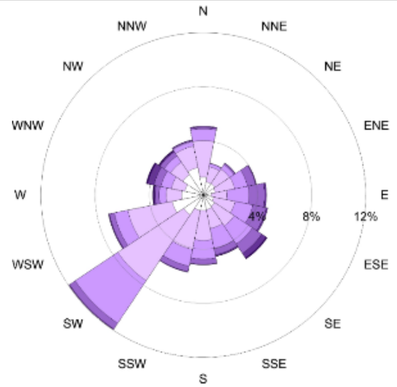
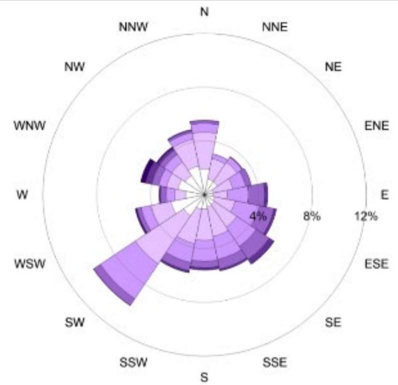
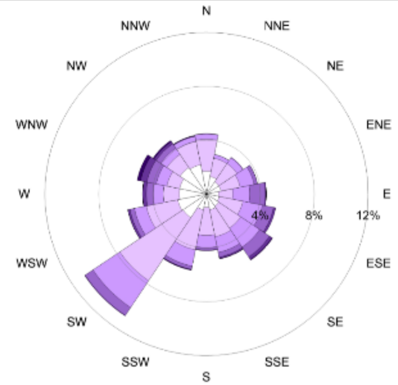
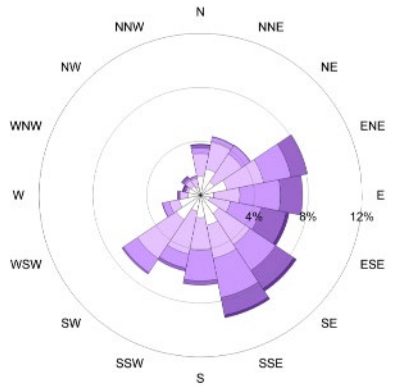
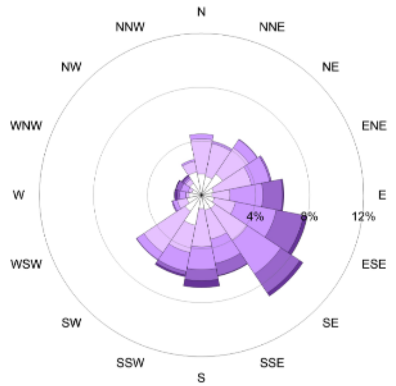
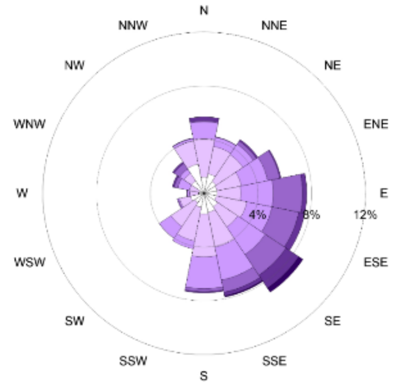
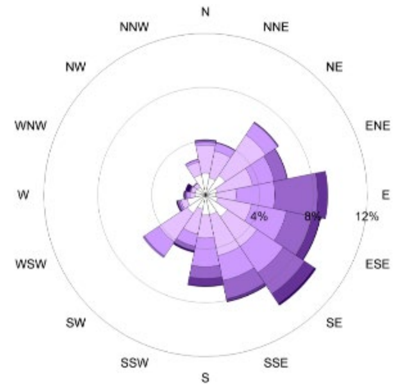
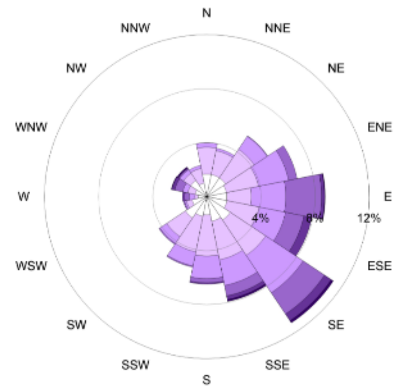
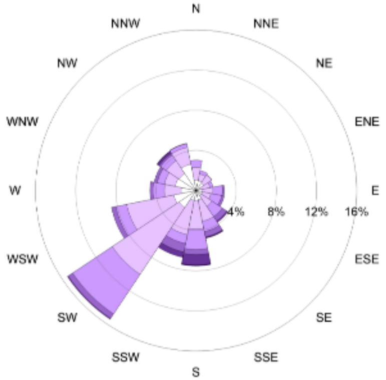
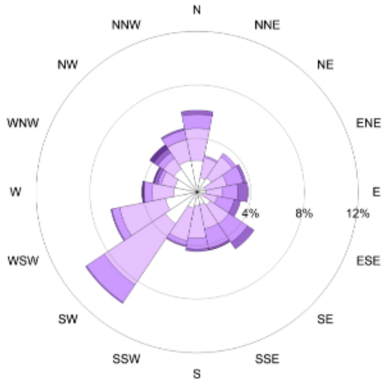
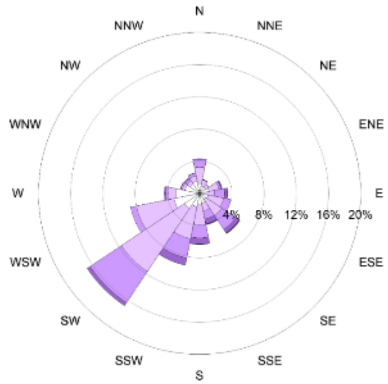
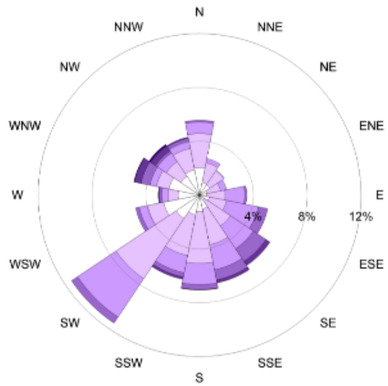
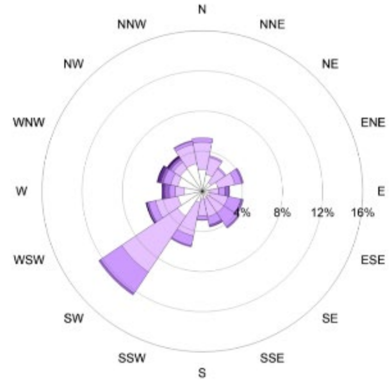
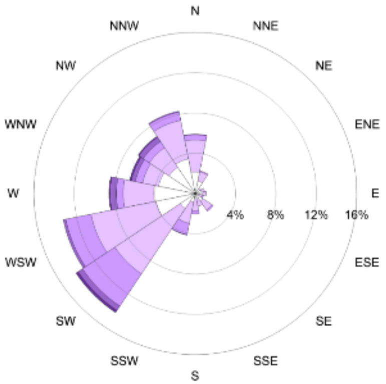
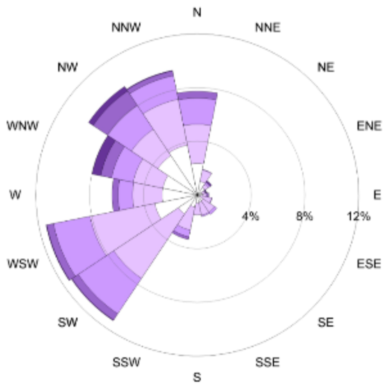
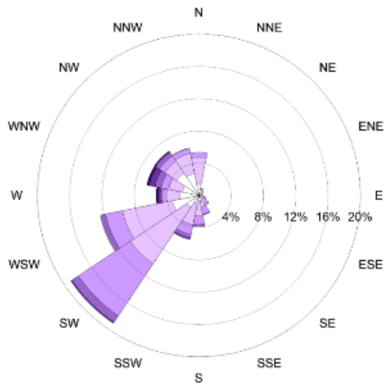
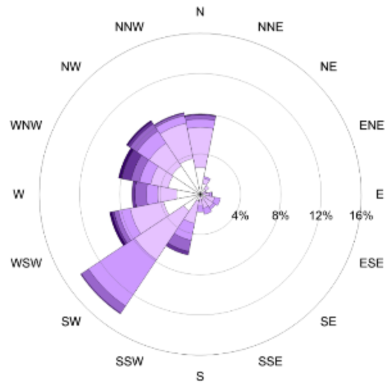
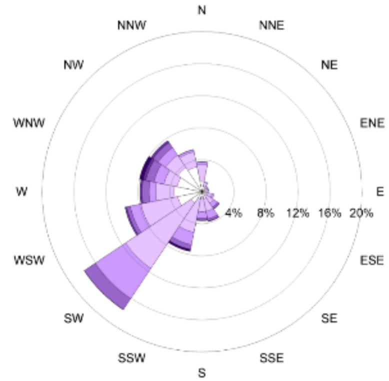
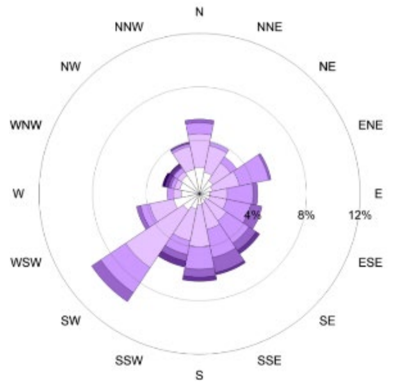
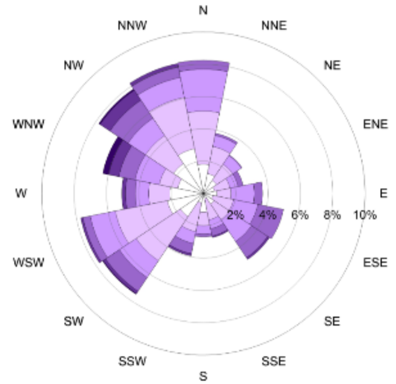
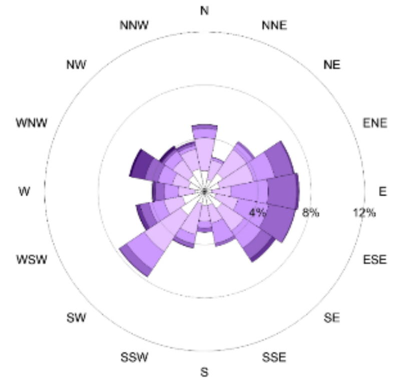
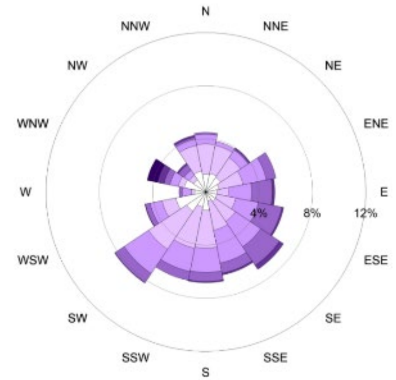
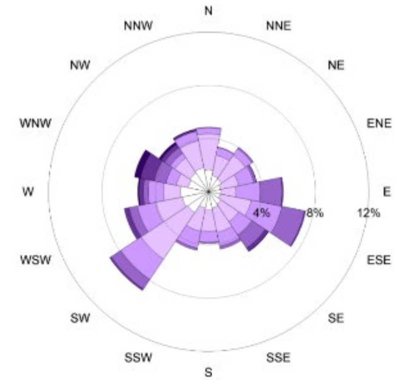
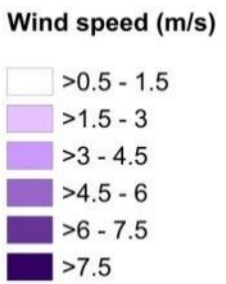
Appendix A. Annual and seasonal wind roses, BoM Horsley park and DPIE Prospect

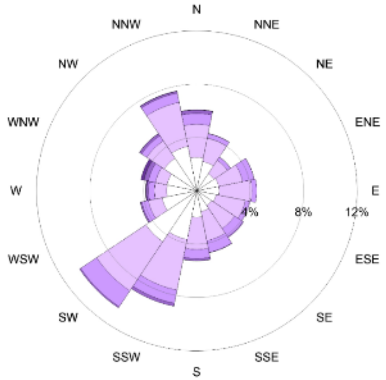
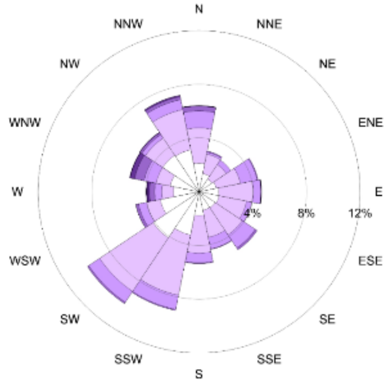
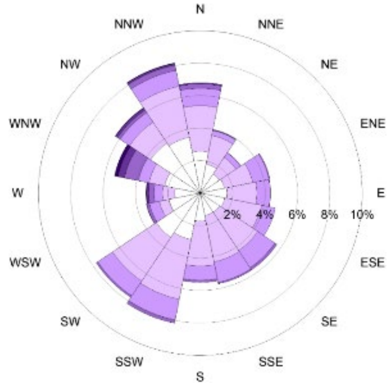
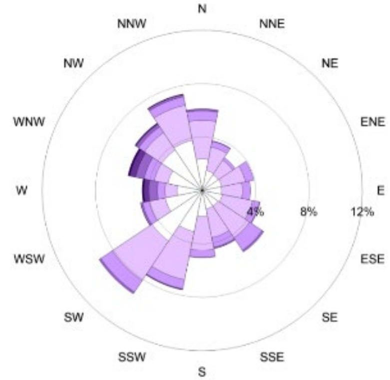
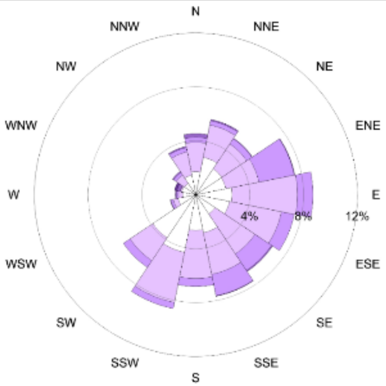
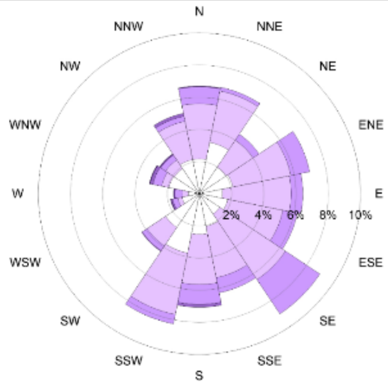
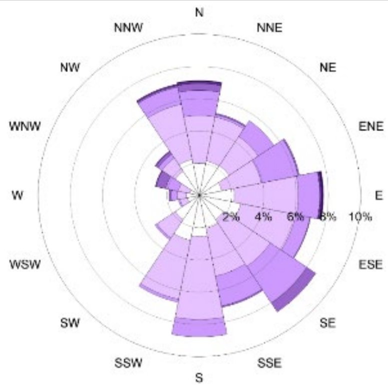
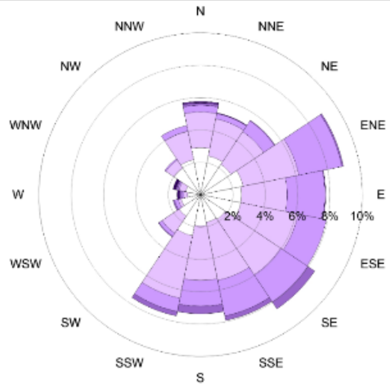
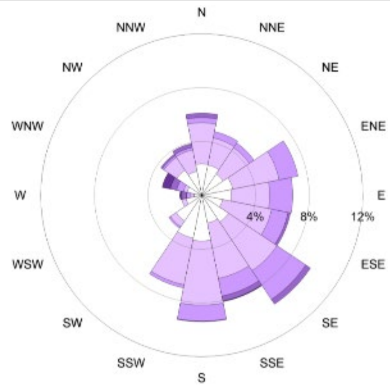
Annual and seasonal wind roses, BoM Horsley 2015 to 2019

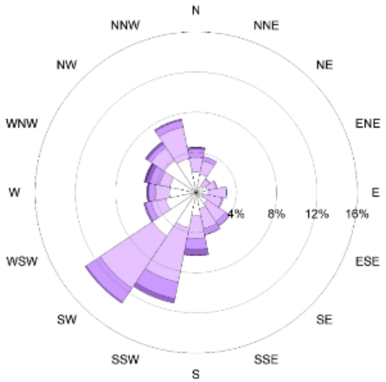
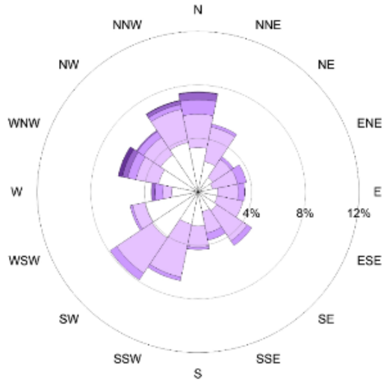
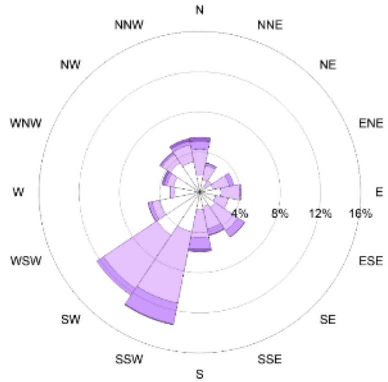
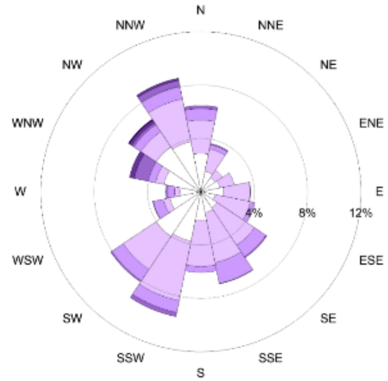
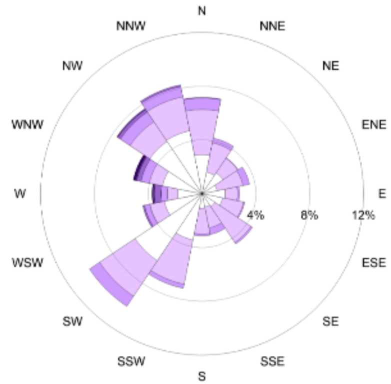
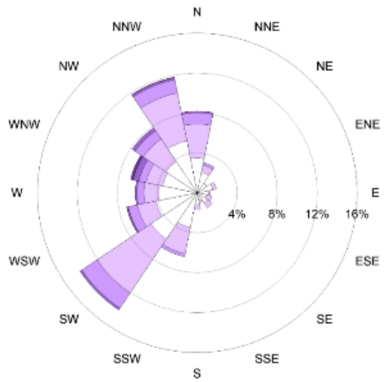
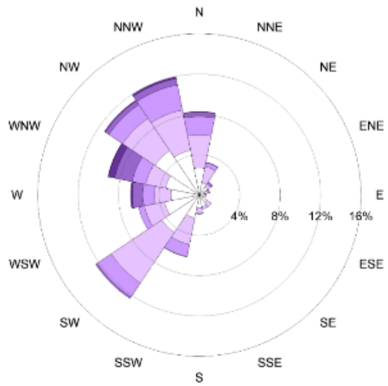
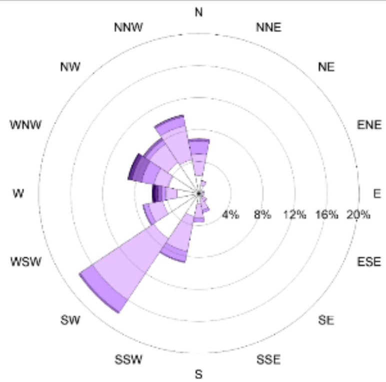
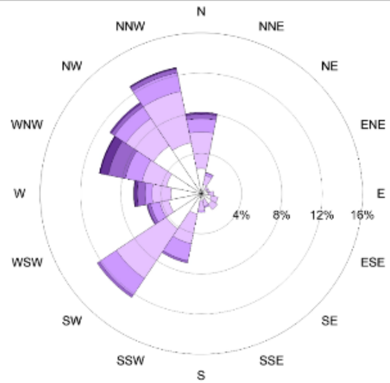
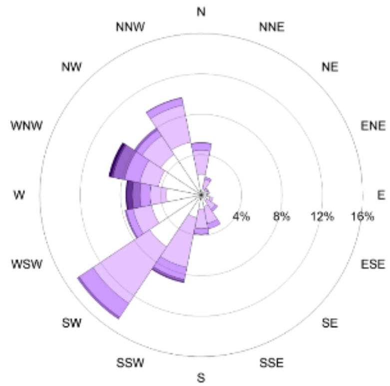
	2015	2016	2017	2018	2019
Annual	 Calms 20.4%	 Calms 21.6%	 Calms 18.9%	 Calms 17.7%	 Calms 18.8%
Summer	 Calms 18.4%	 Calms 22.2%	 Calms 18.9%	 Calms 17.5%	 Calms 17.0%

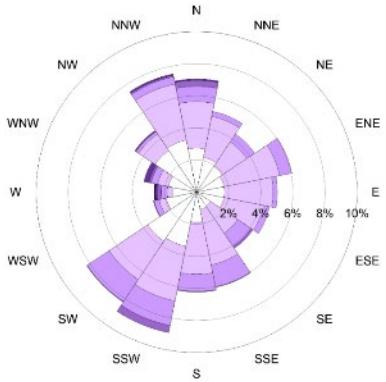
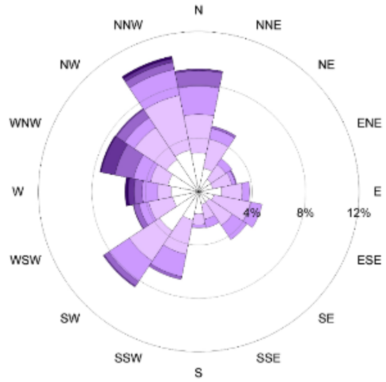
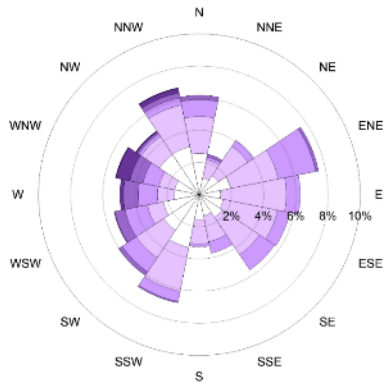
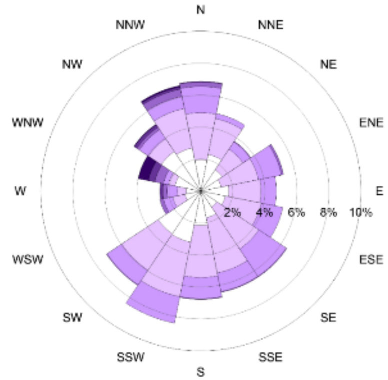
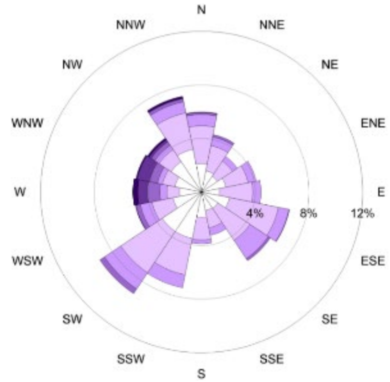
2015	2016	2017	2018	2019
Autumn				
 Calms 20.3%	 Calms 25.5%	 Calms 19.5%	 Calms 19.1%	 Calms 24.4%
Winter				
 Calms 20.6%	 Calms 21.9%	 Calms 21.6%	 Calms 17.8%	 Calms 16.6%

2015	2016	2017	2018	2019
Spring				
 Calms 22.4%	 Calms 16.9%	 Calms 18.1%	 Calms 17.8%	 Calms 17.1%
Legend				
				

Annual and seasonal wind roses, DPIE Prospect 2015 to 2019

2015	2016	2017	2018	2019
Annual				
 Calms 14.4%	 Calms 14.4%	 Calms 13.8%	 Calms 13.4%	 Calms 14.9%
Summer				
 Calms 13.8%	 Calms 12.9%	 Calms 10.1%	 Calms 12.4%	 Calms 12.6%

2015	2016	2017	2018	2019
Autumn				
 Calms 14.1%	 Calms 18.9%	 Calms 15.7%	 Calms 13.8%	 Calms 18.5%
Winter				
 Calms 17.8%	 Calms 15.7%	 Calms 14.4%	 Calms 14.1%	 Calms 14.2%

2015	2016	2017	2018	2019
Spring				
				
Calms 13.2%	Calms 10.2%	Calms 14.9%	Calms 13.1%	Calms 14.2%
Legend				

Wind speed (m/s)

- >0.5 - 1.5
- >1.5 - 3
- >3 - 4.5
- >4.5 - 6
- >6 - 7.5
- >7.5

Appendix B. Emissions calculations (construction)

Emission calculations												
Sydney Speedway - Construction												
	Annual emissions (kg/y)						TSP		PM10		PM2.5	
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units
Stage 1 - Clearing and stripping Dozer	1159	245	58	0	195	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v
Stage 1 - Earthworks Dozer	3478	736	174	0	585	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v
Stage 1 - Earthworks Scraper	2881	725	144	0	99360	t/y	0.029	kg/t	0.0073	kg/t	0.00145	kg/t
Stage 1 - Earthworks Grader	556	249	28	0	2925	VKT/y	0.19007	kg/VKT	0.085	kg/VKT	0.0095	kg/VKT
Stage 1 - Earthworks Excavator loading trucks	328	155	16	0	613000	t/y	0.00053	kg/t	0.00025	kg/t	0.00003	kg/t
Stage 1 - Earthworks Trucks unloading to stockpiles	652	234	33	70	181137	t/y	0.01200	kg/t	0.0043	kg/t	0.00060	kg/t
Stage 1 - Earthworks Haulage, unsealed	8109	2393	243	75	7663	VKT/y	4.23311	kg/VKT	1.24945	kg/VKT	0.127	kg/VKT
Stage 1 - Earthworks Haulage, sealed	2177	418	101	75	7663	VKT/y	1.14	kg/VKT	0.22	kg/VKT	0.05	kg/VKT
Stage 2 - Earthworks Dozer	583	123	29	0	98	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v
Stage 2 - Earthworks Grader	140	62	7	0	735	h/y	0.19007	kg/VKT	0.085	kg/VKT	0.0095	kg/VKT
Stage 2 - Earthworks Excavator loading trucks	24	11	1	0	44800	t/y	0.00053	kg/t	0.00025	kg/t	0.00003	kg/t
Stage 2 - Earthworks Trucks unloading to stockpiles	40	14	2	70	11236	t/y	0.01200	kg/t	0.0043	kg/t	0.00060	kg/t
Stage 2 - Earthworks Haulage, unsealed	593	175	18	75	560	VKT/y	4.23311	kg/VKT	1.24945	kg/VKT	0.127	kg/VKT
Stage 2 - Earthworks Haulage, sealed	159	31	7	75	560	VKT/y	1.14	kg/VKT	0.22	kg/VKT	0.05	kg/VKT
Stage 3 - Earthworks Dozer	559	118	28	0	94	h/y	5.94462	kg/h/v	1.25893	kg/h/v	0.29723	kg/h/v
Stage 3 - Earthworks Grader	134	60	7	0	705	h/y	0.19007	kg/VKT	0.085	kg/VKT	0.0095	kg/VKT
Stage 3 - Earthworks Excavator loading trucks	18	8	1	0	32800	t/y	0.00053	kg/t	0.00025	kg/t	0.00003	kg/t
Stage 3 - Earthworks Trucks unloading to stockpiles	30	11	1	70	8227	t/y	0.01200	kg/t	0.0043	kg/t	0.00060	kg/t
Stage 3 - Earthworks Haulage, unsealed	434	128	13	75	410	VKT/y	4.23311	kg/VKT	1.24945	kg/VKT	0.127	kg/VKT
Stage 3 - Earthworks Haulage, sealed	117	22	5	75	410	VKT/y	1.14	kg/VKT	0.22	kg/VKT	0.05	kg/VKT
Wind erosion exposed areas	7118	3559	356	50	18.2	ha	782.229	kg/ha/y	391.114	kg/ha/y	39.1114	kg/ha/y
Wind erosion stockpiles	978	489	49	50	2.5	ha	782.229	kg/ha/y	391.114	kg/ha/y	39.1114	kg/ha/y
kg/yr	**30265**	**9969**	**1322**									

Emission calculations

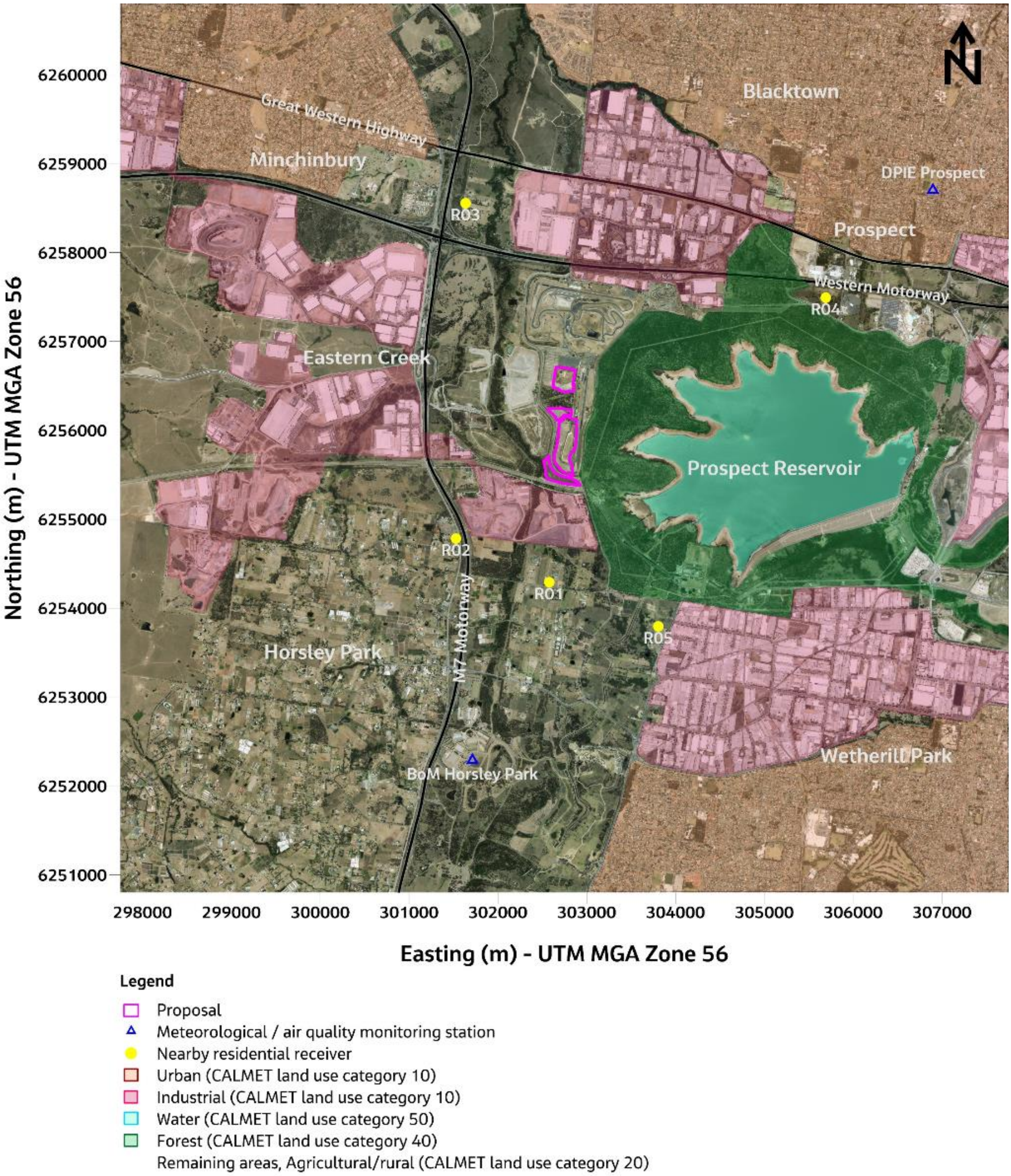
Sydney Speedway - Construction

Activity	Variables: (ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	Speed (km/h)	Density overburden (t/m3)	Density topsoil (t/m3)	Depth topsoil (m)	t/truck	km/trip	Silt load (g/m2)	Silt (%)	Speed (km/h)	wind speed > 5.4 m/s (%)	days >0.25 mm rain (no.)	Reference
Stage 1 - Clearing and stripping Dozer	-	3.4	-	-	-	-	-	-	-	-	-	7.5	-	-	-	EETM Mining (2012), Section 1.1.5
Stage 1 - Earthworks Dozer	-	3.4	-	-	-	-	-	-	-	-	-	7.5	-	-	-	EETM Mining (2012), Section 1.1.5
Stage 1 - Earthworks Scraper	-	-	-	-	-	-	1.6	0.3	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.13
Stage 1 - Earthworks Grader	-	-			5	-	-	-	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.14
Stage 1 - Earthworks Excavator loading trucks	0.95	3.4	-	-	-	2	-	-	-	-	-	-	-	-	-	EETM Mining (2012), Section 1.1.2
Stage 1 - Earthworks Trucks unloading to stockpiles	-	-	-	-	-	-	-	-	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.6
Stage 1 - Earthworks Haulage, unsealed	-	-	-	-	-	-	-	-	48	0.6	-	10	-	-	-	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1
Stage 1 - Earthworks Haulage, sealed	-	-	-	-	-	-	-	-	48	0.6	8.2	-		-	-	EETM Mining (2012), AP42-13.2. 1-1; 3-1
Stage 2 - Earthworks Dozer	-	3.4	-	-	-	-	-	-	-	-	-	7.5	-	-	-	EETM Mining (2012), Section 1.1.5
Stage 2 - Earthworks Grader	-	-			5	-	-	-	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.14
Stage 2 - Earthworks Excavator loading trucks	0.95	3.4	-	-	-	2	-	-	-	-	-	-	-	-	-	EETM Mining (2012), Section 1.1.2
Stage 2 - Earthworks Trucks unloading to stockpiles	-	-	-	-	-	-	-	-	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.6
Stage 2 - Earthworks Haulage, unsealed	-	-	-	-	-	-	-	-	48	0.6	-	10	-	-	-	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1
Stage 2 - Earthworks Haulage, sealed	-	-	-	-	-	-	-	-	48	0.6	8.2	-		-	-	EETM Mining (2012), AP42-13.2. 1-1; 3-1
Stage 3 - Earthworks Dozer	-	3.4	-	-	-	-	-	-	-	-	-	7.5	-	-	-	EETM Mining (2012), Section 1.1.5
Stage 3 - Earthworks Grader	-	-			5	-	-	-	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.14
Stage 3 - Earthworks Excavator loading trucks	0.95	3.4	-	-	-	2	-	-	-	-	-	-	-	-	-	EETM Mining (2012), Section 1.1.2
Stage 3 - Earthworks Trucks unloading to stockpiles	-	-	-	-	-	-	-	-	-	-	-	-		-	-	EETM Mining (2012), Section 1.1.6
Stage 3 - Earthworks Haulage, unsealed	-	-	-	-	-	-	-	-	48	0.6	-	10	-	-	-	EETM Mining (2012), Section 1.1.11, AP42-13.2.2-1
Stage 3 - Earthworks Haulage, sealed	-	-	-	-	-	-	-	-	48	0.6	8.2	-		-	-	EETM Mining (2012), AP42-13.2. 1-1; 3-1
Wind erosion exposed areas	-	-	-	-	-	-	-	-	-	-	-	10		2.13	85	EETM Mining (2012), Section 1.1.18
Wind erosion stockpiles	-	-	-	-	-	-	-	-	-	-	-	10		2.13	85	EETM Mining (2012), Section 1.1.18

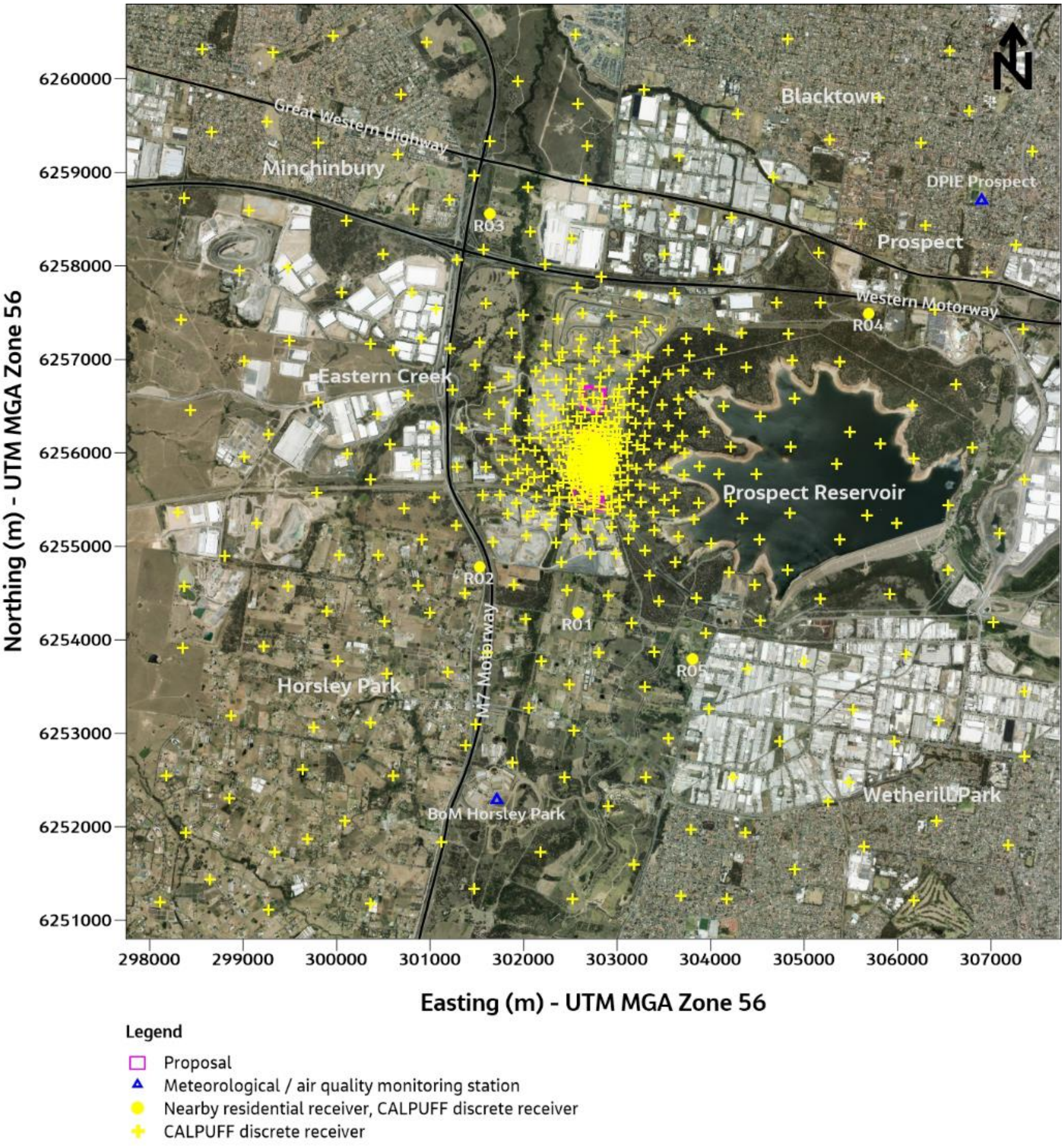
Where:

Silt content (%), dozers (AP-42, 13.2, Table 4-1); moisture content (%) (AP-42 13.2.4 Table 4-1); density topsoil (t/m3) and topsoil depth (m) (http://www.soilquality.org.au/au/nsw/examine/state/bulk-density-10-20); speed grader (km/hr) (Default value NPI, 2012); Wind speed variables (CALMET); density overburden (t/m3) (estimated); Haulage (tonnes per truck and silt content haulage roads default values, NPE, 2012); travel distance (km) (measured); silt load (g/m2) (AP-42 Chapter 13.2.1 Table 1-3, Quarry); precipitation (BoM).

Appendix C. CALMET land use classifications



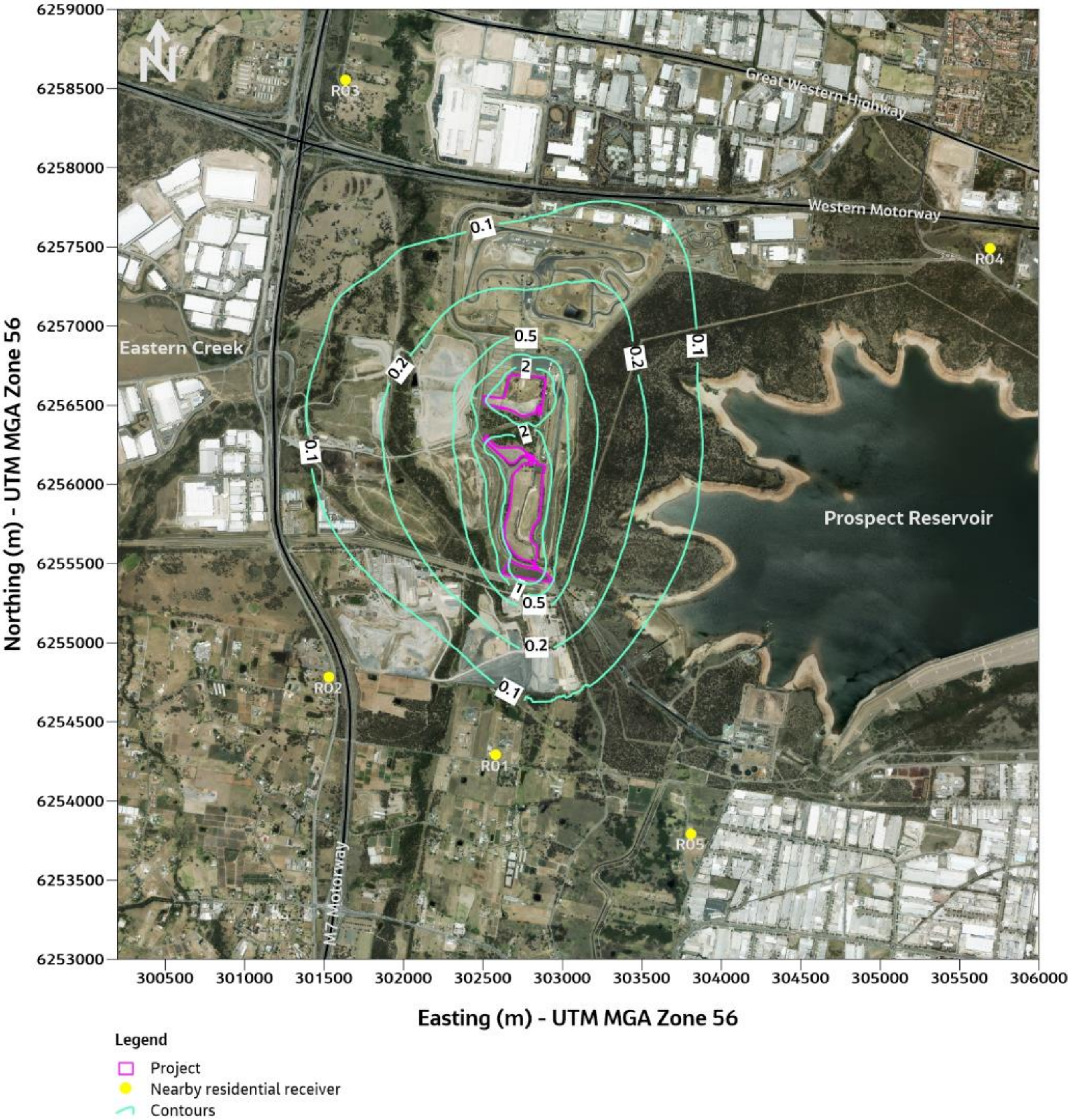
Appendix D. CALPUFF discrete receiver locations



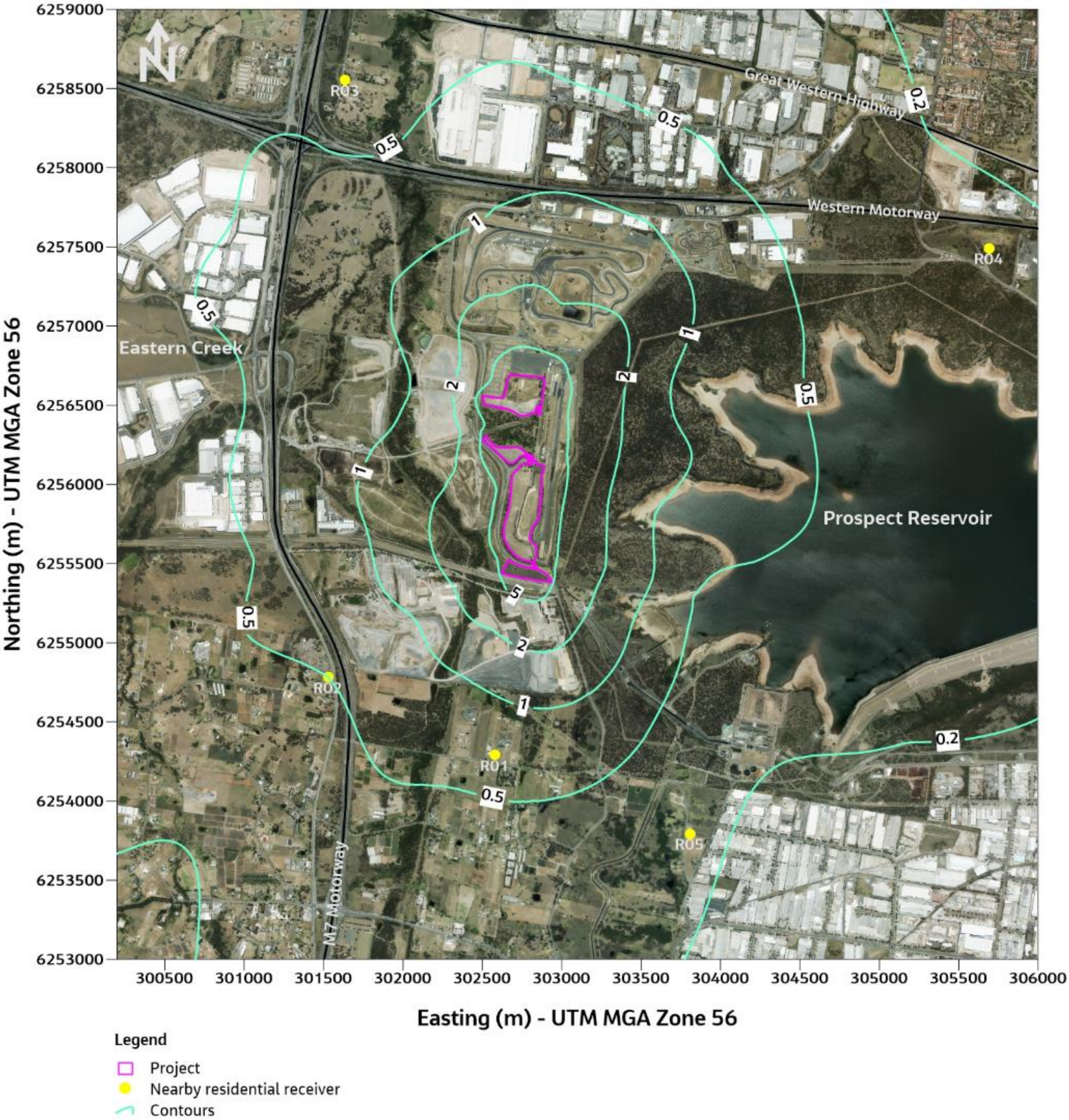
Appendix E. Incremental air quality contour plots

E.1 Construction, standard hours

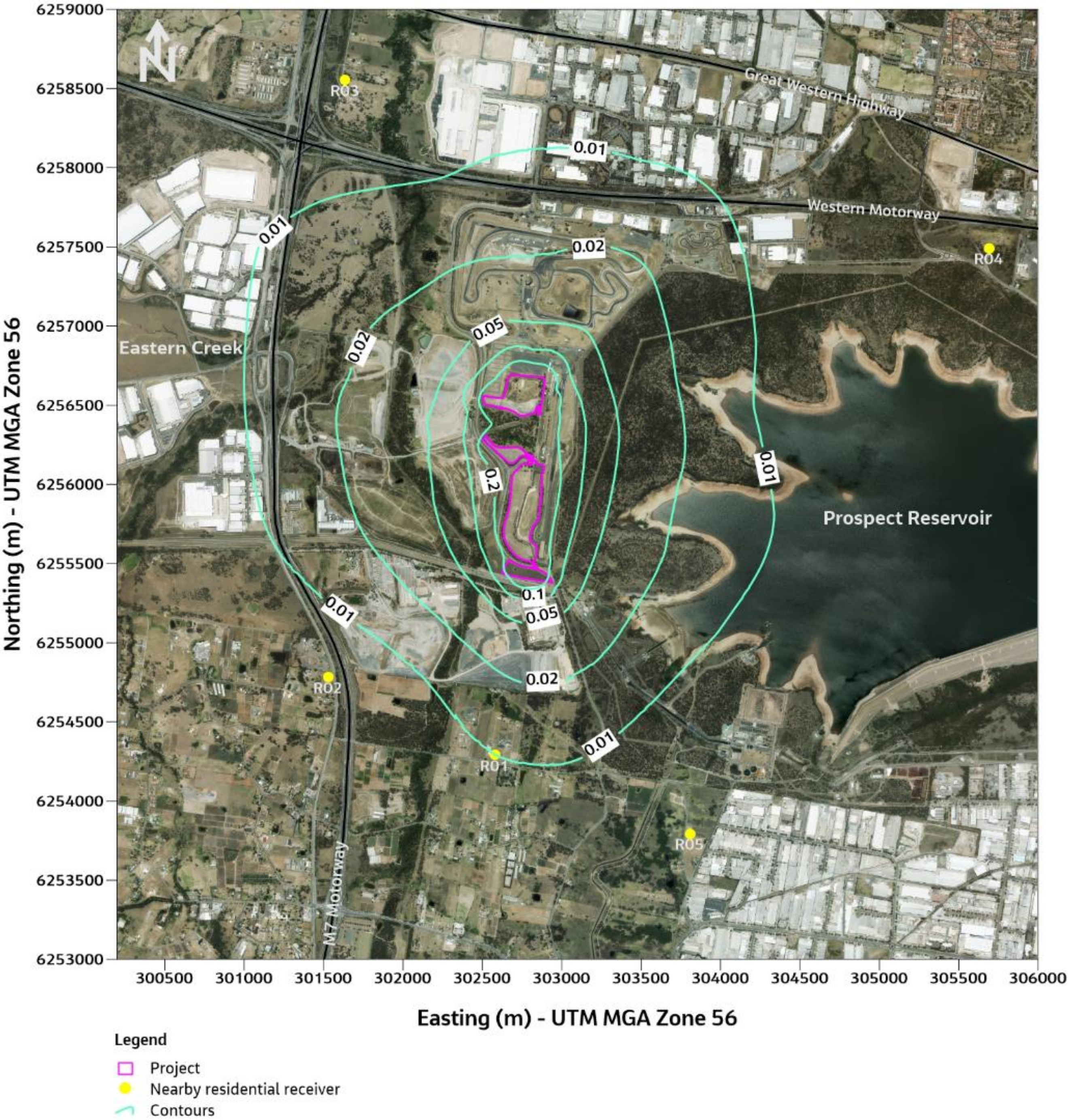
E.1.1 Annually averaged PM_{10} (µg/m^3)



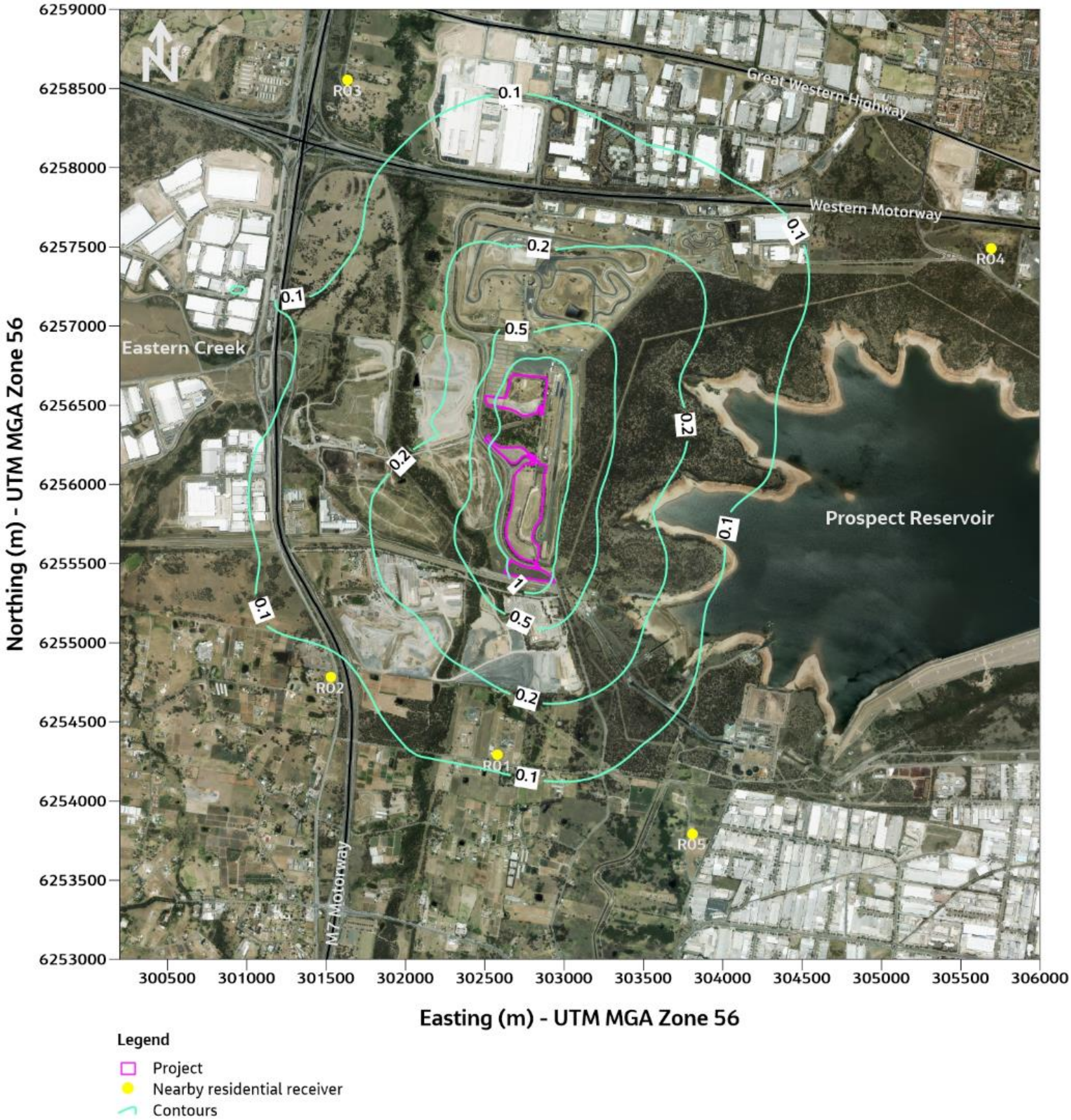
E.1.2 24-hour averaged PM_{10} (µg/m³)



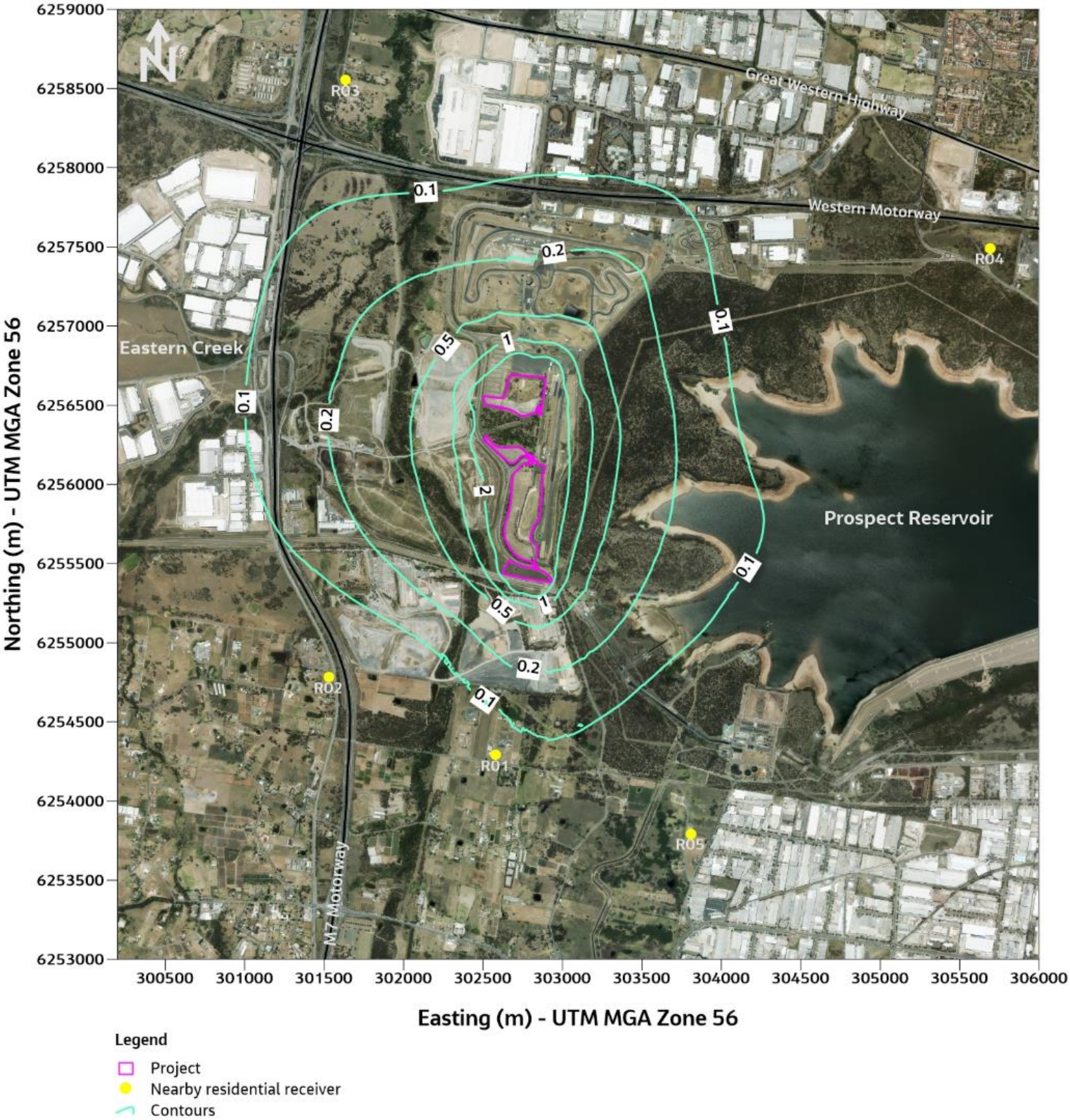
E.1.3 Annually averaged $PM_{2.5}$ ($\mu g/m^3$)



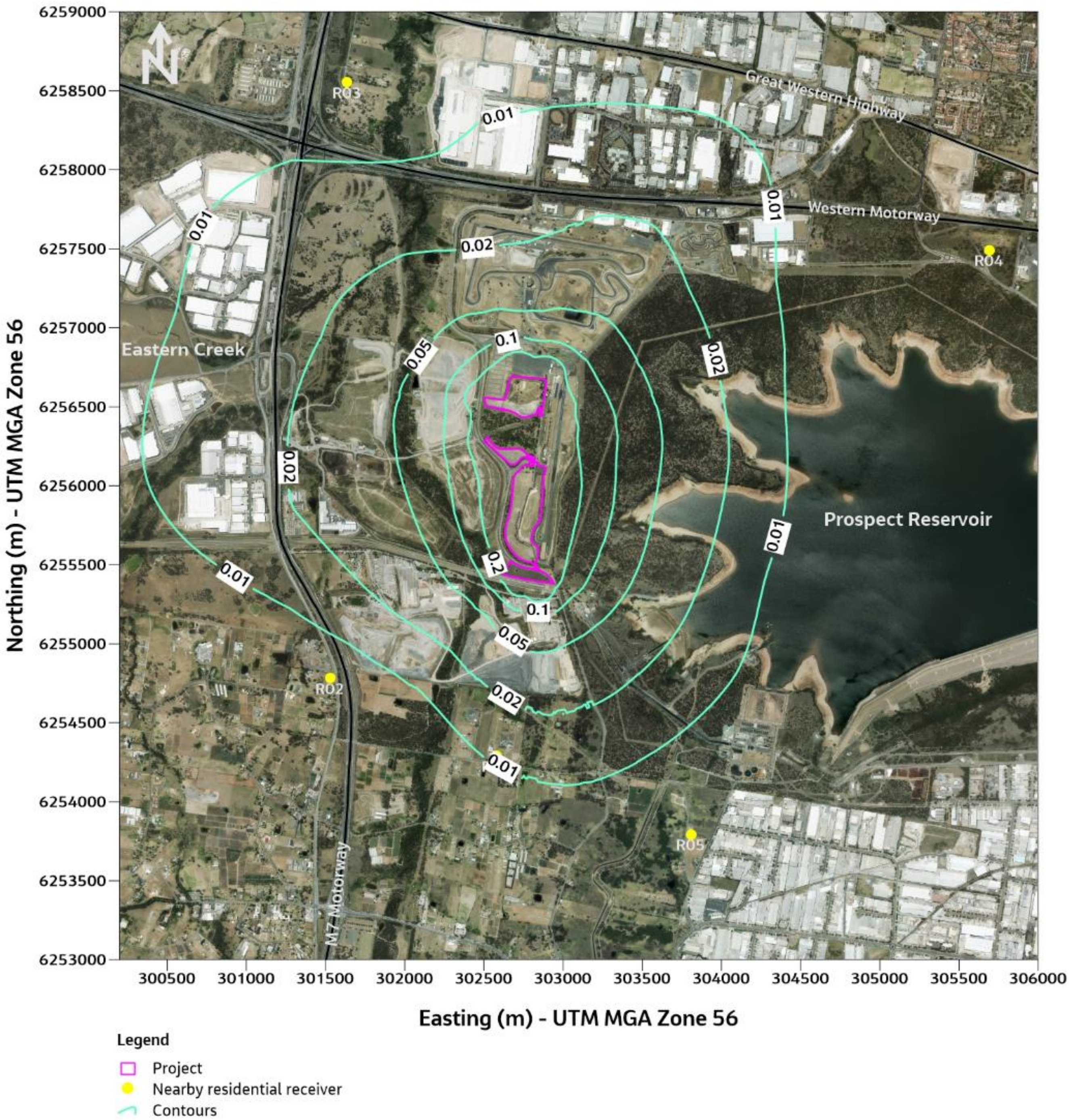
E.1.4 24-hour averaged $PM_{2.5}$ (µg/m³)



E.1.5 Annually averaged TSP (µg/m^3)

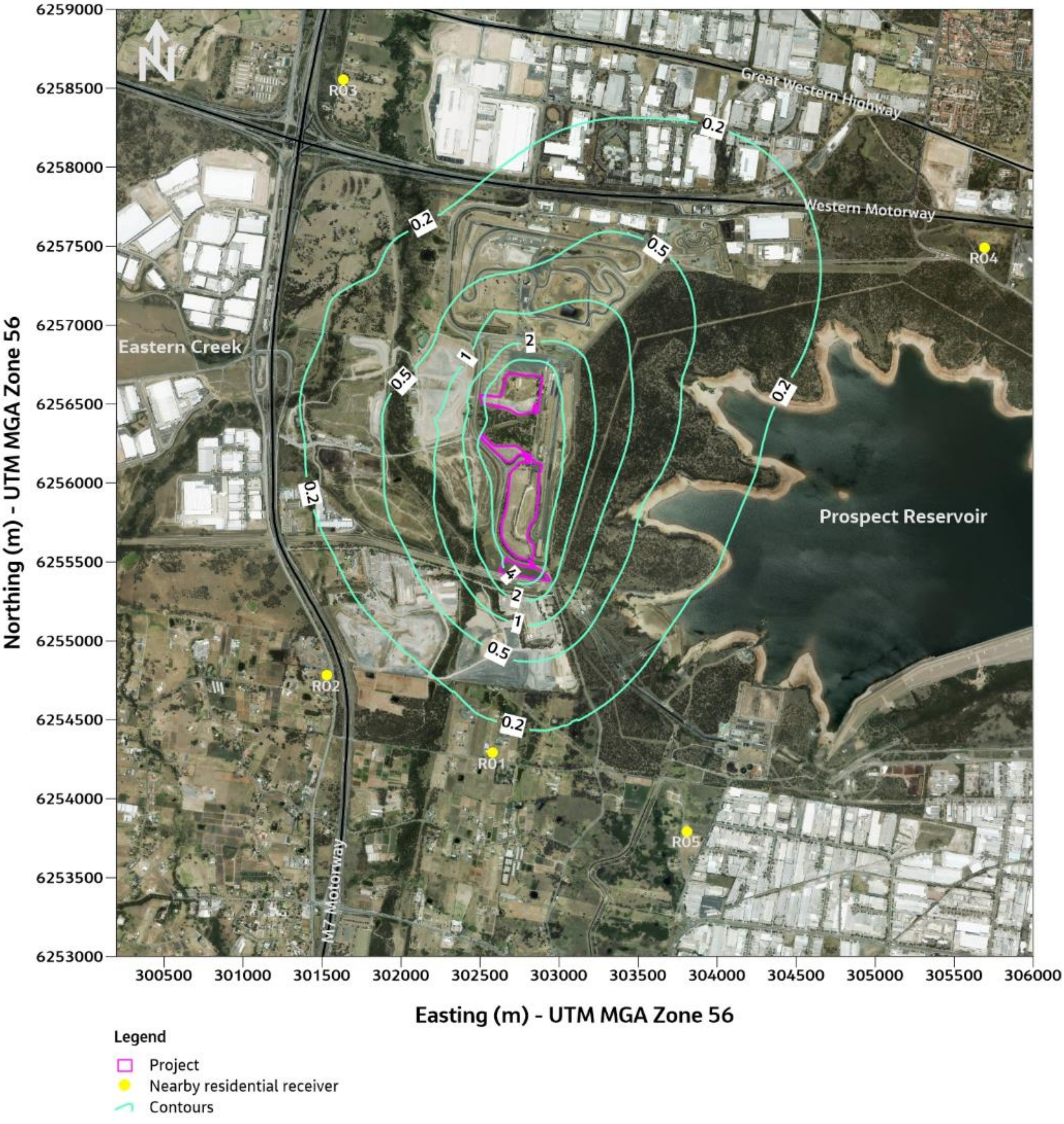


E.1.6 Deposited dust (g/m²/month)

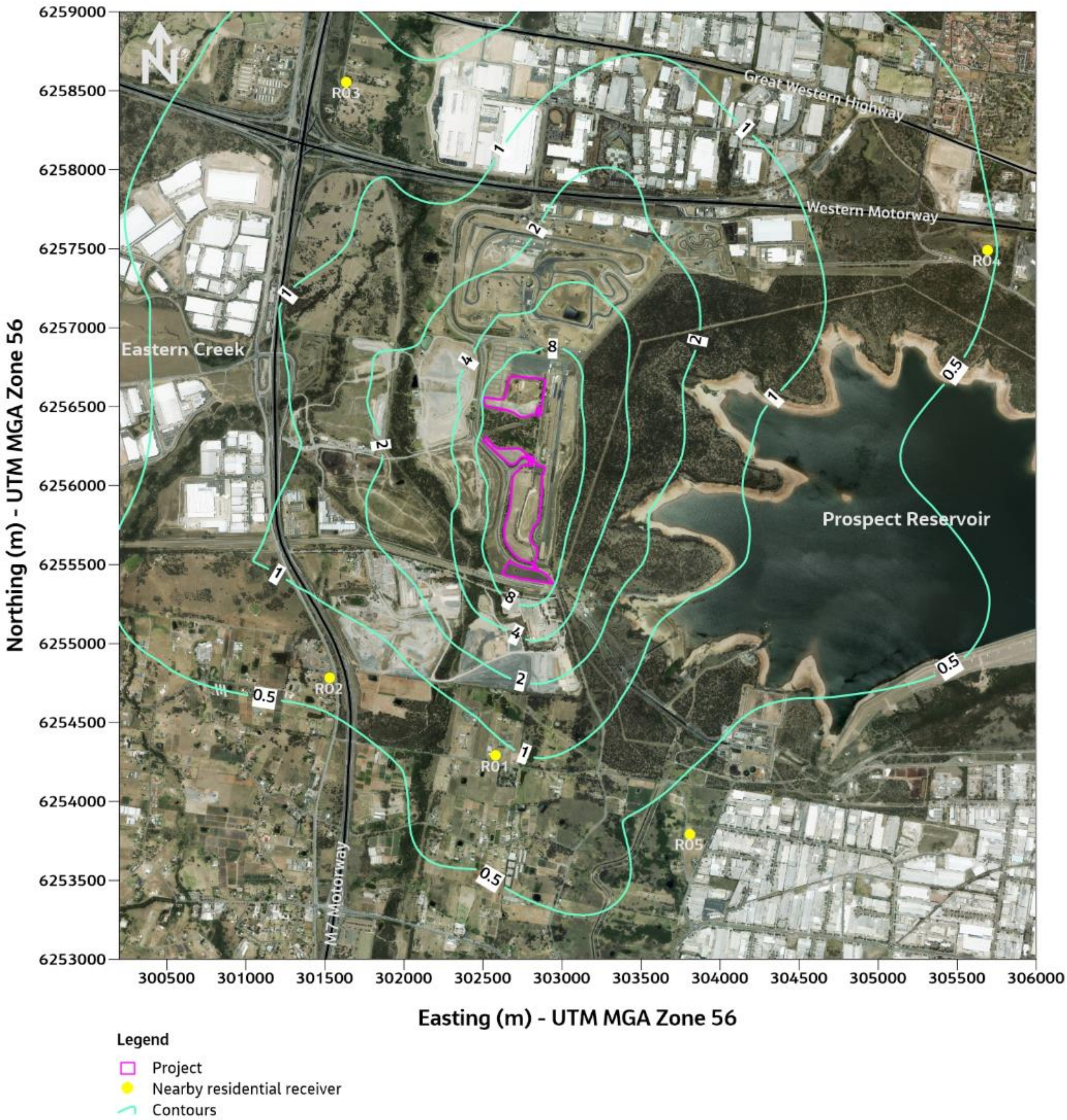


E.2 Construction, 24-hours

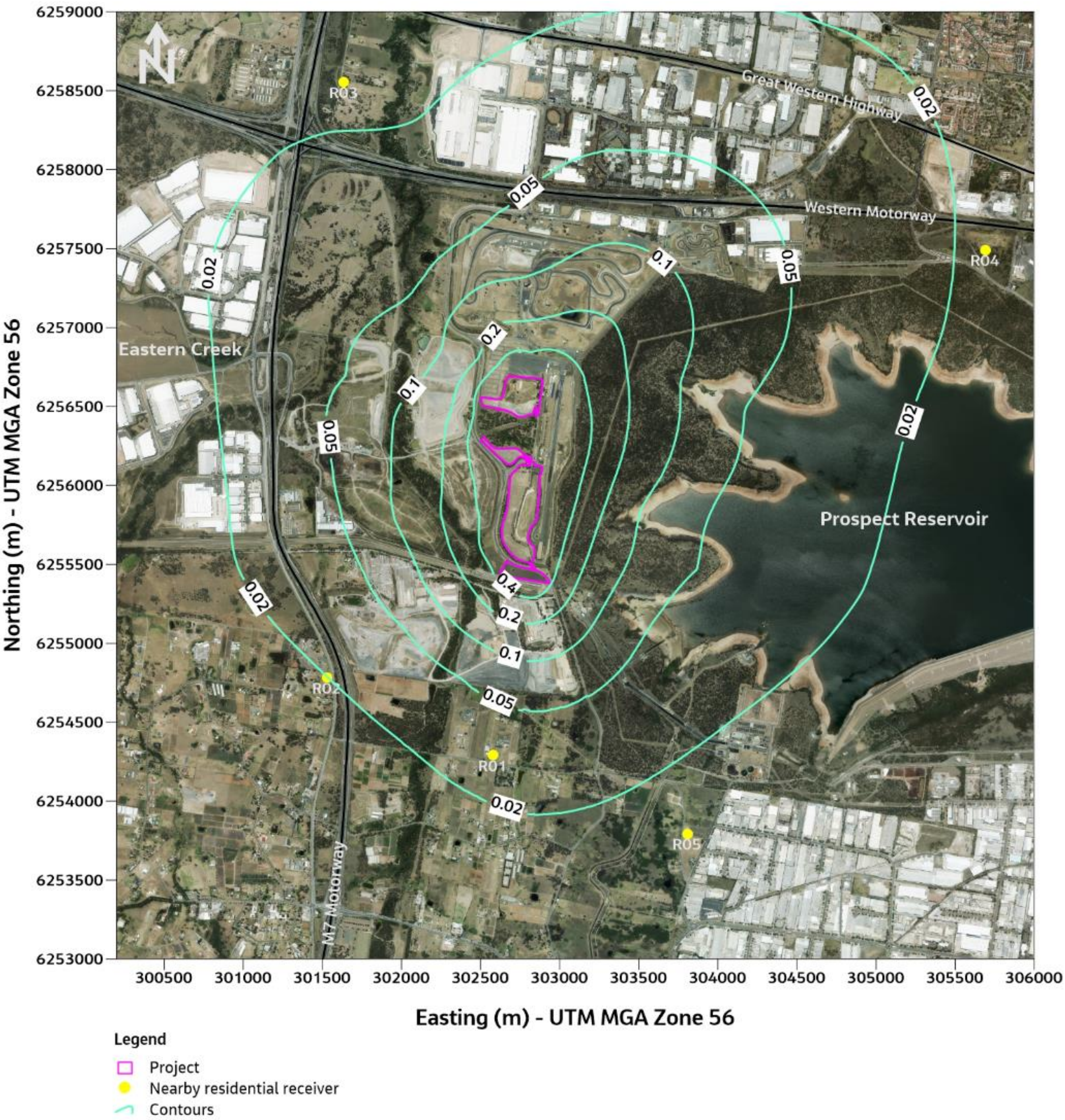
E.2.1 Annually averaged PM_{10} (μg/m^3)



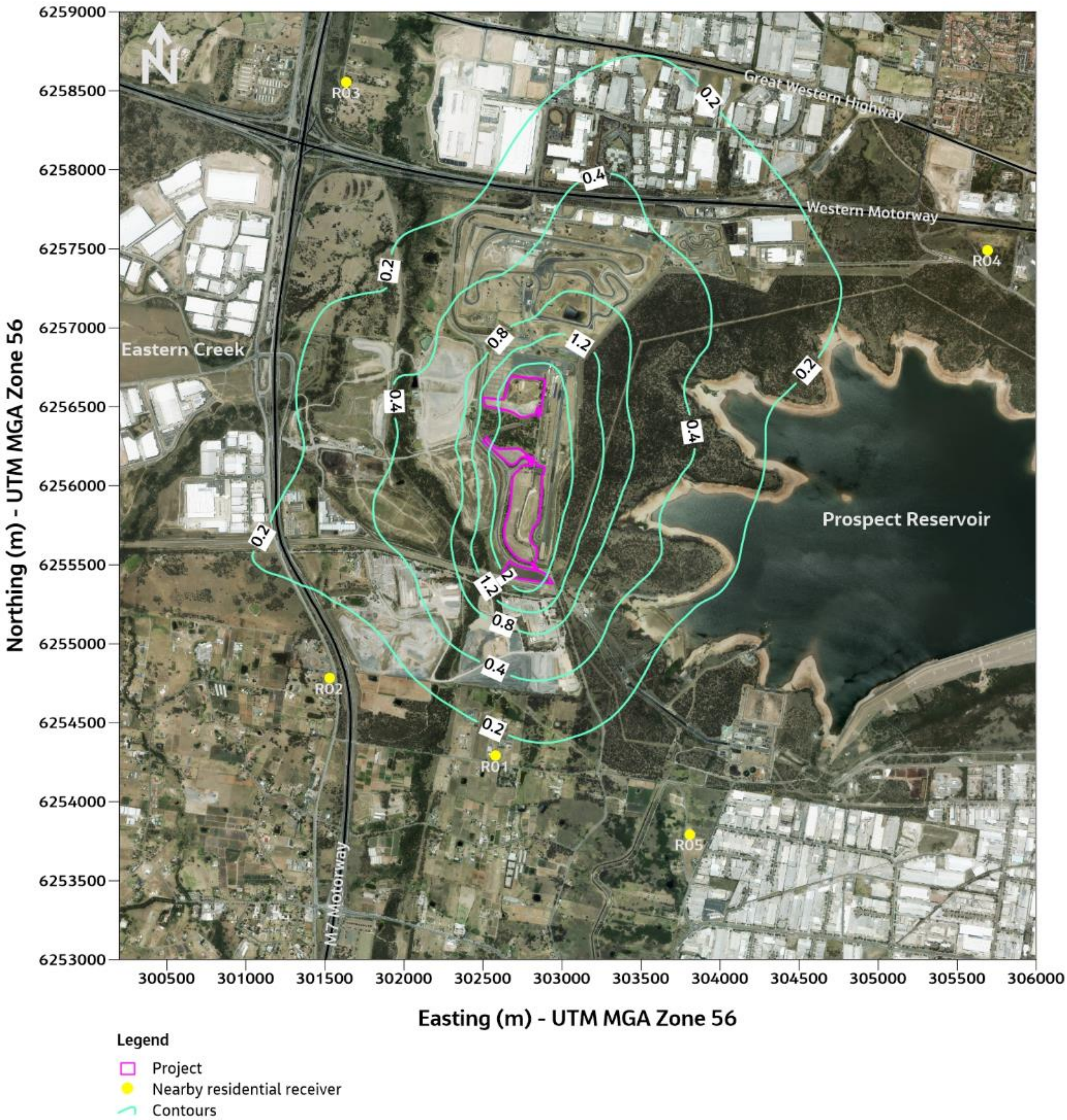
E.2.2 24-hour averaged PM_{10} (µg/m³)



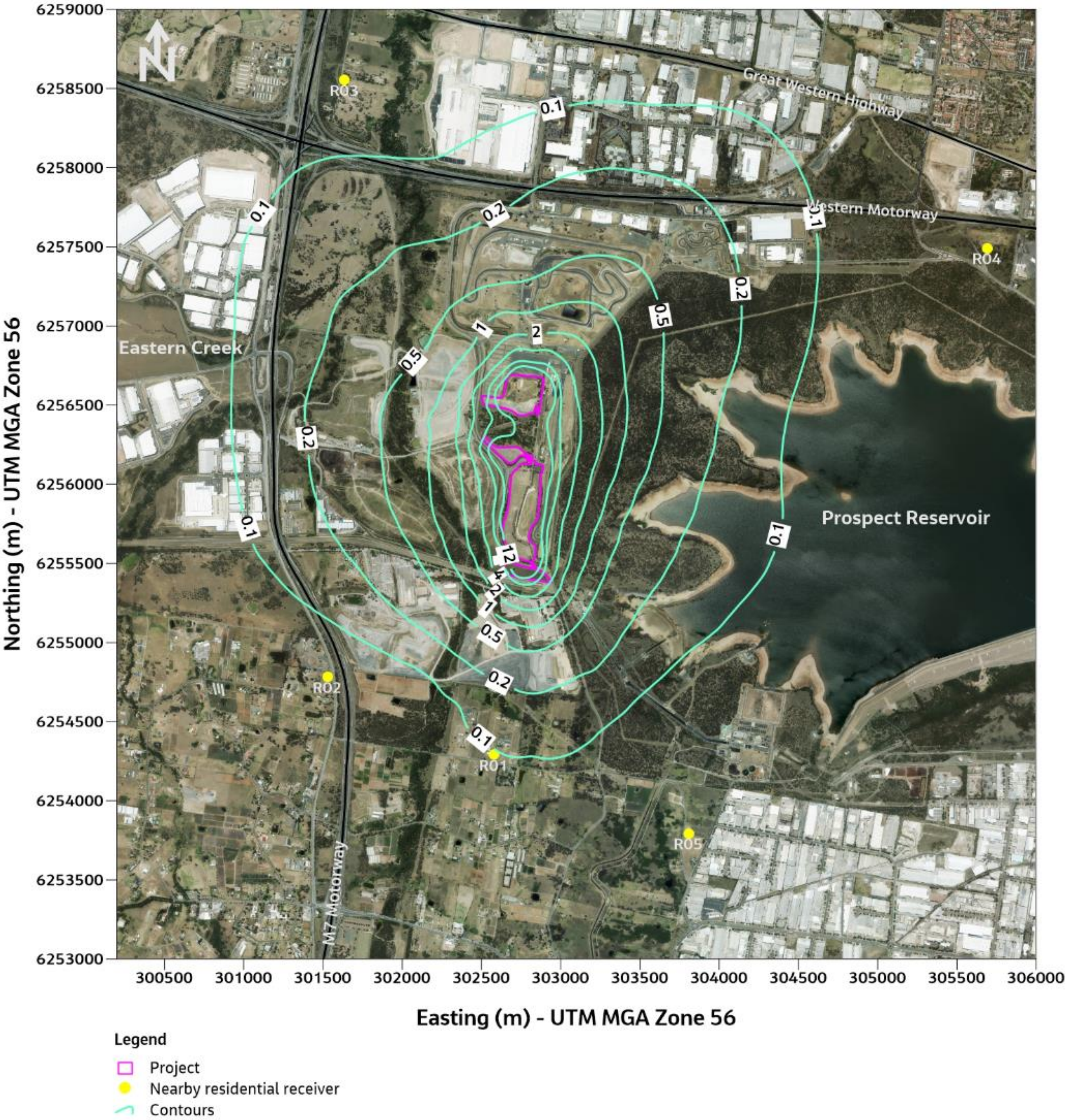
E.2.3 Annually averaged $PM_{2.5}$ ($\mu g/m^3$)



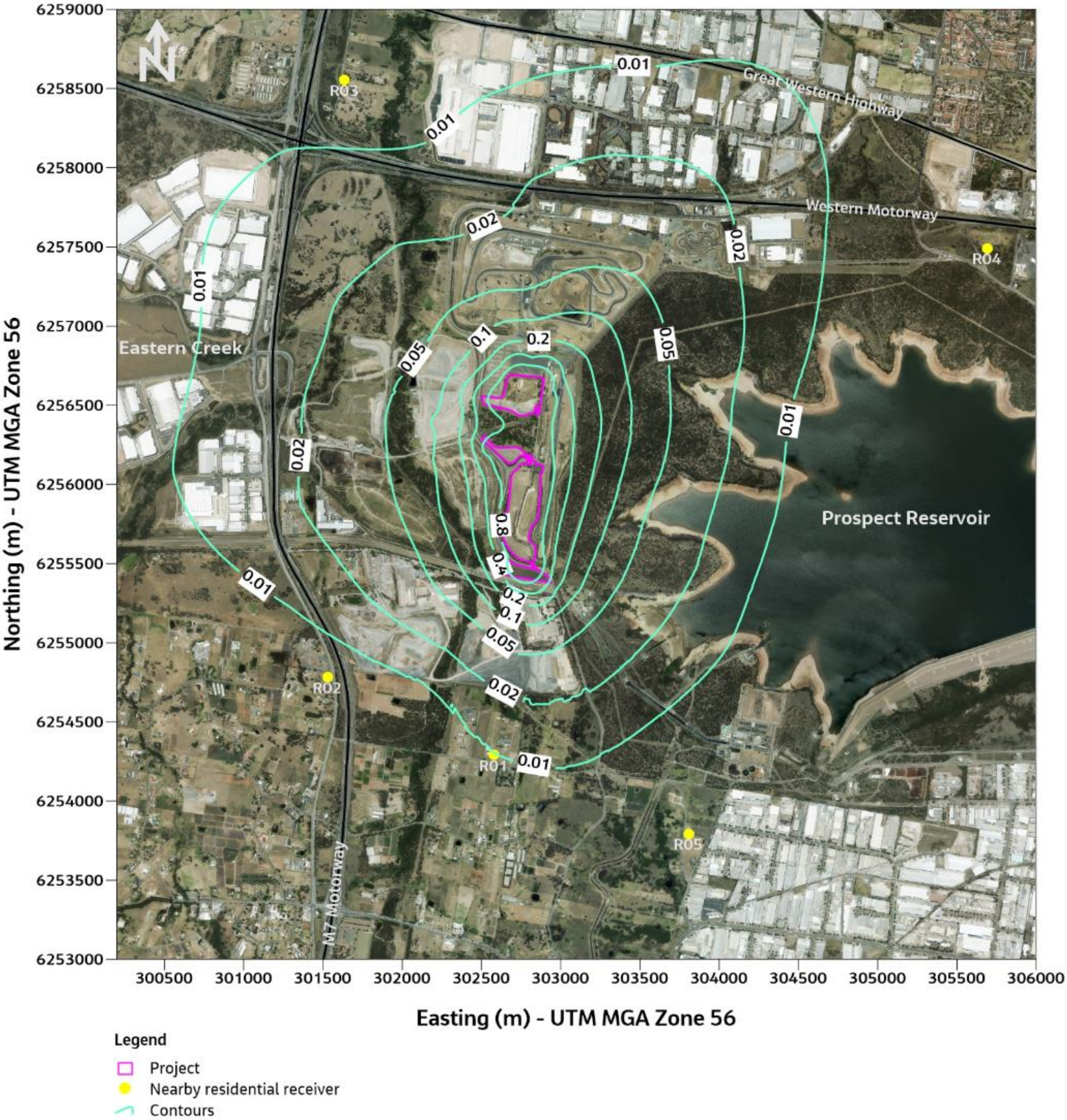
E.2.4 24-hour averaged $PM_{2.5}$ (µg/m³)



E.2.5 Annually averaged TSP (µg/m^3)

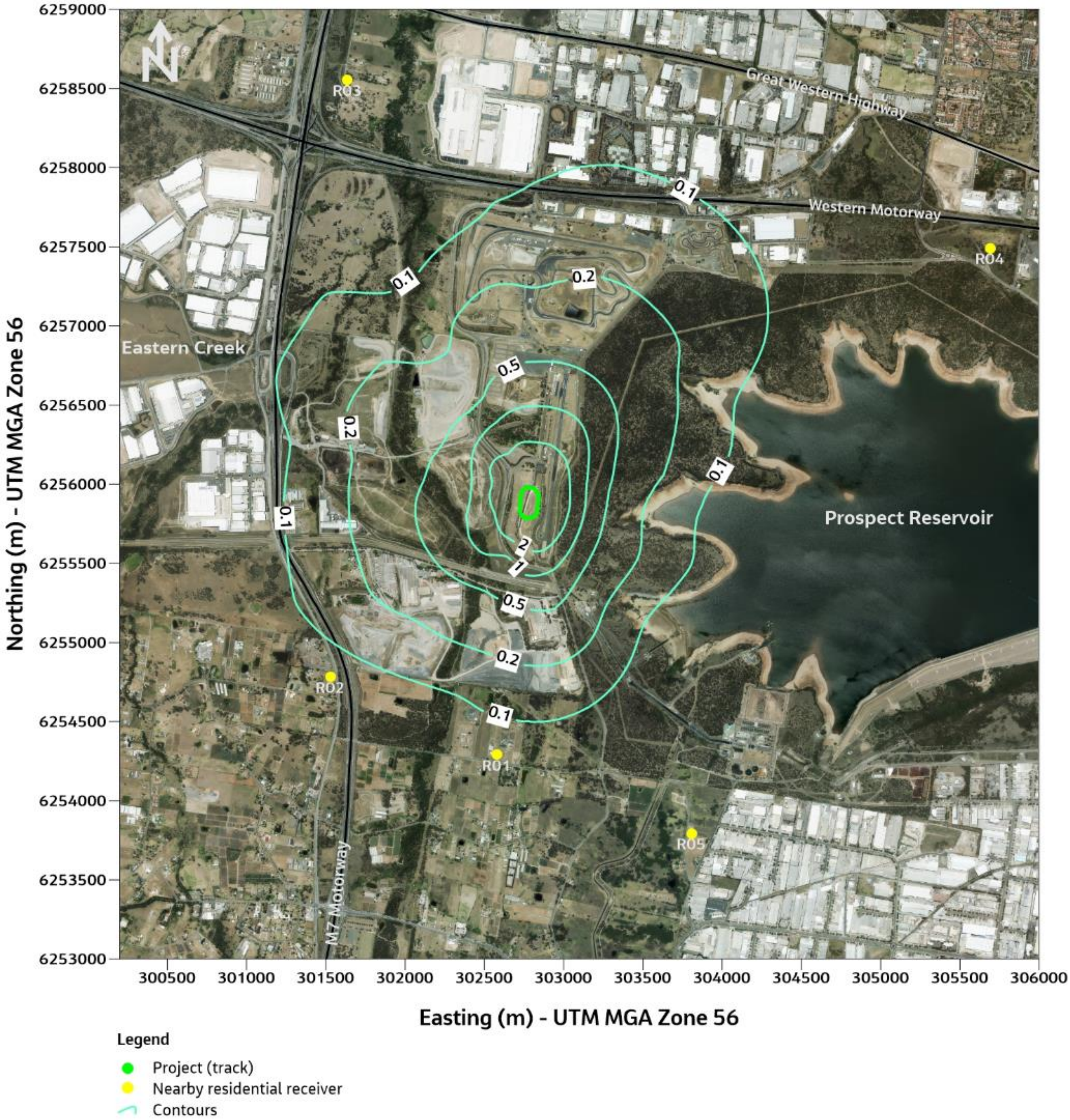


E.2.6 Deposited dust (g/m²/month)

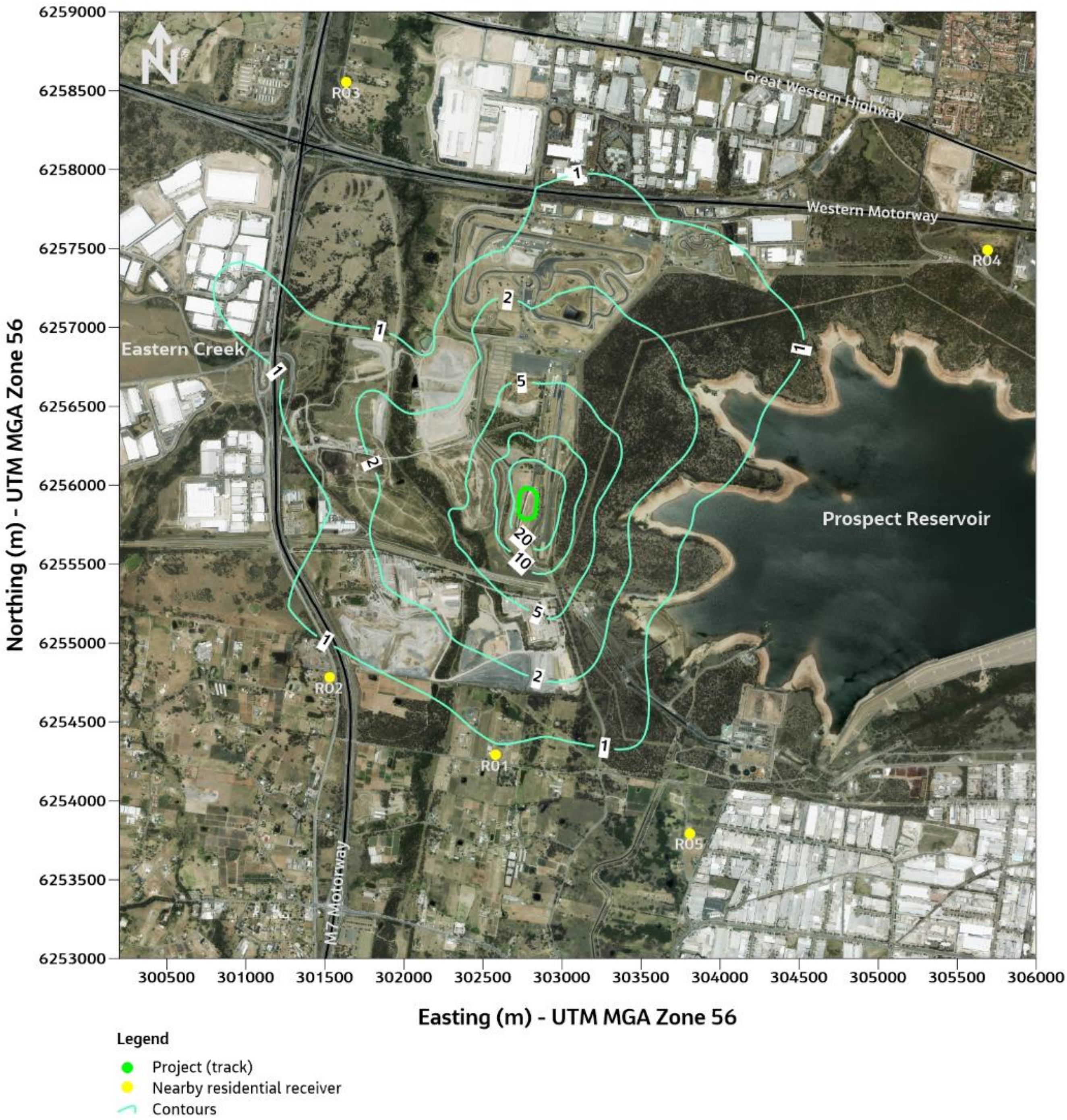


E.3 Operations

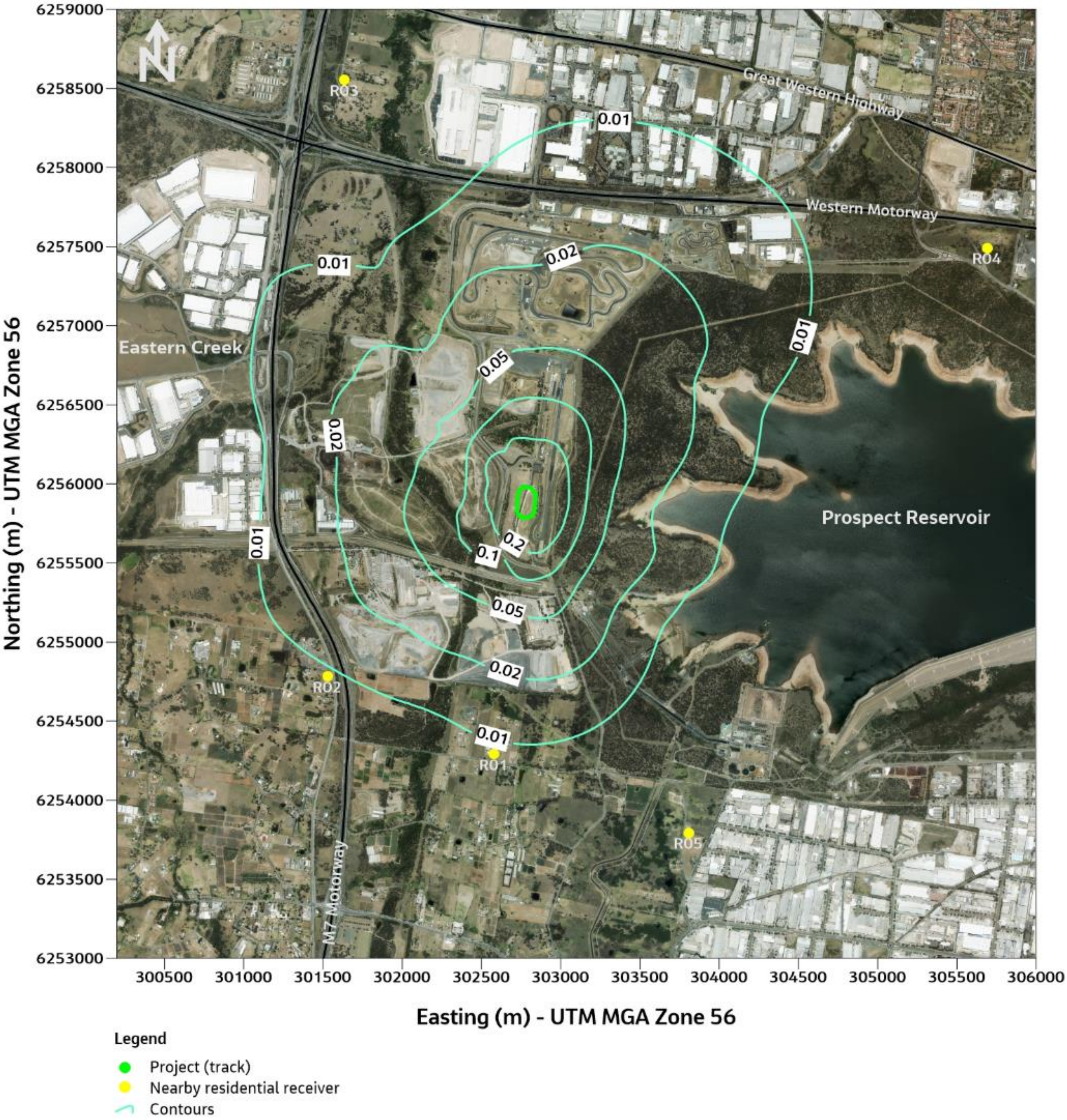
E.3.1 Annually averaged PM_{10} (µg/m^3)



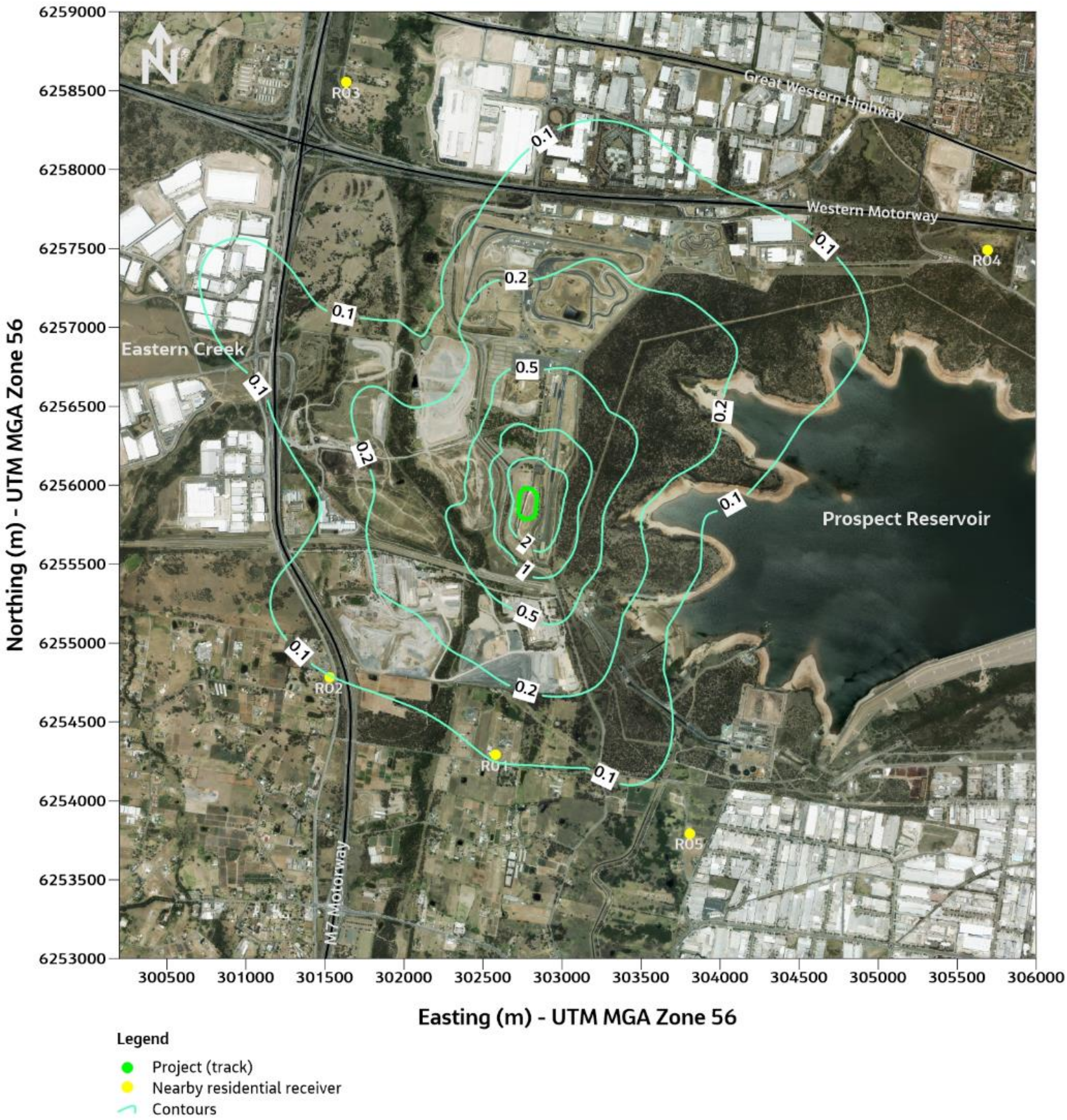
E.3.2 24-hour averaged PM_{10} ($\mu g/m^3$)



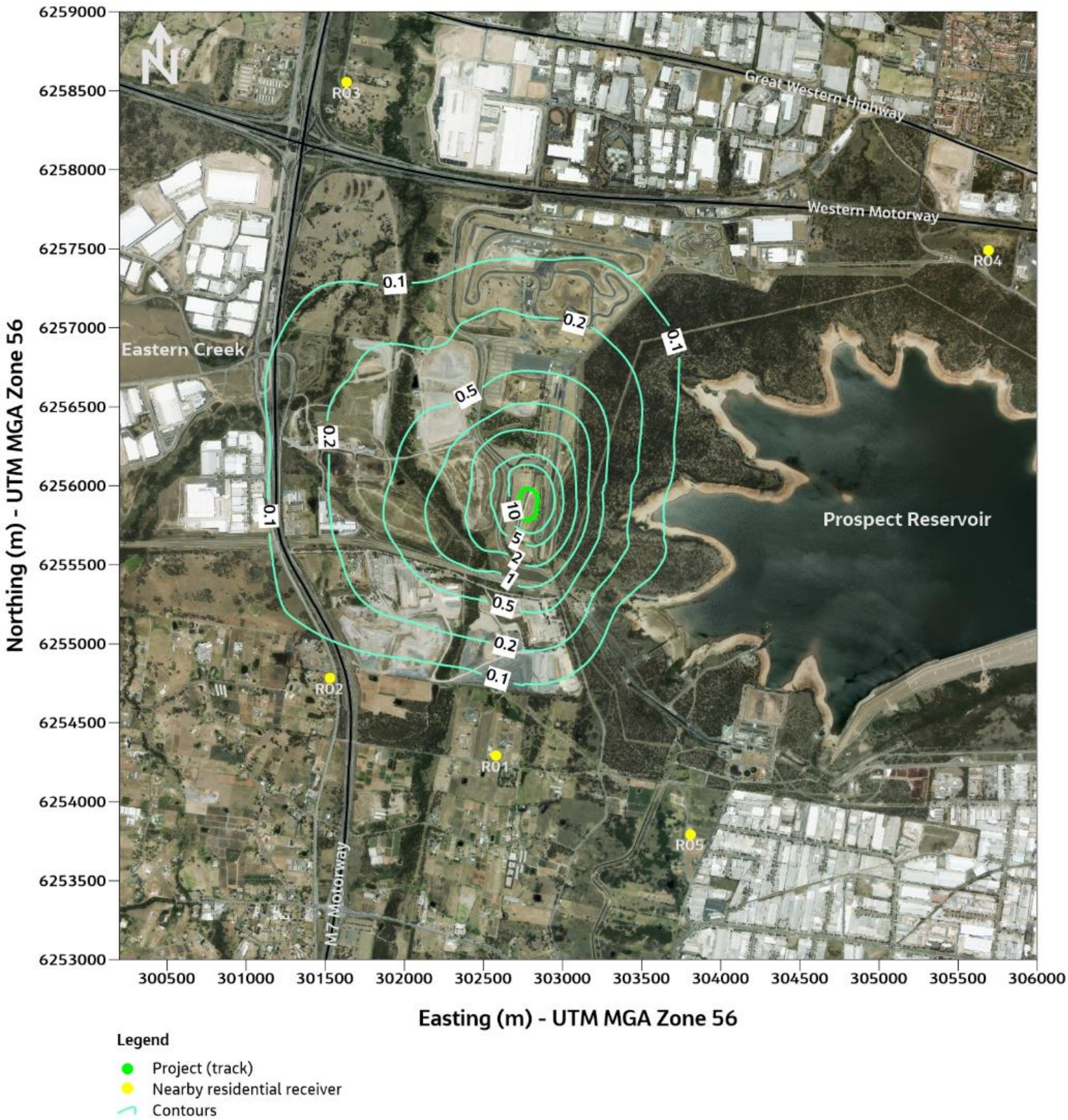
E.3.3 Annually averaged $PM_{2.5}$ ($\mu g/m^3$)



E.3.4 24-hour averaged $PM_{2.5}$ (µg/m³)



E.3.5 Annually averaged TSP (µg/m³)



E.3.6 Deposited dust (g/m²/month)