APPENDIX 10

Air Quality Impact Assessment

Kurri Kurri Lateral Pipeline Project

Air Quality Impact Assessment

APA Group

3 March 2022

The Power of Commitment

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Glossary

Term	Meaning
Alignment	The centreline of the ROW selected for assessment in the EIS.
Clear and grade	The preparation of the construction right of way for vehicular movement, trenching and other construction activities, involving clearing vegetation and other obstacles from the right of way, grading topsoil to the edge of the right of way, and creating a safe working surface (and slope) for construction.
Construction footprint	The area of land directly disturbed for construction of the Project consisting of the transmission pipeline construction right of way, storage pipeline construction footprint, extra workspaces, temporary laydown areas, temporary access tracks and any other ancillary facilities required to construct the Project.
Construction right of way (ROW)	Corridor generally of 30 m width.
Easement	A right held by the proponent to make use of the land for a specific purpose (in this case, for the installation and operation of a pipeline). The easement for the transmission pipeline will typically be 20 m wide.
Grading	Levelling of the construction ROW using graders, backhoes or bulldozers.
Landowner	A general term used to refer to the legal owner or manager of a parcel of land. It may be a private landowner, Government or private utility, or a Government Agency responsible for management of a particular parcel of Crown land (eg National Parks or Forestry areas).
Mainline valve	An above ground facility consisting of a valve used to isolate sections of the pipeline, located at intervals along its length.
Pipeline Inspection Gauge (PIG)	A tool which is inserted into a pipeline and propelled along by hydrotest water or by gas, to clean and inspect the pipe internally.
Pigging	The act of forcing a PIG through a pipeline for the purposes of displacing or separating fluids, and cleaning or inspecting the line.
The Project	The Kuri Kurri Lateral Pipeline. The Project includes a transmission pipeline, storage pipeline, surface facilities, temporary construction camps and temporary support facilities.
Rehabilitation	Rehabilitation is the process of restoring a site or area's environmental attributes by returning an area to its pre-disturbance state. The process may include initial stabilisation, followed by regeneration, revegetation or restoration, depending upon the defined scope of works. Commonly the main objective of rehabilitation is either reinstatement of, or improvement on, the pre-existing condition.
Reinstatement	Reinstatement is the process of re-establishing a pre-existing physical condition, and usually involves bulk earth works and structural replacement of pre-existing attributes of a site, such as soil surface topography, drainage, culverts, fences and gates.
Scraper station	An above-ground facility used to launch and receive PIGs into and from the pipeline system.
Stringing	Laying the pipe adjacent to the pipeline trench.
Study area	The study area is defined as a three hundred metre buffer from the alignment, access tracks, workspace or stockpile for the purposes of this assessment.
Skids	Timber blocks used to keep pipe lengths off the ground.
Trenching	Excavation of a trench for burial of a pipeline.

Air quality technical glossary

Term	Definition
Ausplume	A software implementation of the Gaussian plume dispersion model based on the Victorian Environment Protection Authority's *Plume Calculation Procedure* (EPAV 1985).
Pasquill-Gifford	Stability classification used in atmospheric dispersion models to define the turbulent state of the atmosphere.
$PM_{2.5}$	Particulate matter (airborne dust) with a size of 2.5 micrograms.
PM_{10}	Particulate matter (airborne dust) with a size of 10 micrograms.
Sensitive receptor	A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors.
TSP	Total Suspended Particles – airborne dust.

Abbreviations

Abbreviation	Definition
EPA	Environmental Protection Authority
EPAV	Environmental Protection Authority Victoria
km	Kilometre
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NPI	National Pollutant Inventory
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations (Clean Air) Regulation 2010* Act
The Project	The Kurri Kurri Lateral Pipeline Project

1. Introduction

1.1 Background and project overview

Snowy Hydro Limited is proposing to develop a gas-fired peaking power station, referred to as the Hunter Power Project (HPP), at the site of the former Hydro Australia Pty Ltd (Hydro) aluminium smelter at Kurri Kurri. The HPP is proposed to provide up to 750 megawatts (MW) of 'on-demand' electricity to supplement Snowy Hydro's generation portfolio with dispatchable capacity when the needs of electricity consumers are highest. The HPP is currently undergoing assessment under both NSW and Commonwealth planning and environmental assessment frameworks.

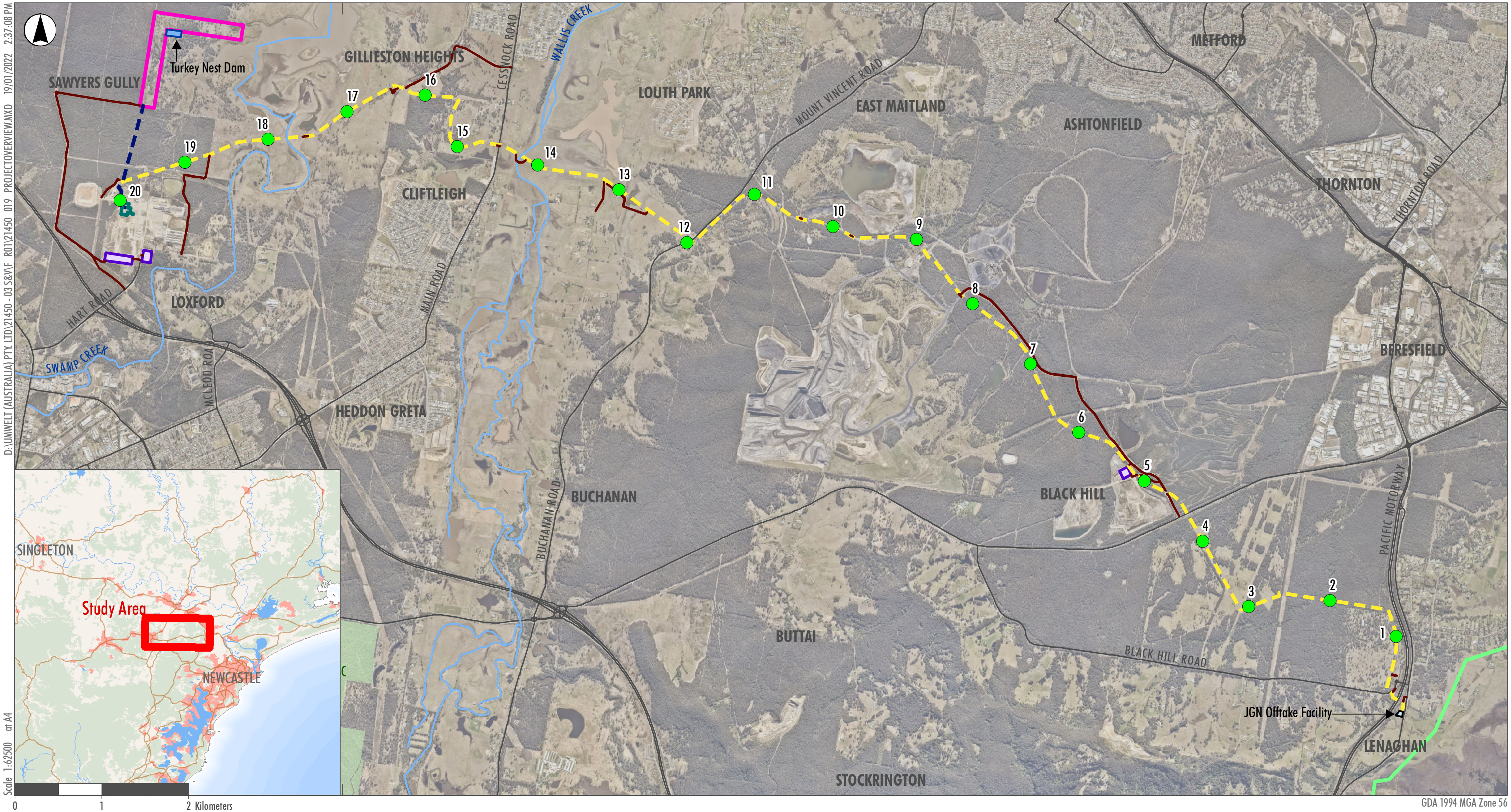
The Kurri Kurri Lateral Pipeline Project (the Project) has been proposed as the gas supply solution for the HPP. This includes a buried steel pipeline of approximately 20.4 km in length for a transmission pipeline and approximately 24.7 km in length for a storage pipeline, as well as a compressor station and delivery station. Construction of the Project will involve excavation of trenches and in some areas horizontal directional drilling (HDD) and boring, and other fixed construction activities, which will inherently cause dust emissions.

1.2 Study area

The study area is situated in the Lower Hunter region of New South Wales, encompassing the Local Government Areas (LGAs) of Cessnock, Maitland and Newcastle.

The study area comprises a 0.3 km buffer of the alignments of the transmission pipeline and storage pipeline, and the associated surface facilities as further detailed in this report. The study area is located within the rural locality of Lenaghan, approximately 15 km northwest of Newcastle to approximately 2 km north of Kurri Kurri. The construction footprint of the Project is approximately 98 ha.

The project location is shown in Figure 1.1.



Legend

- Transmission Pipeline Alignment
- Interconnect Pipeline
- Sydney to Newcastle Pipeline (JGN Northern Trunk)
- Kilometre Point
- Compressor and Delivery Station
- Pipe Laydown Areas
- Storage Pipeline
- Turkey Nest Dam
- JGN Offtake Facility
- NSW Conservation Estates
- Access Tracks
- Roads
- Watercourses

FIGURE 1.1

Project Location

Image Source: Neamap (August 2021) Data source: NSW LPI (2020;2021)

1.3 Purpose of this report

GHD Pty Ltd (GHD) has been commissioned by the APA Group to prepare an Air Quality Impact Assessment (AQIA). This report will support the preparation of an Environmental Impact Statement (EIS) under the EP&A Act for the project.

This report addresses the relevant criteria in the NSW Secretary's Environmental Assessment Requirements (SEARs) for the project issued in July 2021 (as outlined in Section 2) and assesses the potential air quality related impacts associated with construction and operation of the project.

The purpose of this report is to document the results of the AQIA which included:

– Review of project information related to sources of emissions to air. This includes construction methodology, operation of the project and emission controls, process drawings and emission rates.
– Definition of the existing environment at the project area, including identification of air quality sensitive receptors, and completing a review of available ambient air quality monitoring data for the previous 5 years.
– Preparation of a site-representative meteorological data set based on review of local Bureau of Meteorology data.
– Air dispersion modelling using the Ausplume model to quantitatively predict any changes in particulate matter (PM) and total suspended solids (TSP) concentrations for comparison against the EPA criteria.
– Discussion of the findings of dispersion modelling and an overview of proposed mitigation measures and controls associated with the project.
– A qualitative air quality assessment of potentially emission generating operation activities and providing management measures to minimise potential air quality impacts at sensitive receptors during project operation activities
– Assessment of cumulative air quality impacts.

1.4 Limitations

This report: has been prepared by GHD for APA Group and may only be used and relied on by APA Group for the purpose agreed between GHD and APA Group as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than APA Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.5 Structure of this report

The structure of the report is as follows:

- Section 1 provides an introduction to the report
- Section 2 describes the methodology, policy and legislative context for the assessment including the compliance criteria
- Section 3 describes the baseline conditions across the study area
- Section 4 identifies and describes the potential air quality emission sources for the Project
- Section 5 identifies and describes the potential air quality impacts arising from the Project

- Section 6 identifies potential air quality mitigation and management measures
- Section 7 provides a conclusion to the report.

1.6 Assumptions

The following assumptions were made when undertaking the air quality assessment:

- General construction methodology was obtained from the EIS Project Description report (Umwelt 2021) provided by APA.
- When defining impacts from construction, assumptions were made on construction activities and area of works in any area at any one time. Assumed worst-case conditions have been used.
- Sensitive receptors were identified using aerial photography and land use planning and may not include all existing or future receptors in the project area.
- Ambient air quality and meteorological data is considered representative however may vary year to year and be influenced by external factors including climate trends and bushfires.

2. Methodology and legislative context

2.1 Methodology

The following methodology was used to assess the potential air quality impacts associated with construction and operation of the Project in order to address the Secretary's Environmental Assessment Requirements:

- Reviewing the Project alignment and significant construction areas to identify sensitive receptors in the area surrounding the Project.
- Reviewing the existing regional ambient air quality and meteorology including the nearby Bureau of Meteorology (BoM) weather station located at Maitland Airport and the nearby Department of Planning, Industry and Environment (DPIE) air quality monitoring stations (AQMS) located at Beresfield and Wallsend.
- Preparing an emissions inventory that considers typical construction activities associated with the Project.
- Undertaking a worst-case dispersion model (i.e. Level 1 assessment) that predicts particulate concentration at various distances from the proposed construction right of way (ROW) and other key construction areas. A buffer was created where the air quality criteria can be achieved. Modelling was undertaken with consideration to the Approved Methods using the EPA approved Ausplume software.
- Assessing the potential impacts to air quality at sensitive receptors.
- Reviewing potential operational emissions to determine if dispersion modelling is required.
- Providing recommendations for reasonable and feasible air quality mitigation measures, if required.

2.2 Legislative and policy context to the AQIA

The relevant legislation and government guidance for the air quality assessment of the project are:

- NSW *Protection of the Environment Operations Act 1997* (POEO Act)
- NSW Protection of the Environment Operations (Clean Air) Regulation 2021 (POEO Clean Air Regulation)
- National Environment Protection Council (NEPC) National Environment Protection (Ambient Air Quality) Measure 2021 (the Air NEPM)
- Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007)
- Technical framework - Assessment and management of odour from stationary sources in NSW (the Technical Framework), NSW Department of Environment and Conservation (DECC 2006)
- NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2017) (the Approved Methods).
- Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management (2016) (IAQM guidance)

The POEO Act provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act). The POEO Act includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

The POEO Clean Air Regulation provides regulatory measures to control emissions from motor vehicles, fuels, and industry.

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality in February 2016. This is known as the Air NEPM. The Air NEPM sets non-binding standards and goals (for 2025). The Air NEPM contains goals for the identified relevant pollutants inclusive of particulates and concentration limits, averaging periods and number of allowed exceedances for each of the identified pollutants.

The Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007) list the methods to be used for the sampling and analysis of air pollutants in NSW for statutory purposes. No emission sampling was conducted or necessary as part of this assessment. If it is required during construction and operation of the project to demonstrate regulatory compliance, APA has a responsibility to undertake, where possible, all sampling in accordance with requirements outlined in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007). This includes sampling type, duration, location and a number of other requirements.

The Technical Framework provides a legislative context for the control of odour and presents odour assessment criteria guidelines. It provides a framework for different levels of odour assessment, strategies to mitigate odour, and guidance for performance monitoring, regulation and enforcement.

The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above-mentioned legislation and guidance to provide pollutant assessment criteria.

The IAQM guidance provides guidance on the assessment of dust from demolition and construction activities. It provides a qualitative step by step process to assess the risk of dust impacts.

2.2.1 Secretary’s Environmental Assessment Requirements

The *Secretary’s environmental assessment requirements for the Kurri Kurri Lateral Pipeline Project* (SEARs) key issues and referenced guidelines are summarised in Table 2.1. Note only requirements relevant to air quality are referenced.

Table 2.1 Environmental assessment requirements

Requirement	Where addressed in report
Air quality and odour – including:	
Identification of all sources or potential sources of air emissions (point or fugitive) and odour from the project;	Section 4
An assessment of the likely air quality and odour impacts of the project in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA), *Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006); *Technical Notes: Assessment and management of Odour from Stationary Sources in NSW* (DEC, 2006);	Section 5
Demonstrated ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Clean Air) Regulation* 2010;	Section 5.4
Environmental planning instruments, policies, guidelines and plans	
Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)	Section 2.2
Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA)	
Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006)	

2.3 Assessment criteria

Assessment criteria for the Project were predominantly taken from the Approved Methods, with the exception of NO_2 and SO_2 which were also sourced from the Air NEPM air quality objectives as they represent the most recent and stringent standards for protection of the air quality environment. The objective of the criteria is ambient air quality that minimises the risk of adverse health impacts from exposure to air pollution. Achieving compliance with the impact assessment criteria will help demonstrate that the Project will operate in a manner that protects human and environmental health and amenity.

Relevant assessment criteria for the primary pollutants associated with construction and operation of the Project are presented in Table 2.2. The criteria apply to the total impact (increment plus background) and must be reported as the 100th percentile (maximum).

Table 2.2 Air quality impact assessment criteria

Pollutant	Averaging period	Impact location	Impact type	Criteria (µg/m³)	
				EPA Assessment Criteria	Air NEPM
Airborne particulate matter and common gaseous pollutants					
TSP	Annual	Sensitive receptor	Cumulative	90	-
PM_{10}	24 hour	Sensitive receptor	Cumulative	50	50
	Annual	Sensitive receptor	Cumulative	25	25
$PM_{2.5}$	24 hour	Sensitive receptor	Cumulative	25	25 (reduced to 20 in 2025)
	Annual	Sensitive receptor	Cumulative	8	8 (reduced to 7 in 2025)
Deposited dust	Annual (maximum increase)	Sensitive receptor	Cumulative	2 g/m²/month	-
	Annual (maximum total)	Sensitive receptor	Cumulative	4 g/m²/month	-
NO_2	1 hour	Sensitive receptor	Cumulative	246	164
	Annual	Sensitive receptor	Cumulative	62	31
SO_2	1 hour	Sensitive receptor	Cumulative	570	286 (reduced to 215 in 2025)
	24 hour	Sensitive receptor	Cumulative	228	57

3. Existing environment

3.1 Background air quality

An assessment of the total impact, which includes the project impact as well as the background concentrations, is required for the following pollutants:

- TSP
- PM_{10}
- $PM_{2.5}$
- NO_2
- SO_2

To assess the total impact, representative background levels of each pollutant must be established.

3.1.1 Background DPIE AQMS data

DPIE operates air quality monitoring stations (AQMS) in many locations across NSW. A summary of data available from the nearest DPIE AQMS are provided in Table 3.1.

Table 3.1 Summary of data reviewed as part of the assessment

Station name	Distance to project area	Pollutants of interest that are measured
Beresfield	~4.4 - 17 km northeast	PM_{10}, $PM_{2.5}$, NO_2 and SO_2
Wallsend	~6.8 - 21.8 km southeast	PM_{10}, $PM_{2.5}$, NO_2 and SO_2

A summary of the ambient air quality data recorded at each AQMS over the last 5 years is provided in Table 3.2.

Table 3.2 5 year summary of available background air quality data recorded by DPIE

Pollutant	Averaging Period	Recorded Background Concentration by year (µg/m³)				
		2016	2017	2018	2019	2020
Beresfield						
PM_{10}	24 hour maximum	48.0	49.4	149.1	136.7	77.7
	Maximum 24 hour (below assessment criteria)	48.0	49.4	44.0	47.6	47.1
	70th percentile	21.8	22.2	24.0	27.1	20.0
	Annual average	18.9	19.4	21.4	25.6	18.3
$PM_{2.5}$	24 hour maximum	26.8	18.7	24.9	100.5	49.7
	Maximum 24 hour (below assessment criteria)	19.5	18.7	17.4	19.7	19.4
	70th percentile	8.2	8.5	9.4	10.7	8.5
	Annual average	7.0	7.2	7.9	11.1	7.3
NO_2	1 hour maximum	77.1	75.2	75.2	105.3	65.8
	Annual average	13.9	15.5	15.3	13.2	11.6
SO_2	1 hour maximum	88.4	144.7	187.6	182.2	101.8
	24 hour maximum	19.5	20.7	19.1	22.6	20.7
	Annual average	3.6	3.8	4.1	4.3	3.6
Wallsend						
PM_{10}	24 hour maximum	65.5	47.9	136.6	127.9	76.1

	Maximum 24 hour (below assessment criteria)	35.2	47.9	47.6	48.8	46.1
	70th percentile	18.6	19.3	20.4	23.9	19.3
	Annual average	16.3	17.2	18.7	22.4	17.6
$PM_{2.5}$	24 hour maximum	48.6	20.4	20.2	108.3	54.5
	Maximum 24 hour (below assessment criteria)	19.3	19.1	16.5	19.1	18.9
	70th percentile	8.5	8.5	8.5	10.2	7.8
	Annual average	7.3	7.0	7.2	9.9	7.1
NO_2	1 hour maximum	69.6	69.6	65.8	79.0	54.5
	Annual average	12.6	13.6	12.1	12.2	10.5
SO_2	1 hour maximum	101.8	150.1	211.7	134.0	107.2
	24 hour maximum	15.7	25.9	20.1	23.6	25.3
	Annual average	2.8	3.5	3.1	4.2	4.3

The 24-hour average PM_{10} and $PM_{2.5}$ recordings are shown in Figure 3.1 as well as the daily PM_{10} and $PM_{2.5}$ criteria. The 2019 bushfire season is clearly visible by significantly increased concentrations of these pollutants, as such this year has been excluded when calculating average background values.

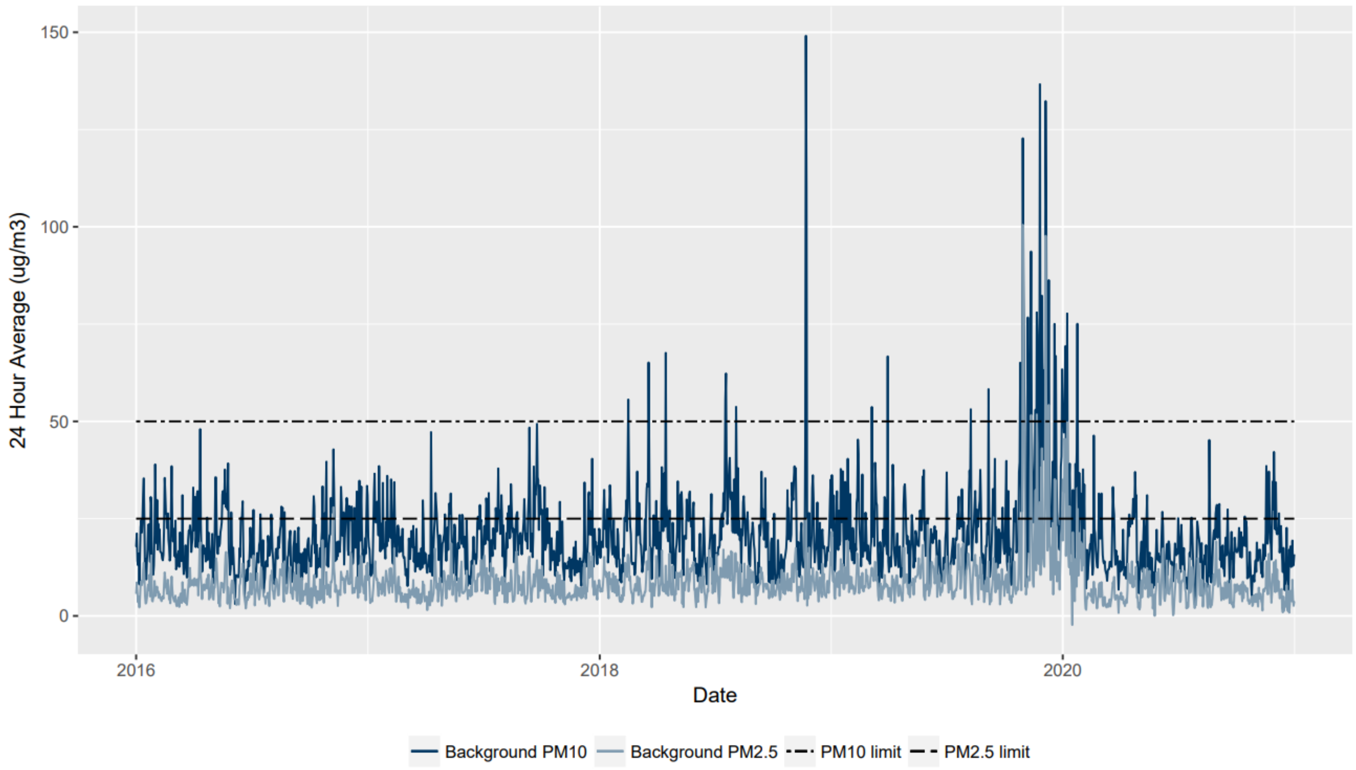


Figure 3.1 *PM_{10} and $PM_{2.5}$ recordings from DPIE Beresfield AQMS (2016-2020)*

3.2 Existing and future sources of air pollutants

3.2.1 Facilities reporting to the NPI

The National Pollutant Inventory (NPI), operated under the *National Environment Protection (National Pollutant Inventory) Measure 1998*, provides publicly available information about emissions of 93 pollutants throughout Australia. Facilities that exceed prescribed threshold values are required to report their emissions to the NPI on a yearly basis.

Emissions from the 9 facilities reporting to the NPI in the area surrounding the project area are summarised in Table 3.3. Annual PM_{10} emissions have been included as they are relevant to construction emissions associated with this project.

Table 3.3 Existing operations reporting emissions to the NPI

Name of operation	Proximity to the nearest part of project	Description of operation	Applicable pollutant emissions	Annual PM_{10} emissions (kg)
Bloomfield Colliery	~0.5 km northeast	Open cut coal mining including processing for the export market	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	712801.5
Kurri Kurri Wastewater Treatment Works	~2 km south	Wastewater treatment by activated sludge	Ammonia, total nitrogen, total phosphorous	NA
Steggles Beresfield Site	~4 km northeast	Poultry processing	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	902.8
Buttai Quarry	~3.7 km south	Crushing, grinding and separating of conglomerate material for construction purposes	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	11282.7
Beresfield Feed Mill	~4km northeast	Feed manufacturing	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	3204.9
Weston Aluminium	~2.2 km southwest	Secondary aluminium dross processing	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	2848
Steggles Beresfield Site No 2	~4 km northeast	Further processing poultry plant	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	194.1
SPF Diana Australia Beresfield Plant	~4km northeast	Ingredient production for pet food industry	Phosphoric acid	NA
LMS Flare Maitland	~1.5 km north	Landfill gas flaring	CO, NO_x, SO_2, total VOCs, PM_{10}, $PM_{2.5}$ and others	448.2

3.2.2 Nearby developments

A review of the DPIE Major Projects website was completed to understand future sources of air pollutants within 5 kilometres of the project area which may contribute to cumulative impacts with the project. New state significant projects (SS projects), that is both State Significant Developments and State Significant Infrastructure, as of 9/12/2021, with potential for air emissions are summarised in Table 3.4.

An assessment of the Newcastle, Cessnock and Maitland Council planned projects identified no other major projects that would significantly impact air quality in the project area (also as of 9/12/2021).

Table 3.4 Summary of nearby developments with emissions to air

Name of project	Proximity to the project	Project status	Description of project	Expected impact on air quality at project sensitive receptors
The Heights Learning Community, Gillieston Heights	~3.6 km north	Prepare EIS	Concept DA for the constriction of five building envelopes for use as education establishment, including a hospitality centre and café, and first stage construction	Emissions of particulates during construction.

Name of project	Proximity to the project	Project status	Description of project	Expected impact on air quality at project sensitive receptors
			of one building, onsite car parking and internal roadworks.	
Hunter Power Project (Kurri Kurri Power Station)	Adjacent to western end of transmission pipeline	Determination	A Critical SS Infrastructure application, involving construction and operation of a 750 megawatt (MW) gas fired power station, electrical switchyard and ancillary infrastructure.	Possible emissions of CO, SO_2, particulate matter, NO_2 and VOCs.
Hyrdo Kurri Kurri Aluminium Smelter Remediation	~100 m from western end of transmission pipeline	Determination	Remediation of the former Hydro Aluminium Smelter, Kurri Kurri including remediation of the site, design, construction and operation of a containment cell for encapsulating contaminated material.	The decommissioning, demolition and remediation activities have the potential to cause dust generation and airborne contaminants.
Kurri Kurri Battery Recycling Facility	~1.3 km south	Determination		Possible emissions of particulates, lead, NO_2, SO_2 and individual air toxics.
Weston Waste Processing Trial	~1.3 km south	Determination		Possible emissions of particulates, cyanide and other pollutants.
Hunter Industrial Ecology Park	~1.3 km south	Prepare EIS	MRF and EfW to process in excess of 200,000 of MSW, C&I and C&D waste.	No details given yet.
Bloomfield Coal Mine – Extension	~0.5 km northeast	Determination	Open cut coal mining including processing for the export market	Increase in emissions listed above in Table 3.3.
Enviroking Liquid Waste Facility – Processing limit increase	~1.5 km south	Prepare Mod Report	Proposal to increase the maximum amount of waste to be processed on site from 20,000 tonnes per year to 30,000 tonnes per year.	Increase in existing emissions rates.
DALE Young Parents' School	~ 3.5 km south	Prepare EIS	The Young Parents School is an education facility which seeks to equip young parents for employment and to prepare their young children for school. The centre also will provide student support services and on site child care for students.	Emissions of particulates during demolition and construction.
Beresfield battery energy storage system	~ 5 km north	Prepare SEARs	Development of a 100 MW / 400 MWh battery energy storage facility with associated infrastructure.	Emissions of particulates during construction.
JGN delivery facility	Adjacent to JGN offtake facility	Application not yet submitted	Proposed construction and operation of the JGN delivery facility to control the flow of gas between the east coast grid and the transmission pipeline.	Emissions of particulates during construction.
Testers Hollow Roadworks	~0.1-0.4 km south	Under construction, expected completion in early 2023	Upgrading Cessnock Road at Testers Hollow.The project will raise the height of Cessnock Road at Testers Hollow to provide a more reliable	

Name of project	Proximity to the project	Project status	Description of project	Expected impact on air quality at project sensitive receptors
			connection during certain flood events.	
Emerging Black Hill Precinct industrial estates: Stevens Group Hunter Business Park and Broaden Management Industrial Estate	Adjacent to transmission pipeline	Stage 1 of Hunter Business Park is approved. The Broaden Management Industrial Estate is not approved.	The Broaden Management industrial estate is a proposed subdivision of land to create 39 light industrial lots and 1 environmental conservation lot.	Emissions of particulates during construction.
Gillieston Heights urban release area	Adjacent to transmission pipeline	Housing subdivisions at various stages of approval, construction and completion.	Ongoing residential development between the Hunter Expressway and Testers Hollow	Emissions of particulates during construction.
Cliftleigh Urban Precinct	600m south of transmission pipeline	Housing subdivisions at various stages of approval, construction and completion.	Ongoing residential development between Testers Hollow and south of Maitland	Emissions of particulates during construction.
Lower Hunter Freight Corridor	Adjacent to transmission pipeline	Concept stage	Corridor protection project for a proposed future freight rail line	Nil associated with corridor protection
M1 Pacific Motorway extension to Raymond Terrace	~ 500m north of the transmission pipeline	EIS under assessment	Major road project connecting the existing M1 Pacific Motorway at Black Hill and the A1 Pacific Highway at Raymond Terrace.	Emissions of particulates during construction. Vehicle exhaust emissions during operations.
Regrowth Kurri Kurri	Adjacent to transmission pipeline, compressor station and delivery station	Gateway application approved. DAs for subdivisions not yet submitted..	Rezoning and redevelopment of the buffer zone of the former Kurri Kurri aluminium smelter	Emissions of particulates during construction

Cumulative impacts from these projects affecting air quality at the project area are discussed in Section 5.4.3.

3.3 Climate and meteorology

The local climate and meteorology (weather) within the study area is of critical importance when assessing the potential for air quality impacts at sensitive receptors.

The meteorological environment relevant to a project area is best understood through review of data collected from long-running monitoring weather stations, most commonly operated by the Bureau of Meteorology (BoM) as well as state authorities (DPIE in this case) and in some instances private entities. Simulation of the meteorological environment (modelling) is a useful tool in understanding the environment where suitable meteorological observations are not available.

3.3.1 Available observations

The BoM operates a network of automatic weather stations (AWS) across Australia. A BoM AWS typically measures critical meteorological parameters including wind speed, wind direction, temperature, relative humidity, and pressure, with some stations also measuring cloud coverage.

The nearest AWS to the project area is the Maitland Airport AWS, which is 8.5 km (at the nearest point) to 20.5 km (at the furthest point) from the pipeline. This station was commissioned in July 2016 and as such data has been collected for the full years of 2017 through 2020.

3.3.1.1 Temperature

Figure 3.2 shows monthly temperature statistics for data measured at BoM Maitland Airport AWS for the period 2017 through 2020. The 50th percentile monthly maximum and minimum temperatures are used to show the typical temperature range for each month of the year. This is shown along with the monthly average temperature, average monthly maximum temperature and average monthly minimum temperature.

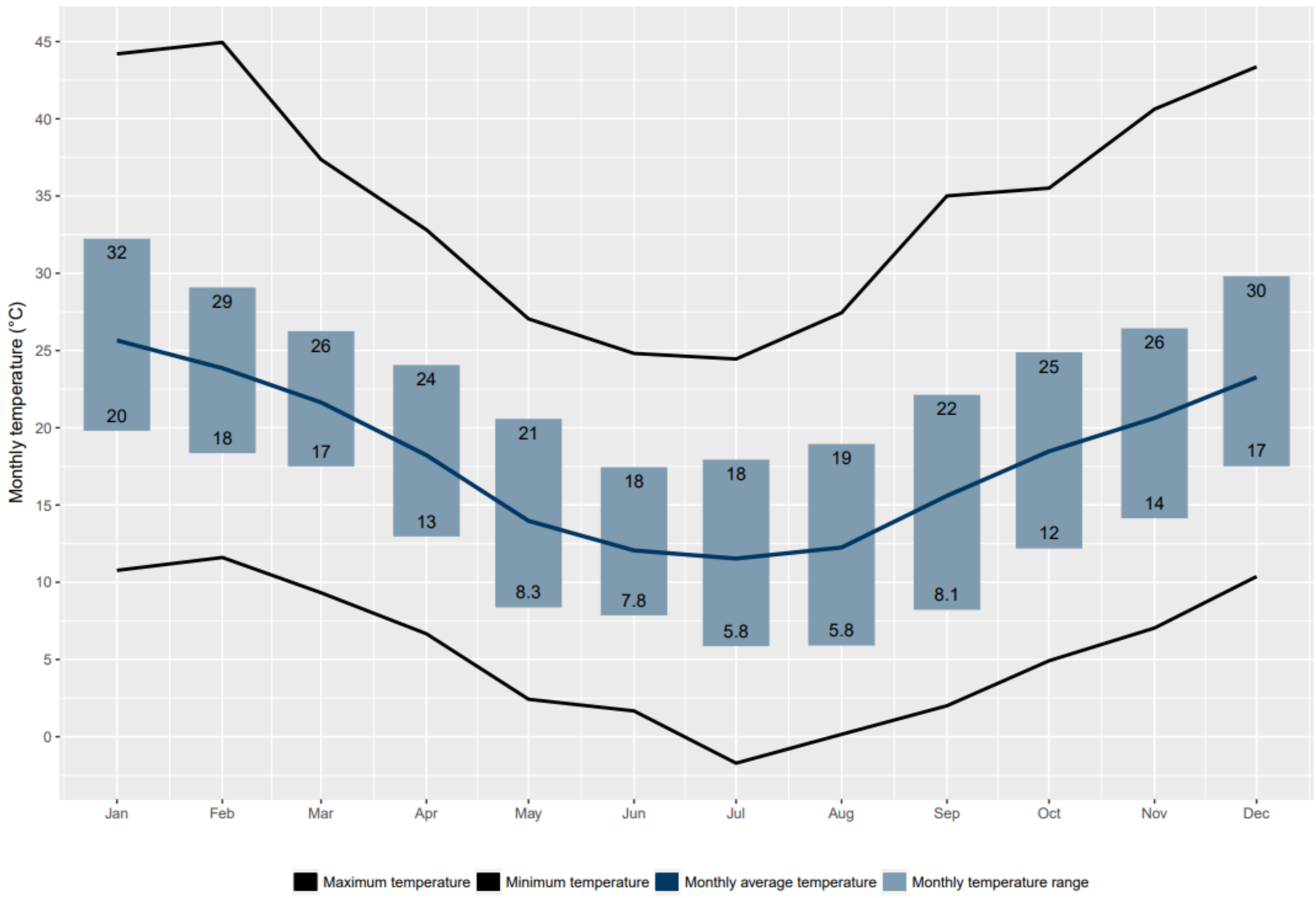


Figure 3.2 Monthly climate temperature statistics from BoM Maitland Airport AWS (2017-2020)

3.3.1.2 Rainfall

Figure 3.3 shows monthly rainfall statistics for data measured at BoM Maitland Airport AWS for the period 2017 through 2020. The statistics shown include average monthly rainfall amount (mm) and average number of days per month where rainfall is greater than 0.25 mm (number of 'rain days').

The data shows that the number of rain days and the total rainfall amounts are greater during the summer and autumn months.

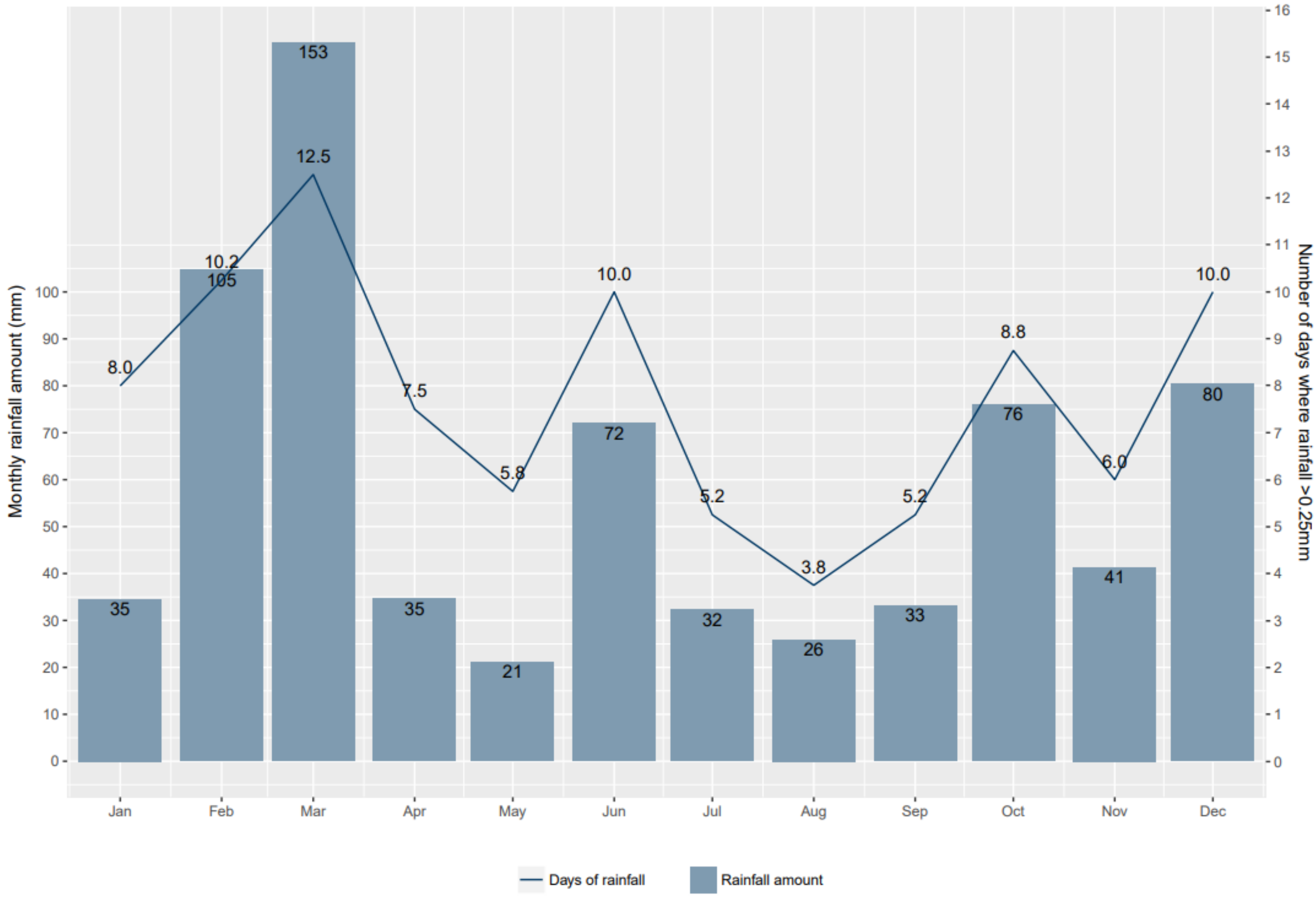


Figure 3.3 Monthly climate rainfall statistics from BoM Maitland Airport AWS (2017-2020)

3.3.1.3 Wind

Figure 3.4 shows the average annual wind rose and Figure 3.5 shows the average seasonal wind roses, both measured at BoM Maitland Airport AWS for the period 2017 through 2020. Figure 3.4 shows the following features:

- The predominant annual average wind direction is from the northwest
- The average wind speed measured was 3.2 metres per second
- Calm conditions (wind speeds less than 0.5 m/s) occurred 12.7% of the time
- High wind speeds (winds greater than 5 m/s which are often attributed to dust lift off) mostly occur from the southeast and northwest.

Figure 3.5 extends these observations, showing that:

- The winds from the northwest mainly occur during winter and autumn, while the winds from the southeast mainly occur during summer and spring
- Spring and summer have slightly higher average wind speeds than autumn and winter
- Summer has the smallest proportion of calm conditions.

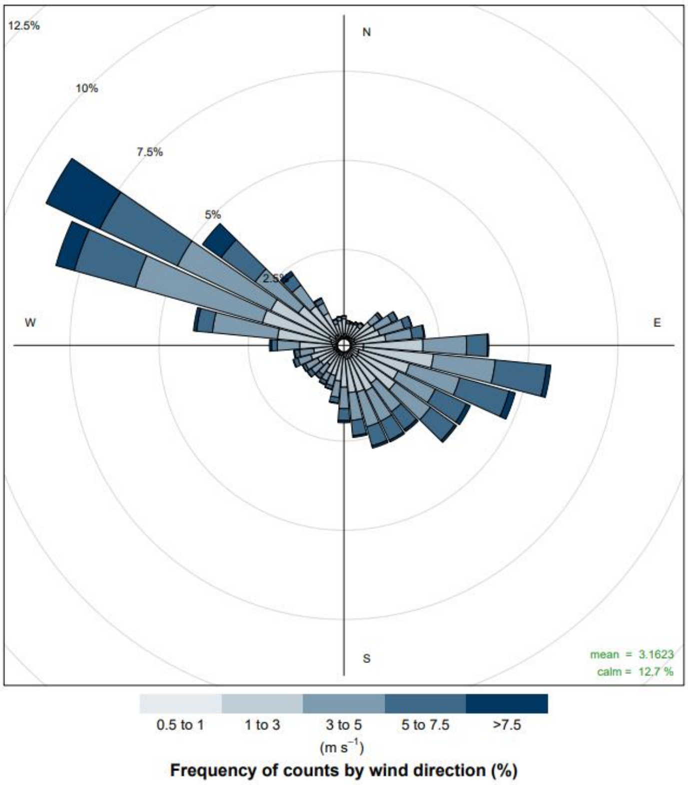


Figure 3.4 Average annual wind rose from BoM Maitland Airport AWS (2017-2020)

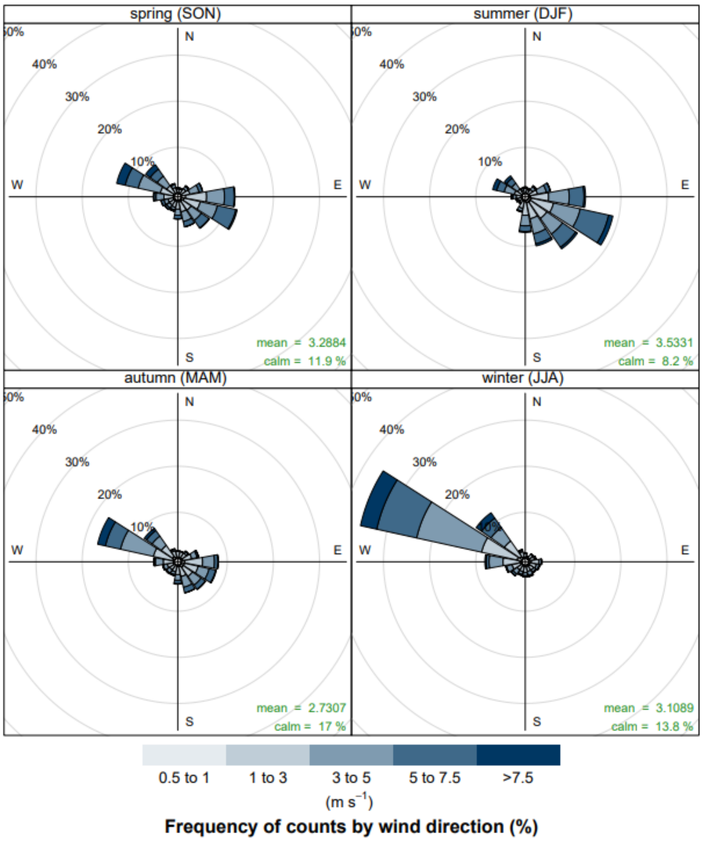


Figure 3.5 Average seasonal wind roses from BoM Maitland Airport AWS (2017-2020)

3.4 Sensitive receptors

Air quality sensitive receptors are defined based on the type of occupancy and the activities performed in the land use. Sensitive receptors are locations where people are likely to work or reside; this may be any of the following:

- Dwelling
- School
- Hospital
- Office
- Public recreational area

Most of the sensitive receptors near the project area are residential, as well as some offices and public recreational spaces. No schools or hospitals were identified within 800 m of the project area. The sensitive receptors are listed in Table 3.5 with their location, the distance from the project and the nearest emissions source.

Where there is more than one receptor in a residential cluster, only one receptor has been identified in the table. These are noted as residential clusters in the address column.

Table 3.5 Identified sensitive receptors and distance from the Project

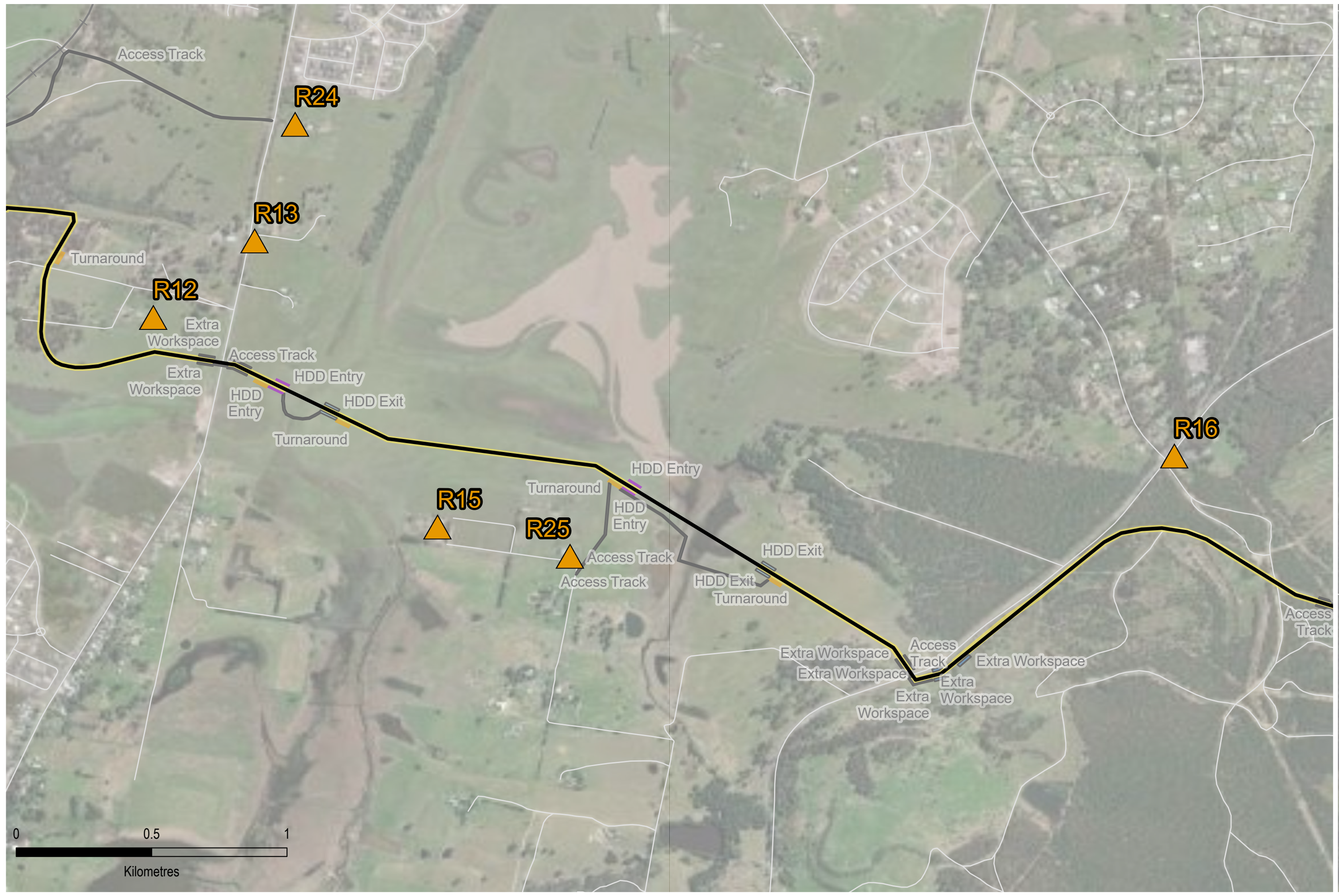
Receptor ID	Receptor type	Address	Distance from project area	Nearest emissions source
R01	Dwellings	6 Dawes Ave, McLeod Rd and Bowditch Ave (residential cluster)	~430 m southeast ~1000 m southeast	Pipe stockpile Compressor station
R02	Offices	Mcleod Rd	~1500 m southeast	Pipe stockpile
R03	Dwellings	Mcgarva Ave	~720 m southwest	Pipe stockpile
R04	Dwelling	103 Bishops Bridge Rd	~365 m south west	Access track to storage pipeline
R05	Dwellings	Sawyers Gully Rd (residential cluster)	~1300 m southwest	Pipe stockpile
R06	Dwellings	Old Maitland Rd and Wollombi Rd (residential cluster)	~1800 northwest	Storage pipeline
R07	Dwellings	683-695 Wollombi Rd (residential cluster)	~1700 m north	Storage pipeline
R08	Dwelling	929 Old Maitland Rd	~1600 m north	Storage pipeline
R09	Dwellings	Main Rd and Avery Ln (residential cluster)	~500 m south	Transmission pipeline
R10	Public recreational area	William Tester Dr	~680 m south	Transmission pipeline
R11	Dwellings	Kelman Dr and cross streets (residential cluster)	~1000 m south	Transmission pipeline
R12	Dwelling	532 Main Rd	~130 m north	Transmission pipeline
R13	Dwellings	501-528 Main Rd (residential cluster)	~260-500 m north	Transmission pipeline
R14	Dwellings	Cessnock Rd and cross streets (residential cluster)	~1100 m north	Transmission pipeline
R15	Dwellings	268 Valley View Ln	~270 m south	Transmission pipeline

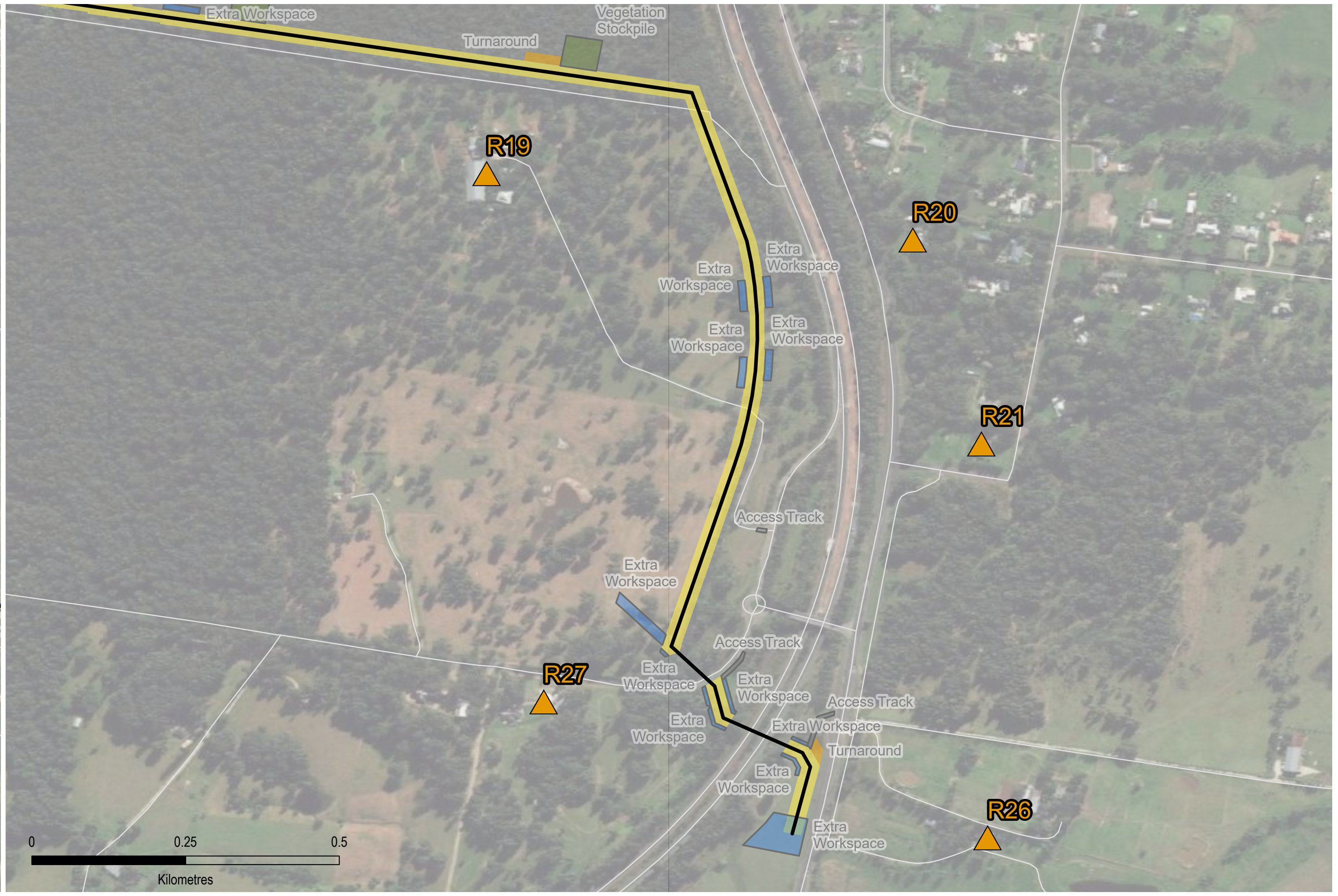
Receptor ID	Receptor type	Address	Distance from project area	Nearest emissions source
R16	Dwellings	Louth Park Rd and Mount Vincent Rd (residential cluster)	~230 m north	Transmission pipeline
R17	Dwellings	Reflection Dr and cross roads (residential cluster)	~1150 m north	Transmission pipeline
R18	Public recreational area and offices	John Renshaw Dr and Weakleys Dr (residential cluster)	~1800 m north	Transmission pipeline
R19	Public recreational area	2 Black Hill Rd	~170 m south	Transmission pipeline
R20	Dwellings	Cahill Cl and Phoenix Rd (residential cluster)	~200 m east	Transmission pipeline
R21	Dwellings	Lenaghans Dr (residential cluster)	~240 m east	Transmission pipeline
R22	Dwellings	Lenaghans Dr (residential cluster)	~420 m south	Transmission pipeline
R23	Dwellings	Graham Ln (residential cluster)	~1400 west	Compressor and delivery stations
R24	Dwellings	463-457 Cessnock Rd (residential cluster)	~110 m east	Access track to transmission pipeline
R25	Dwelling	Valley View Ln (residential cluster)	~ 50 m west	Access track to transmission pipeline
R26	Dwellings	153-159 Lenaghans Dr (residential cluster)	~ 240 m east	JGN offtake facility
R27	Dwellings	21-25 Black Hill Rd (residential cluster)	~ 190 m southwest	Access track to transmission pipeline
R28	School	Black Hill Public School, 408 Black Hill Rd	~ 900 m south	Transmission pipeline
R29	School	Kurri Kurri High School, 11 Deakin St	~ 2000 m south	Compressor and delivery stations
R30	School	TAFE NSW – Kurri Kurri, Mcleod Rd	~ 1500 m east	Compressor and delivery stations
R31	Dwelling	464 Cessnock Rd	~ 1415 m east	Storage pipeline

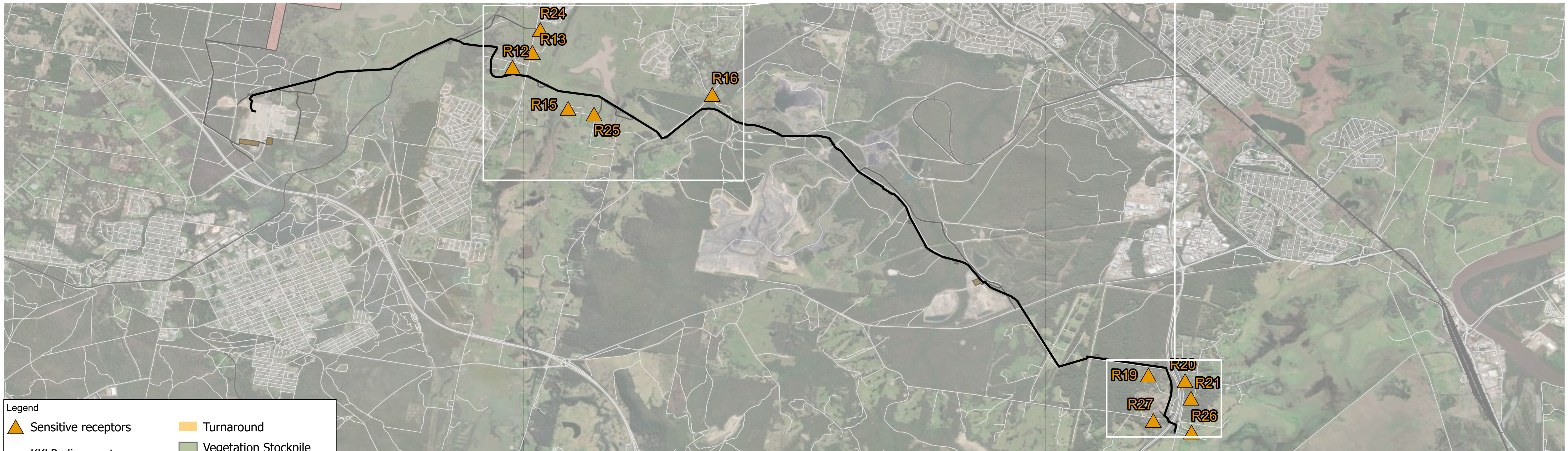
Sensitive receptors within 300 m of the transmission pipeline construction footprint are shown in Figure 3.6 as these are the key receptors of concern with respect to the results of the modelling (i.e. other than the storage pipeline, the greatest buffer distance is predicted to be 230 m from the construction area). Where there is more than one receptor in a residential cluster, the nearest receptor has been identified on the map.

There may be additional future sensitive receptors in proximity to the transmission pipeline construction footprint such as residential subdivisions, however details of where these are and when they will be constructed are not yet known. Based on the findings of this assessment (refer Section 5.4.1), if these are located further than 300 m from the transmission pipeline construction footprint then impacts from construction of the project (including cumulative impacts on other receptors) are not anticipated.

No sensitive receptors are located within 1,400 m of the storage pipeline construction footprint.







Legend

Sensitive receptors	Turnaround
KKLP alignment	Vegetation Stockpile
Access Track	Storage pipeline
Extra Workspace	Construction footprint
HDD Entry	Railway
HDD Exit	Roads
Pipe Stockpile	

Paper Size ISO A3
0 1 2
Kilometres

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

GHD

APA Group
Kurri Kurri Gas Pipeline
Air Quality Impact Assessment

Sensitive receptors within 300 m of the study area

Project No. 12568407
Revision No. A
Date 11-Feb-22

FIGURE 3.6

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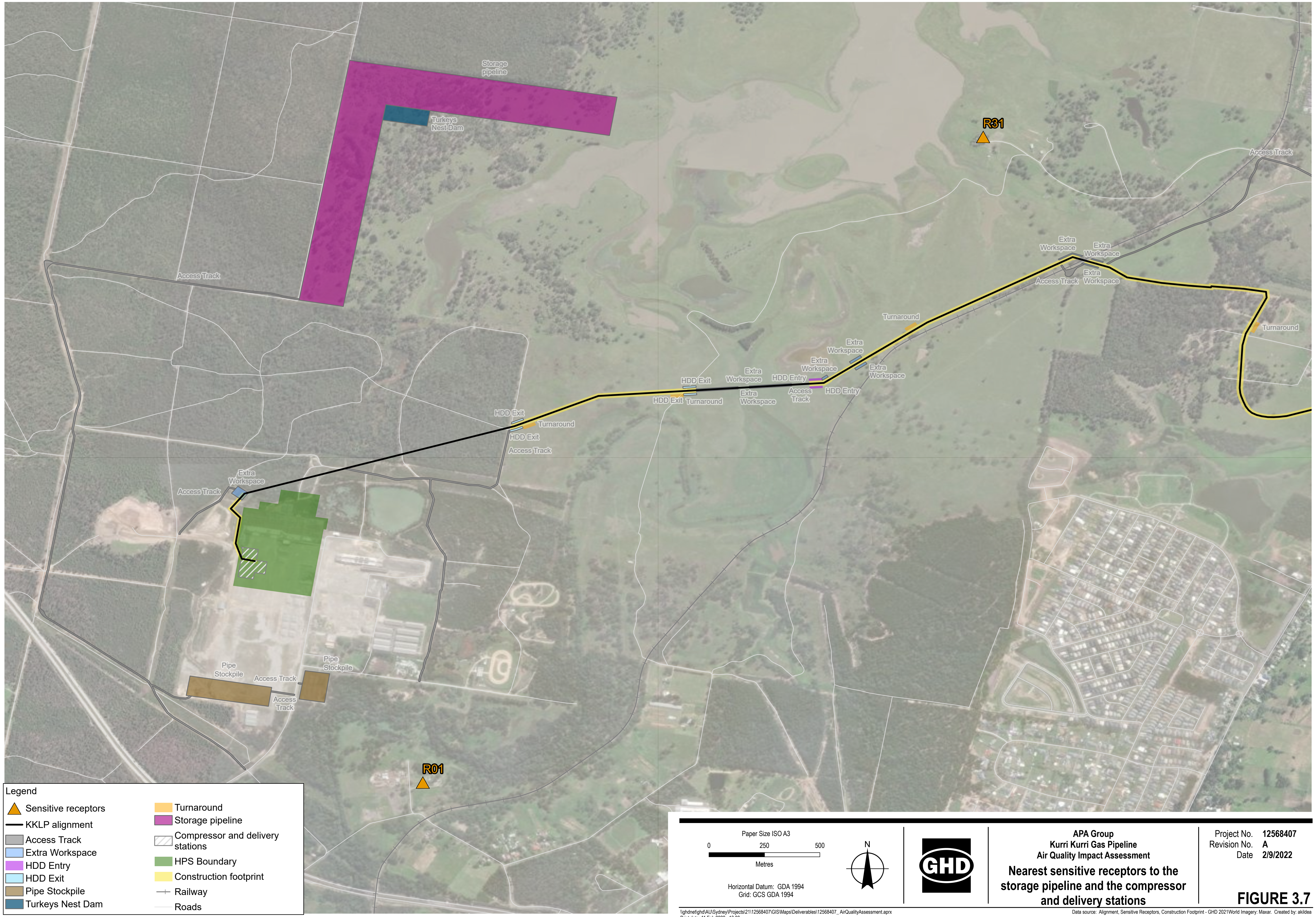
Print date: 08 Mar 2022 - 13:38

Data source: Alignment, Sensitive Receptors, Construction Footprint - GHD 2021World Imagery: Earthstar Geographics
World Imagery: Maxar. Created by: akildea



GHD

APA Group
Kurri Kurri Gas Pipeline
Air Quality Impact Assessment

Nearest sensitive receptors to the storage pipeline and the compressor and delivery stations

Project No. **12568407**
Revision No. **A**
Date **2/9/2022**

FIGURE 3.7

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Data source: Alignment, Sensitive Receptors, Construction Footprint - GHD 2021World Imagery: Maxar. Created by: akildea

4. Project emissions

4.1 Project overview

This section provides a high level summary of the project from an air quality context. The EIS should be referred to for more detailed description.

The Project comprises the following primary components:

- A buried, steel, medium diameter (up to DN350), medium pressure (up to 6.9 megapascal (MPag)) transmission pipeline of approximately 20.1 km in length to provide a gas supply from the existing Sydney to Newcastle Pipeline (SNP), via receipt and delivery facilities, to the HPP site.
- A compressor station at the termination of the transmission pipeline to boost gas pressure prior to transfer to a storage pipeline.
- A buried, steel, medium diameter (up to DN350), high pressure (up to 15.3 MPag) interconnect pipeline of approximately 1.3 km in total length, providing an interface between the compressor station, storage pipeline and delivery station.
- A buried, steel, large diameter (up to DN1050), high pressure (up to 15.3 MPag) storage pipeline of approximately 24 km in total length downstream of the compressor station with approximately 70 terajoules (TJ) of useable gas storage ready to supply the HPP.
- A delivery station to receive gas from the storage pipeline and control temperature, pressure and flow rate prior to delivery of gas to the HPP.

The compressor station and delivery station are located within the HPP project site boundary.

A compressor station and storage pipeline are required as part of the project as the Sydney to Newcastle Pipeline (SNP) does not provide sufficient gas volumes or pressure to meet the supply requirements of the HPP. As such, a direct pipeline connection between the Sydney to Newcastle Pipeline and the HPP is not a viable solution for gas supply to the HPP.

The Project is subject to a separate planning and environmental approvals process than the HPP. Furthermore, the design, approvals, construction and operation of the JGN delivery facility and the approximately 600m pipeline connection to the SNP pipeline will be the responsibility of Jemena.

The Project schedule is provided in Table 4.1 and is indicative and will be confirmed based on approval of the HPP and a final investment decision.

Table 4.1 Indicative project schedule

Milestone	Target Date
Environmental assessment and approvals	Q1 2021-Q4 2022
Design and procurement	Q1 2021-Q3 2022
Project construction	Q4 2022 – Q3 2023
Project commissioning and operations	Q4 2023

4.2 Construction emissions

4.2.1 Construction overview

Construction of both the transmission and storage pipelines will use typical methods for modern gas pipelines. Given the larger diameter pipe required for the storage pipeline, there will be some differences in construction methodology relative to the transmission pipeline. Notably construction equipment will be larger, the construction rate will be slower and welding and weld testing methods appropriate for the increased wall thickness will be implemented. The construction footprint for the storage pipeline will also be cleared and reinstated incrementally to match construction progress, and to minimise the area of exposed ground during construction. During construction, there is the potential for impacts as a result of airborne particulate matter and dust deposition.

Construction activities for the transmission pipeline will typically be undertaken from 6am to 6pm Monday to Friday on a 5 days on 2 days off basis. To mitigate noise impacts to residential areas in proximity to the transmission pipeline construction footprint, work will not typically be undertaken during weekends unless noise limits can be met or continuous work is required.

Construction activities for the storage pipeline are proposed to be undertaken between 6 am and 6 pm, seven days per week, given the much larger separation distances to residential areas. Construction crews will typically work a rostered cycle of 21 days on/7 days off, as per the pipeline industry standard, with 10 cycles likely to be required during the construction phase.

Construction shifts for the compressor station and delivery station are likely to comprise 6 days/week, with no work Sundays. Typical working hours are 6 am to 6 pm. Construction shifts for the JGN offtake facility will be the same as the transmission pipeline, given the proximity of residences.

Some activities, including but not limited to the construction of road crossings, trenchless construction and hydrostatic testing, may require construction outside the hours of 6 am and 6 pm.

The construction sequence involves the following steps:

- Preliminary survey works (including geotechnical surveys, installation of temporary gates in fences)
- Clearing of vegetation and grading the ROW
- Stripping and stockpiling of topsoil
- Delivery of pipe segments to the ROW and welding into ‘strings’
- Non-destructive testing (NDT) and coating
- Excavating a trench and any necessary bell holes in which to lay the pipe
- Lowering the pipeline strings into the trench and welding strings together
- Backfilling the trench with excavated material
- Crossing watercourses and roads by open cut trench, horizontal boring or HDD methods
- Installing pipeline markers at fences, road crossings and other locations as required by AS 2885
- Testing the structural integrity of the pipeline by hydrostatic testing
- Installing permanent gates in fences, where required
- Rehabilitating the ROW.

A typical layout for construction ROW is shown in Figure 4.1. The general rate of construction for the transmission pipeline and storage pipeline will be approximately 1 km/day and 200 m/day respectively. Some crews will move at a faster rate, such as survey at approximately 4 km/day, fencing at approximately 5 km/day and vegetation clearing at approximately 1.5 km/day.

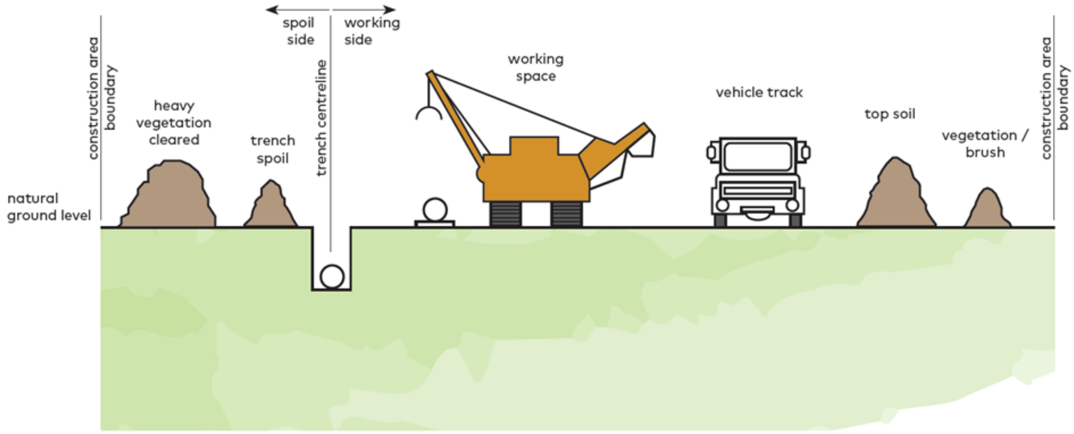

Figure 4.1 Construction ROW layout

HDD will be used for the crossing of selected watercourses, or other features of high sensitivity, where standard open cut methods are less desirable. HDD may also be used for road crossings as an alternative to boring. Horizontal boring (also referred to as thrust boring or micro-tunnelling) involves construction of a horizontal bore hole for installation of the pipeline beneath surface features which typically cannot be open cut, such as sealed roads and underground services.

There is potential for some works to encounter potentially acid sulphate soils when trenching in the Wallis Creek flood plain (around alignment KP 13.1 to 14.3 and KP 18.0), however given the location and distance to receptors (greater than 300 m), as well as management measures outlined in Section 6, odour impacts from these areas are not anticipated.

There would also be potential for odour from excavation activities during works at the former poultry farm located at KP 2.5 – 4.4, on the southern side of John Renshaw Drive. While the alignment does not traverse known dead pits, there may be other sources of odour (like buried waste) encountered during construction.

As most construction activities will move along the alignment, the potential for dust impacts would be minimised, as works would be undertaken near to a sensitive receptor for a limited time only, providing the work area is reinstated as soon as reasonably possible.

4.2.2 Emissions inventory

The potential impacts of construction of the transmission pipeline were assessed based on a 30 m wide construction footprint (compared to the proposed 25 m wide construction footprint) undergoing earthworks and activities typical of pipeline construction, to be conservative. Dust emissions for each construction area have been calculated using generic emission factors for a range of typical construction activities, published in the *Western Regional Air Partnership Fugitive Dust Handbook* (WRAP) (Countess Environmental, 2006) and the National Pollutant Inventory (NPI) *Emission estimation technique manual for mining version 3.1* (NPI manual) (2012).

Fine particle emissions associated with exhausts from vehicles and plant used during construction activities are accounted for in the emission factors for earthmoving and handling used in the assessment. Exhaust emissions during construction are expected to be discontinuous, transient, and mobile.

Total suspended particles and dust deposition is usually assessed against annual criteria however, these criteria are less relevant to the Project as construction works would be transient. The primary emission of concern during the construction phase was found to be dust as PM_{10}, as described in Section 5. As a result, for this Project, air quality was assessed in terms of distances at which the relevant criteria are achieved at any time.

Modelled construction surface area dimensions for construction activities are provided in Table 4.2. The construction surface area dimensions are based on the following:

- Unpaved roads include heavy and light vehicles along the ROW where other general construction activities are not being undertaken, or on local unpaved roads used to access the ROW. As unpaved roads can be located anywhere within the ROW, they have been conservatively modelled with dimensions 10 m (width) based on a 6 m lane width and 100 m (length). Vehicle emissions have been calculated assuming a maximum of 70 light vehicles and 12 heavy vehicles per working day (6am to 6pm). A 50% reduction has been applied to the vehicle emission factors due to watering (Table 4 NPI manual, level 1 watering).

- General construction activities along the transmission pipeline have been modelled as 30 m (width) by 100 m (length) areas along the alignment. The 30 m width has been modelled based on a conservative estimate of the width of the construction footprint (recorded as 25 m in the EIS). The 100 m length has been modelled based on an assumed minimum rate of construction for the pipeline.
- The storage pipeline has been modelled as a general construction activity with dimensions 180 m (width) by 200 m (length). The 180 m (width) has been modelled based on a conservative estimate of the construction footprint (recorded as 175 m in the EIS). The 200 m length has been modelled based on the minimum rate of construction for the pipeline (200 m/day for the storage pipeline).
- Fixed construction activities, such has HDD sites, truck turnaround areas, blasting and trenched/bored crossings have been modelled as 20 m (width) by 50 m (length) areas. The areas are based on the worst-case impact footprints associated with each activity.
- The compressor and delivery stations have been modelled as 100 m (width) by 100 m (length) areas based on an estimated maximum intensive work area on any one day. The JGN offtake and delivery stations have been similarly assessed.
- Vegetation stockpiles have been modelled as 50 m (width) by 50 m (length) areas based on the worst-case impact footprints associated with the activity.
- Pipe stockpiles have been modelled as 90 m (width) by 320 m (length) areas based on the worst-case impact footprints associated with the activity.

Table 4.2 Modelled construction dimensions for the dust impact assessment

Construction area emission source	Width (m)	Length (m)
Heavy and light vehicles along unpaved roads	10	100
General construction activities along pipeline alignment, access road construction	30	100
Storage pipeline	180	200
Fixed construction dust activities: Horizontal directional drilling Truck turnaround areas Temporary workplaces Trenched/bored crossings	20	50
Compressor and delivery stations and JGN offtake and delivery facilities	100	100
Vegetation stockpiles	50	50
Pipe stockpiles	90	320

The dust emission factors used in the construction assessment are provided in Table 4.3. The PM_{10} emission factors have been sourced directly from literature, and the following assumptions were made for TSP and $PM_{2.5}$ emission factors:

- PM_{10}/ TSP ratio assumed to be a factor of 0.5 (from NPI Mining assumed factor for excavators and front end loaders operating on overburden (0.47) and wind erosion (0.5))
- $PM_{2.5}/PM_{10}$ ratio assumed to be 0.1 (from WRAP, Section 3.3.1)

Emission factor for vehicles travelling on unpaved roads include a 50% reduction factor assuming that level 1 watering (2 litres/m^2/h) would be undertaken as required during construction.

Table 4.3 Dust emission factors for construction activities

Construction activity	Particle size emission factors			Unit	Source
	PM_{10}	Total suspended particles (TSP)	$PM_{2.5}$		
General and fixed construction activities	9.51E-06	1.90E-05	9.51E-07	$g/m^2/s$	Table 3-2, WRAP (Level 1, average conditions)
Stockpile erosion	5.56E-06	1.11E-05	5.56E-06	$g/m^2/s$	Table 2, NPI manual – wind erosion
Light vehicles travelling along unpaved roads (level 1 watering)	5.35E-05	1.07E-04	5.35E-06	$g/m^2/s$	Table 2, NPI manual – wheel generated dust from unpaved roads (used by light vehicles)
Heavy vehicles travelling along unpaved roads (level 1 watering)	3.47E-05	6.94E-05	3.47E-06	$g/m^2/s$	Table 2, NPI manual – wheel generated dust from unpaved roads at industrial sites

4.3 Operational emissions

4.3.1 Operational overview

A limited range of activities will be required to operate the Project. A routine inspection and maintenance program will be implemented for the transmission and storage pipelines during the operation of the Project. Inspection of the easements for issues such as erosion, weeds, subsidence, revegetation and unauthorised third party activity will be undertaken on a regular basis by ground and aerial patrols.

Aerial patrols of the pipelines will typically be undertaken monthly with ground patrols conducted annually. Ground patrols of the easement will be generally undertaken by travelling along accessible sections of the easement in light vehicles.

Ongoing activities to maintain pipeline integrity will include mainline valve and scraper station inspection and maintenance, cathodic protection surveys and scheduled internal pipeline inspections.

Monitoring of mainline vales and scraper stations will typically occur monthly, or more frequently where required, where they will be tested to ensure they operate correctly, and the fenced compound maintained.

Inspection of the CP system will typically be undertaken annually in accordance with AS2832.

Pigging of the transmission pipeline will be undertaken at a low frequency of approximately every 5 to 10 years. Minor amounts of gas will be vented during pigging activities to depressurise the PIG launcher/receiver.

The compressor station is electrified and will have no combustion emissions. As such air quality impacts are expected to be negligible.

4.3.2 Operational emissions

The surface infrastructure (other than water bath heaters as discussed below) are not expected to generate significant air quality emissions as part of general operations. Venting events from scraper stations during pigging will involve the release of methane into the ambient atmosphere. However, these events will be infrequent (once every 10 years) and short term in duration.

Maintenance testing of the storage pipeline will be completed once every 5-7 years and will require some gas venting. Prior to testing, approximately 99% of the gas held in the storage pipeline will be transferred to the HPP or into the SNP. The subsequent reduction in storage pipeline pressure will prevent all stored gas from being transferred, and a residual volume of gas will remain in the storage pipeline. This residual volume of gas is proposed to be vented using a standard vertical vent located adjacent to the above ground connection header assembly. The duration of venting will be approximately 6-8 hours for each primary loop of the storage pipeline.

Emergency venting of the transmission pipeline via apparatus at the MLV would only be required during an emergency event and is therefore not expected happen during the lifetime of the Project. Fugitive emissions of methane and carbon dioxide from pipeline operations are estimated and included in the greenhouse gas technical report. No flaring of fugitive gases is assumed to occur.

Combustion emissions during operation of the delivery station are expected from water bath heaters. When the delivery station is operating and natural gas is being supplied to the HPP, there will be a maximum of 2 water bath heaters operating at 50% capacity each. A comparison has been undertaken of these based on natural gas use of the HPP.

When the HPP is operating on natural gas the water bath heaters consume a maximum of about 32.4 GJ/hr of natural gas. This makes up less than 0.5% of the energy consumption of the HPP when operating on natural gas at maximum load consuming 7,298 GJ/hr (Jacobs 2021, Table 15.12), as described in Table 4.4. When the HPP is not operating on natural gas, the water bath heaters operate in standby mode consuming a minor quantity of natural gas.

The assessment report for the HPP EIS (DPIE 2021, p v) notes that air quality modelling indicates that there would only be a minor incremental increase in ambient concentrations of key air pollutants at sensitive receivers around the site, and that modelling conservatively assumed that the HPP was operating throughout the entire year. As such, the minor emissions from combustion of natural gas during operation of the delivery station are not expected to lead to any material increase in cumulative air quality impacts at sensitive receptors when the HPP is operating.

Table 4.4 Maximum natural gas consumption comparison between the delivery station and the Hunter Power Project

Site	Annual energy consumption (GJ)	Operational hours per year (h)	Energy consumption (GJ/h)
HPP - natural gas combustion in gas turbine	6,393,121	876	7298
Delivery station water bath heaters - operating	28.382	876	32.4
Delivery station water bath heaters – stand-by mode	11.038	7,884	1.4

The compressor station is electrically driven, so no gas combustion emissions will occur from this component of the Project.

Operational air quality impacts from the Project are not anticipated and are not discussed further in this report.

5. Predicted impacts

A screening level assessment was undertaken with consideration of the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016). The predicted worst-case PM_{10}, $PM_{2.5}$ and TSP concentrations are presented below as concentration versus distance graphs for the following scenarios:

- Scenario 1: Combined light and heavy vehicles on unpaved roads
- Scenario 2: General construction of transmission pipeline and light vehicles on unpaved roads
- Scenario 3: General construction of storage pipeline
- Scenario 4: Fixed construction

- Scenario 5: General construction of associated surface facilities Scenario 6: Vegetation stockpiles
- Scenario 7: Pipe stockpiles

Daily concentrations are presented for all scenarios. Annual concentrations are provided for scenarios 3, 4, 5, 6 and 7 as the remaining activities will be short term in duration at any one location.

The calculations consider a 24-hour background PM_{10} dust level of 20.0 µg/m^3 and an annual background of 18.3 µg/m^3. The predictions are based on 2020 recordings from the DPIE Beresfield AQMS. The most recent full year has been used for this assessment as the 2018 and 2019 were affected by bushfires and had significantly increased concentrations. The values used are considered worst case and actual daily cumulative levels would depend on background dust levels and local meteorology on any given day.

5.1 Dispersion modelling

Dispersion modelling was undertaken using Ausplume version 6.0, a Gaussian plume dispersion model developed by the Victorian EPA[1] to assess the impact of airborne pollutants by predicting downwind concentrations for the model inputs representative of pollutant emissions at a given physical site under a range of hourly varying meteorological conditions over a period of a year or more. Features of the model include: building downwash (the effect of buildings in causing a plume to be dragged down to ground level where it can impact an area); area, line and volume sources; plume rise as a function of downwind distance; and terrain adjustment. Ausplume is the approved regulatory dispersion model in NSW.

5.2 Model configuration

Ausplume was configured to model the situation using the estimated emissions, relevant physical site characteristics and worst-case meteorological data. Key components of the model configuration are summarised below:

- A worst-case screening meteorological dataset prepared in accordance with the Approved Methods
- Horizontal dispersion was parameterised according to equations for the Pasquill-Gifford curves
- Averaging time period of 24-hour and all hours (annual)
- A surface roughness height of 0.1 m (flat rural)
- Emissions were modelled as area sources between the construction hours of 6am to 6pm.

5.3 Results

5.3.1 Scenario 1: Combined light and heavy vehicles on unpaved roads

The results for scenario 1 are shown in Figure 5.1. The results indicate that the daily PM_{10} criteria and $PM_{2.5}$ criteria are met at 230 m and 20 m respectively from the construction footprint.

Heavy and light vehicles combined will have most significant impact on access tracks. The nearest sensitive receptors to the access tracks proposed for non-restricted use have been identified as R24 at a distance of 110 m and R27 at a distance of 190 m. Based on conservative assumptions, the dust criteria would not be met at these sensitive receptors, without additional mitigation which is discussed below and in Section 6.

The nearest sensitive receptor to the access track used to access the storage pipeline construction footprint is R04, at a distance of 365m at the closest point. The dust criteria is met at this residence.

The dust criteria is also predicted to be met for all other sensitive receptors in the study area.

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[4] http://www.epa.vic.gov.au/air/epa/ausplume-pub391.asp

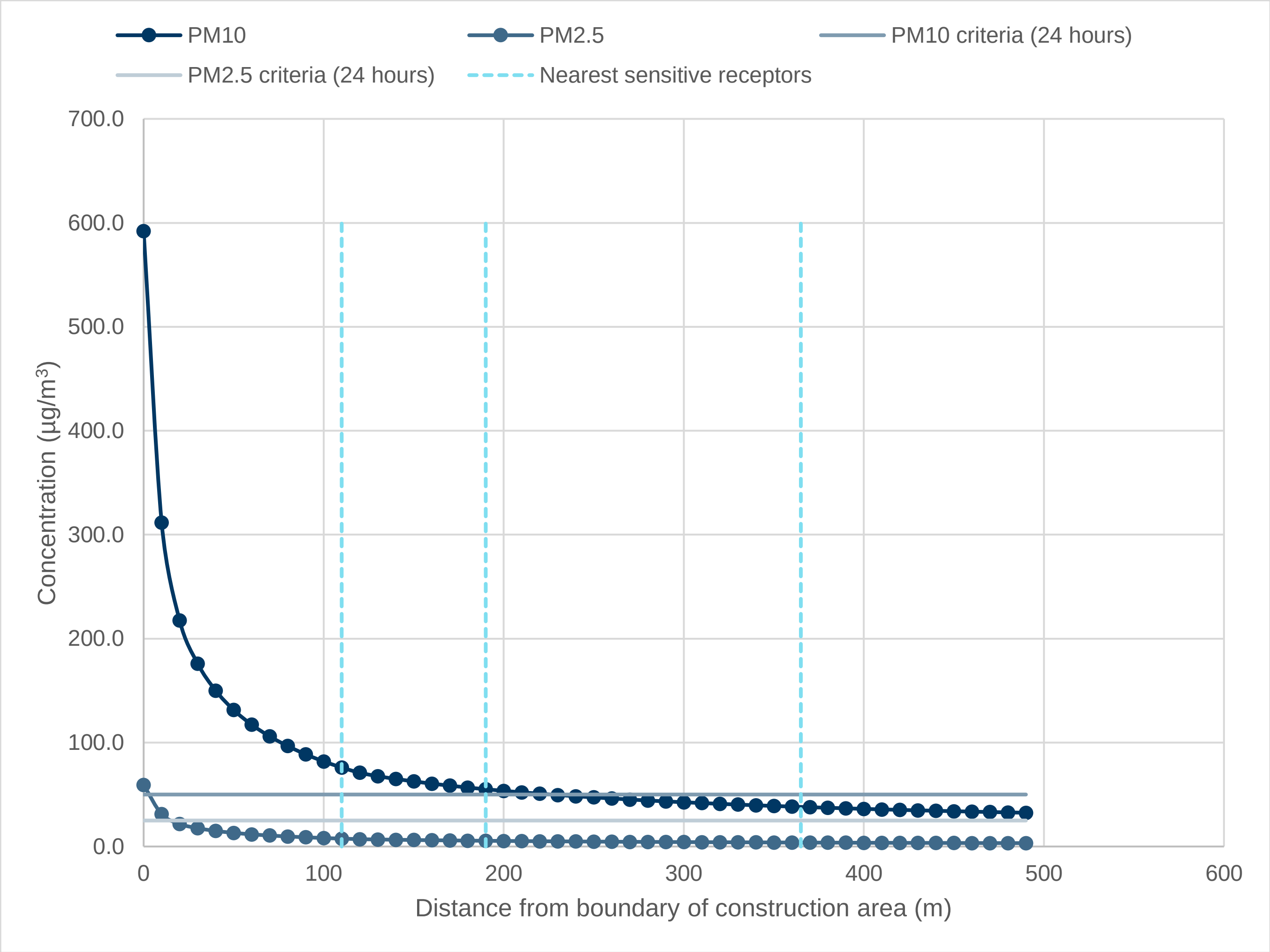

Figure 5.1 ***Scenario 1: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m³) with distance (m) from boundary of construction area (including background) (level 1 watering)***

As the PM_{10} criteria is not met at the nearest sensitive receptors (R24 and R27), modelling has been completed for level 2 watering (>2 litres/m²/h), which is a 75 per cent reduction factor applied to the emission factor.

This increase in watering reduces the potential impact and the results shown in Figure 5.2 indicate that the daily PM_{10} criteria and $PM_{2.5}$ criteria are met at 110 m and 10 m respectively from the construction area. As such, additional watering should be applied during work near the nearest sensitive receptors (R24 and R27) to meet the dust criteria at this location. More details of this additional dust mitigation are provided in Section 6.

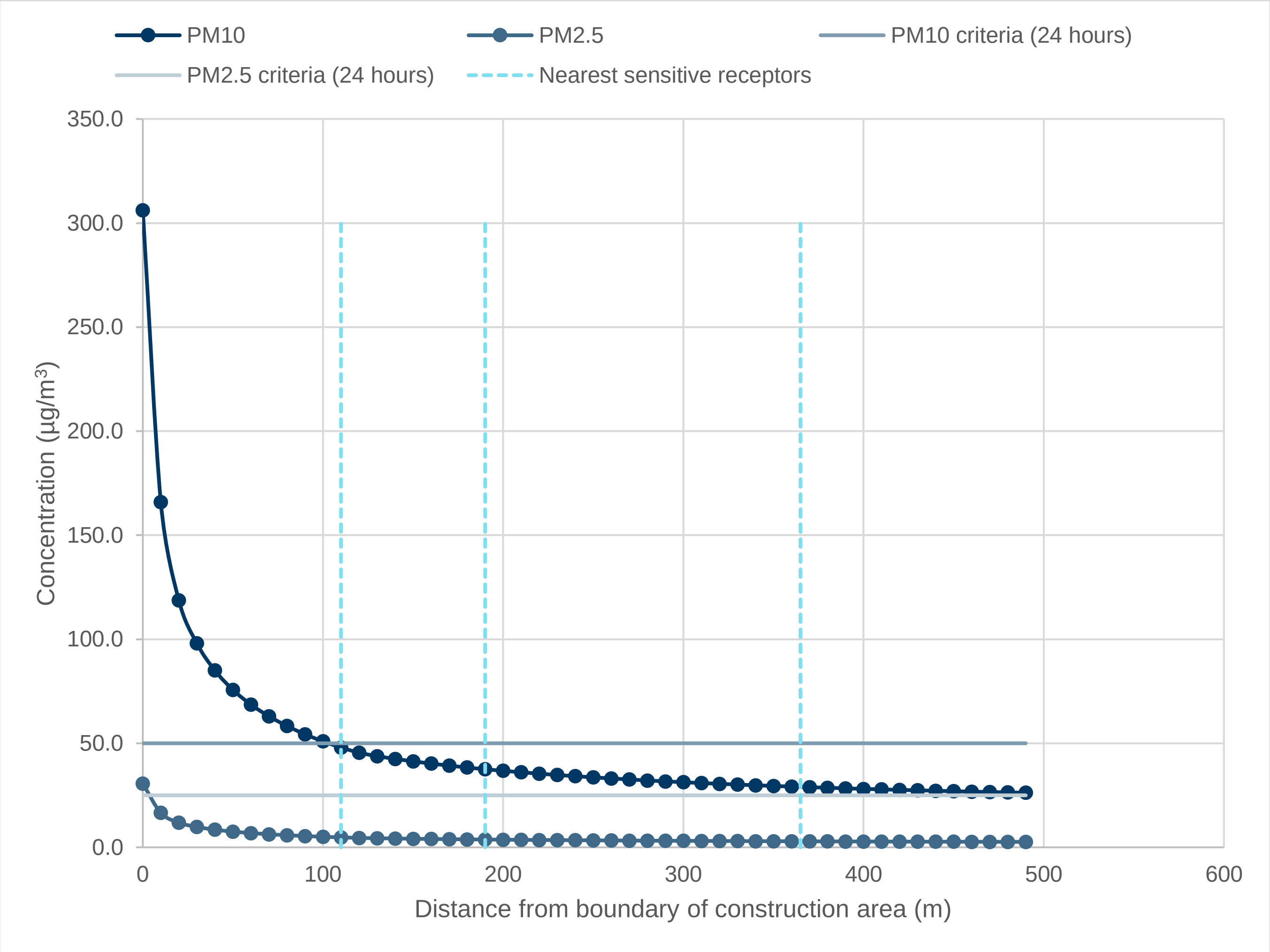

Figure 5.2 ***Scenario 1: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m³) with distance (m) from boundary of construction area (including background) (level 2 watering)***

The access track which connects Valley View Lane to the transmission pipeline construction footprint at KP 13.2 is proposed for restricted use during wet conditions when the access tracks crossing Buttai Creek and Wallis Creek may not be useable. In this situation the Valley View Lane access track may be used provide access to the HDD entry and exit points for the trenchless crossings of Buttai Creek and Wallis Creek respectively, and the transmission pipeline construction footprint between Buttai Creek and Wallis Creek.

As a reduced number of vehicles is proposed for use on this access track it has been assessed separately assuming 23 light vehicle and 5 heavy vehicle movements per day. The results indicated that with level 1 watering, the daily PM_{10} criteria is met at 80 m and daily $PM_{2.5}$ criteria is met at all distances. The nearest sensitive receptor is R25 which is 50 m from the access track and as such dust criteria would not be met at this sensitive receptor. With level 2 watering, the daily PM_{10} criteria is met at 30 m from the access track, hence the dust criteria would be met at this sensitive receptor. More details of this additional dust mitigation are provided in Section 6.

If use of the access track beyond the proposed restricted use is required then additional control measures, such as reduced speed limits or application of a dust control polymer, may be necessary.

5.3.2 Scenario 2: General construction of transmission pipeline and light vehicles on unpaved roads

The results for scenario 2 are shown in Figure 5.3. The results indicate that the daily PM_{10} criteria is met at 190 m and the $PM_{2.5}$ criteria is met at all distances from the construction area.

The nearest sensitive receptors from the ROW have been identified as R12 and R19 at a distance of 130 m and 170 m respectively from the ROW. Based on conservative assumptions, the dust criteria would not be met at these sensitive receptors without additional mitigation, which is discussed below and in Section 6. The next nearest receptor has been identified as R26 at a distance of 190 m from the ROW. The dust criteria is predicted to be met for this receptor and all other sensitive receptors in the study area.

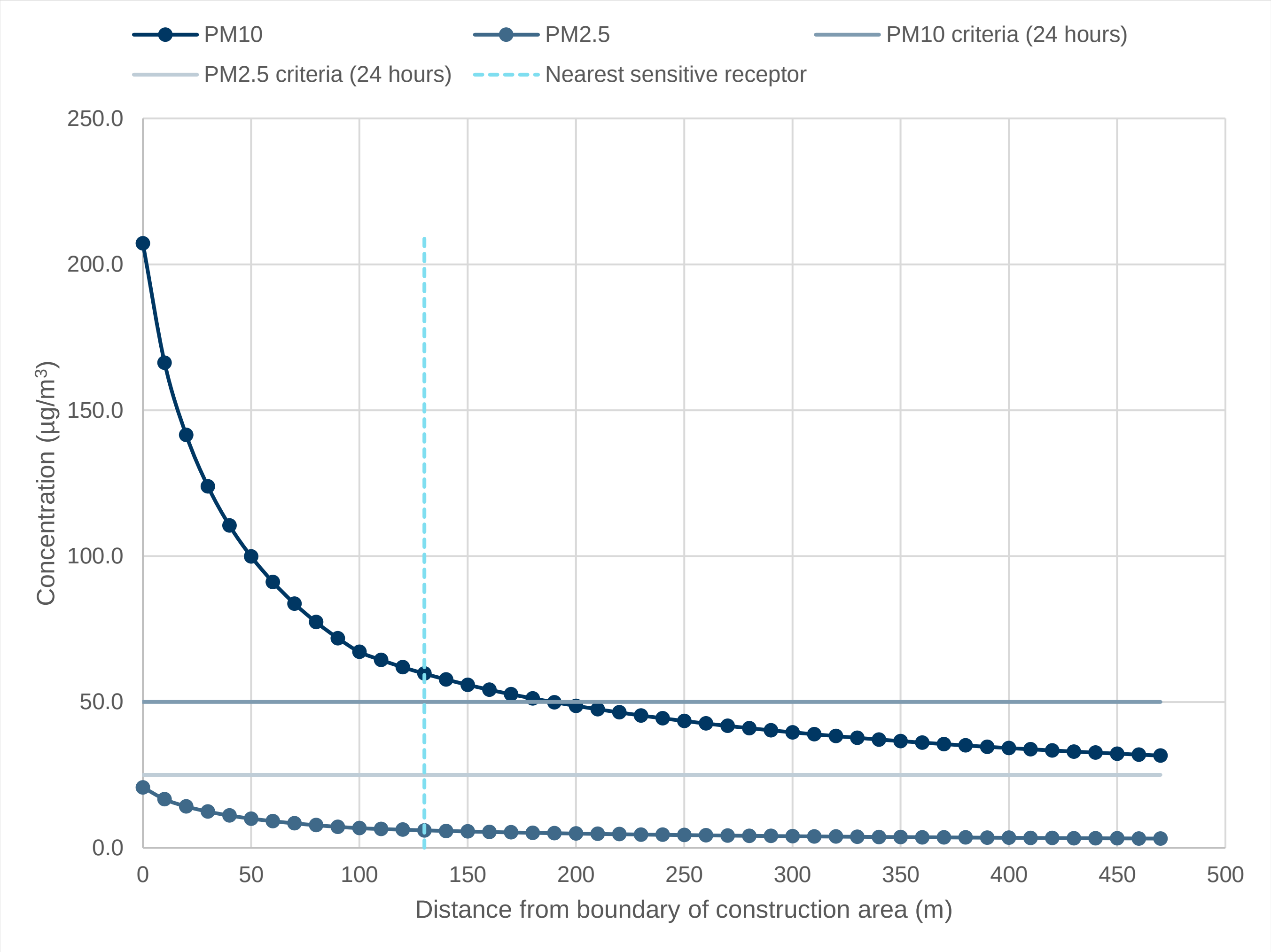

Figure 5.3 ***Scenario 2: Daily PM_{10} and $PM_{2.5}$ concentrations ($\mu g/m^3$) with distance (m) from boundary of construction area (including background) (level 1 watering)***

As the criteria is not met at the nearest sensitive receptor, modelling has been completed for level 2 watering (>2 litres/m^2/h), which is a 75 per cent reduction applied to the emission factor.

This increase in watering reduces the buffer radius and the results shown in Figure 5.4 indicate that the daily PM_{10} criteria is met at 110 m and the $PM_{2.5}$ criteria is met at all distances from the construction area. As such, additional watering should be applied during work near the nearest sensitive receptors (R12 and R19) to meet the dust criteria at these locations. More details of this additional dust mitigation are provided in Section 6.

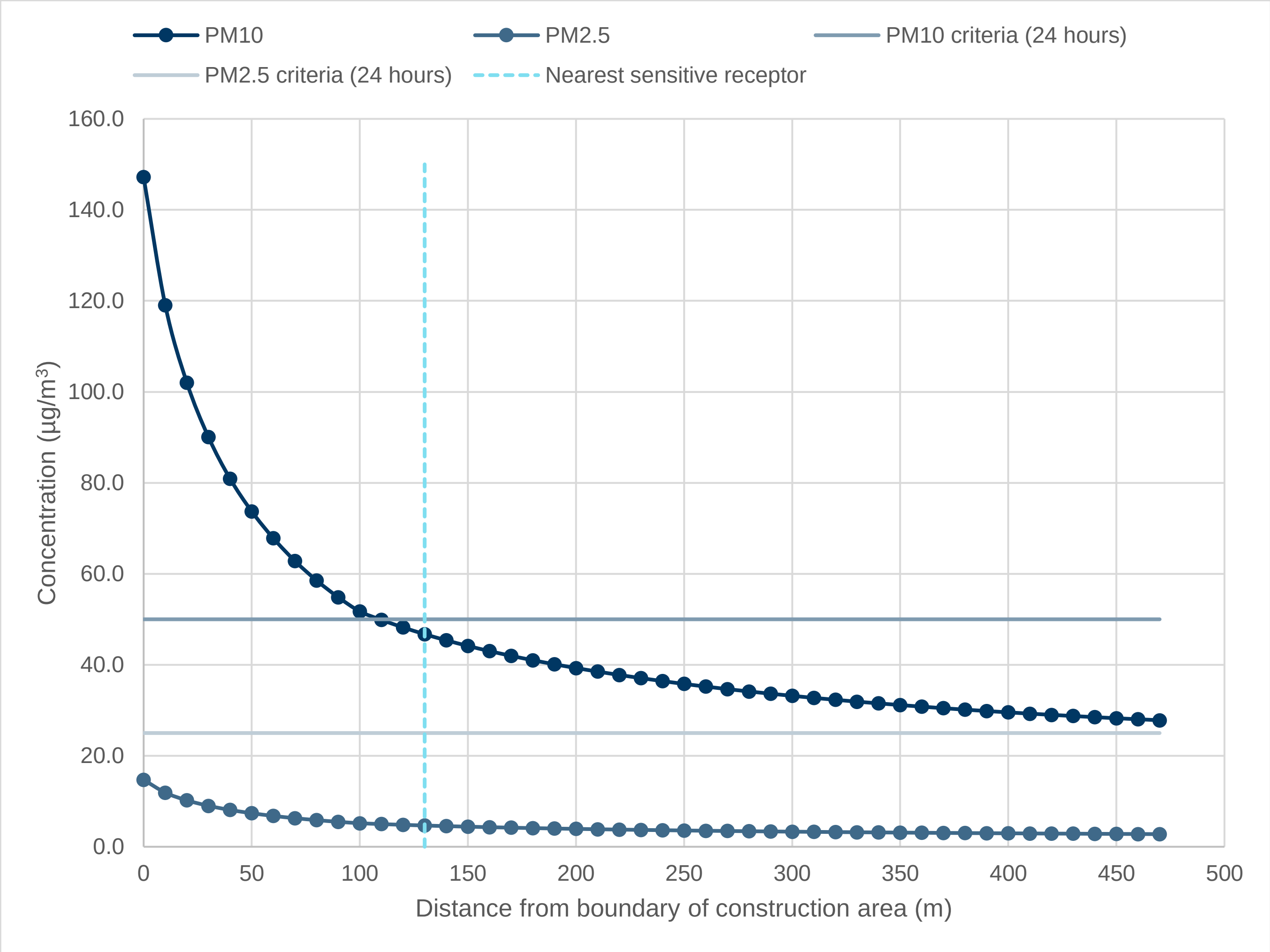

Figure 5.4 ***Scenario 2: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m³) with distance (m) from boundary of construction area (including background) (level 2 watering)***

5.3.3 Scenario 3: General construction of storage pipeline

The results for scenario 3 are shown in Figure 5.5 (daily) and Figure 5.6 (annual). The results indicate that the following:

- The daily PM_{10} criteria is met at 380 m from the construction area and $PM_{2.5}$ is met at all distances.
- The annual PM_{10} criteria is met at 10 m from the construction area and TSP and $PM_{2.5}$ criteria are met at all distances.

The nearest sensitive receptor to the construction area has been identified as R08 at a distance of 1600 m. Hence, both the daily and the annual dust criteria would be met at all sensitive receptors in the study area.

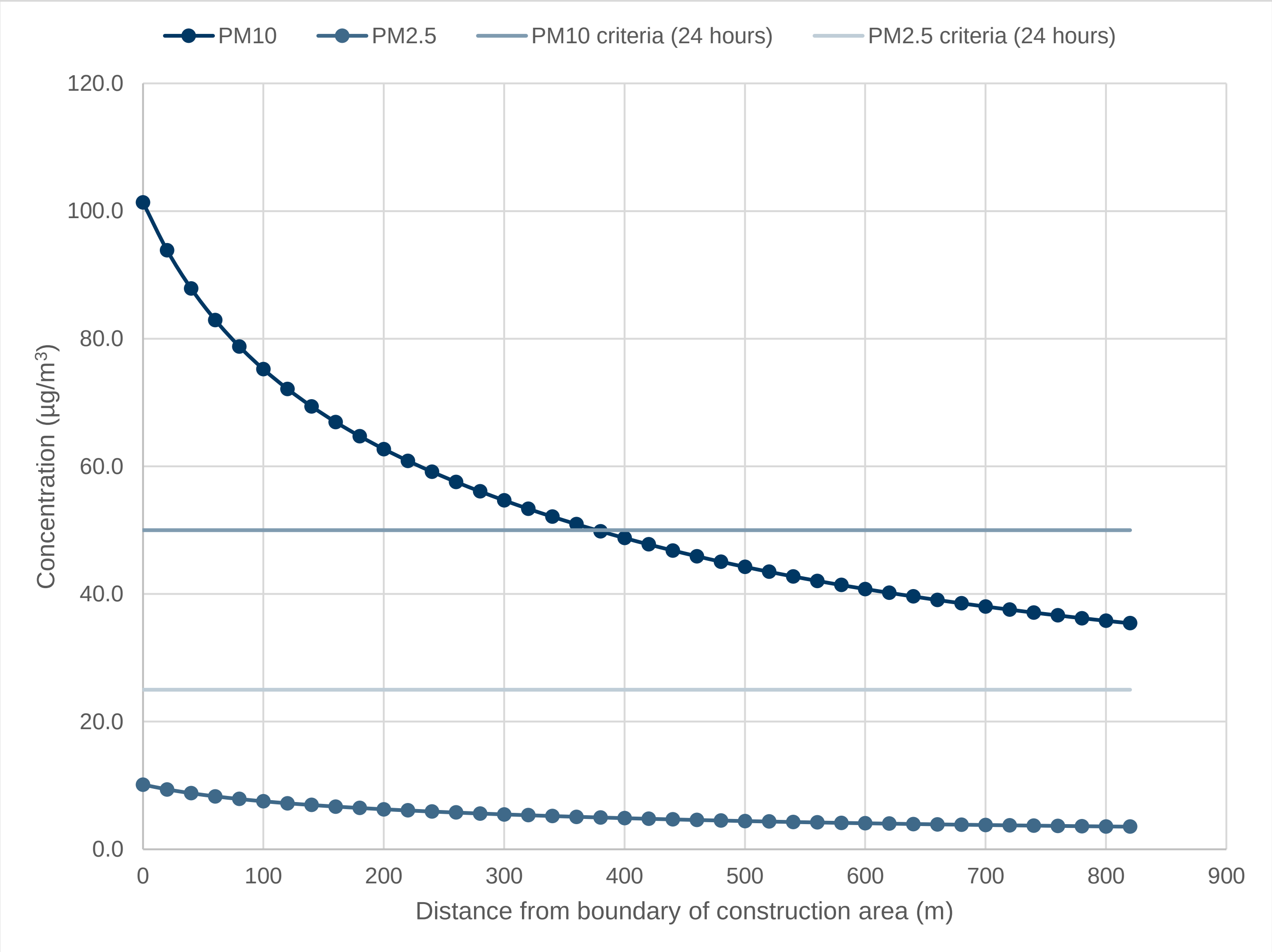

Figure 5.5 Scenario 3: Daily PM_{10} and $PM_{2.5}$ concentrations ($\mu g/m^3$) with distance (m) from boundary of construction area (including background)

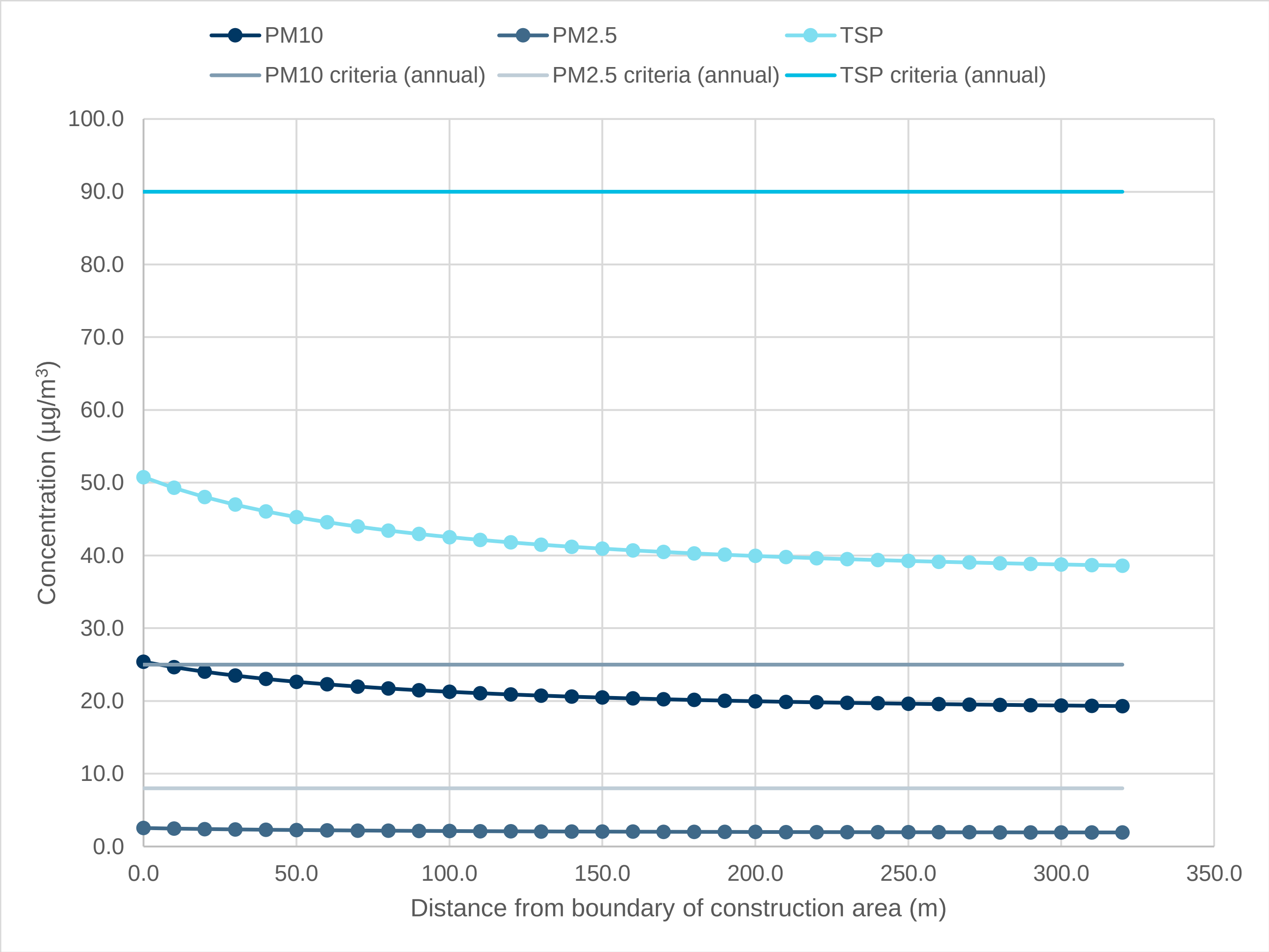

Figure 5.6 ***Scenario 3: Annual PM_{10}, $PM_{2.5}$ and TSP concentrations (µg/m³) with distance (m) from boundary of construction area (including background)***

5.3.4 Scenario 4: Fixed construction

The results for scenario 4 are shown in Figure 5.7 (daily) and Figure 5.8 (annual). The results indicate the following:

- The daily PM_{10} criteria is met at 30 m from the construction area and the daily $PM_{2.5}$ criteria is met at all distances.
- The annual PM_{10} criteria is met at 10 m from the stockpiles and the annual $PM_{2.5}$ and TSP criteria are met at all distances.

Fixed construction will occur at several locations along the ROW. The nearest sensitive receptor from the ROW has been identified as R12 at a distance of 130 m from the ROW. Hence, the dust criteria would be met at all sensitive receptors in the study area.

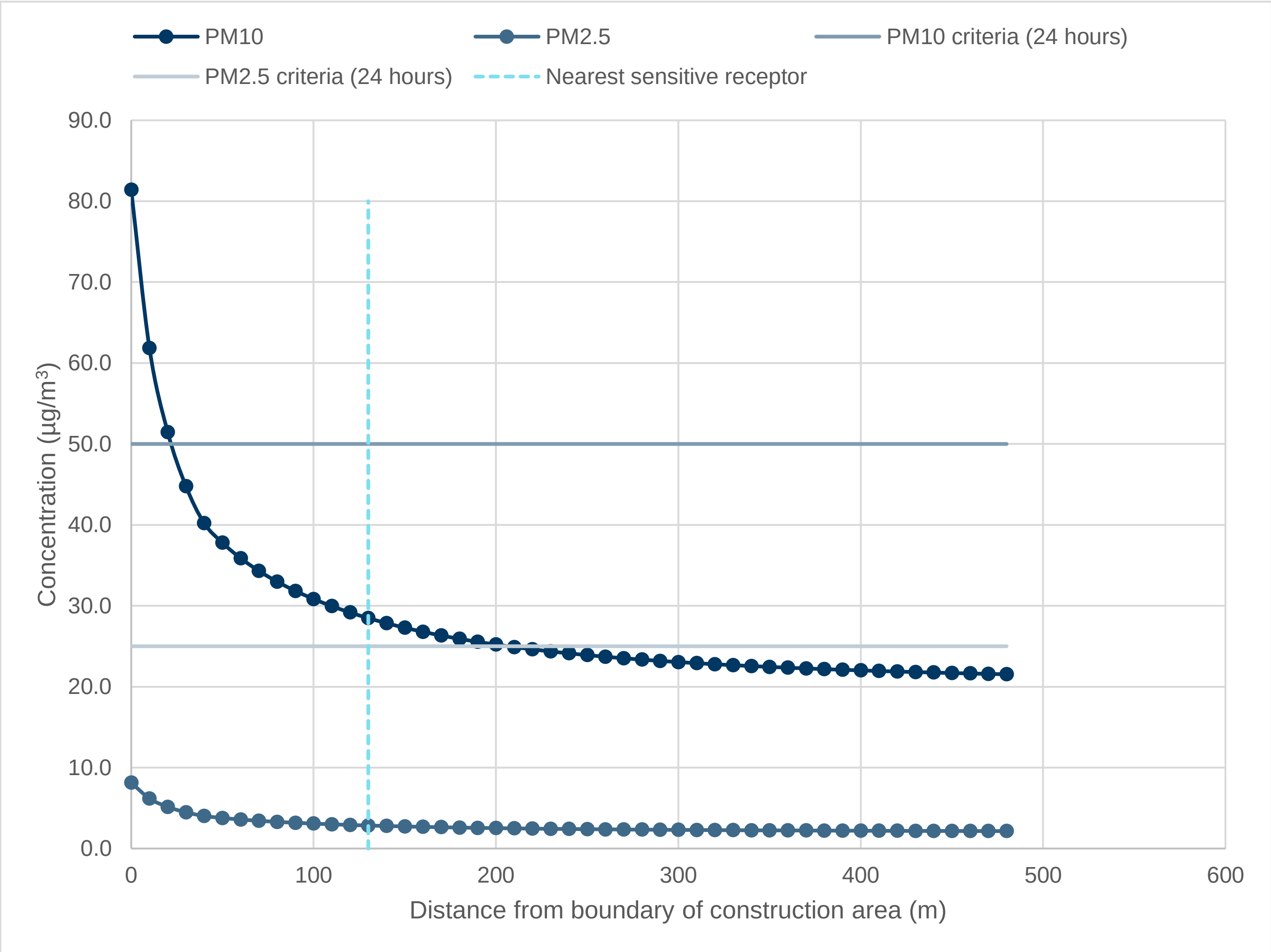

Figure 5.7 Scenario 4: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m³) with distance (m) from boundary of construction area (including background)

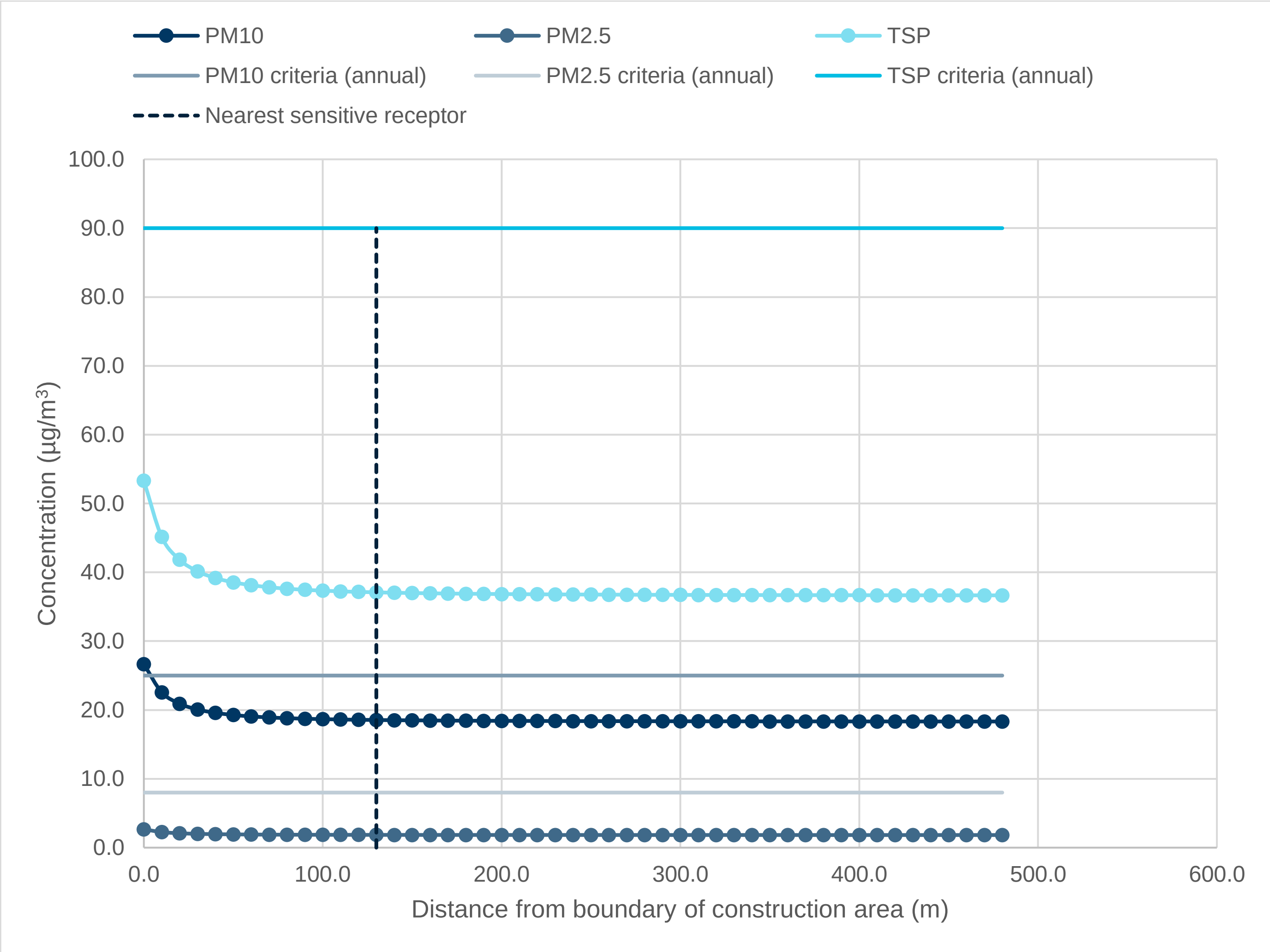

Figure 5.8 ***Scenario 4: Annual PM_{10}, $PM_{2.5}$ and TSP concentrations (µg/m^3) with distance (m) from boundary of construction area (including background)***

5.3.5 Scenario 5: General construction of associated surface facilities

Air emissions during construction of associated surface facilities (comprised of the compressor station, delivery station and JGN offtake facility) are assessed in this section. The JGN delivery facility, to be constructed by Jemena, has also been included in this assessment given it is adjacent to the JGN offtake facility.

The results for scenario 5 are shown in Figure 5.9 (daily) and Figure 5.10 (annual). The results indicate the following:

- The daily PM_{10} criteria is met at 160 m from the construction area and the daily $PM_{2.5}$ criteria is met at all distances.
- The annual PM_{10}, $PM_{2.5}$ and TSP criteria are met at all distances.

The nearest sensitive receptors to the compressor and delivery stations have been identified as R01 and R04, each at a distance of 800 m. Hence, both the daily and annual dust criteria would be met at all sensitive receptors in the study area.

The nearest sensitive receptor to the JGN offtake facility and JGN delivery facility is R26 at a distance of 240 m. Hence, both the daily and annual dust criteria would be met at all sensitive receptors in the study area.

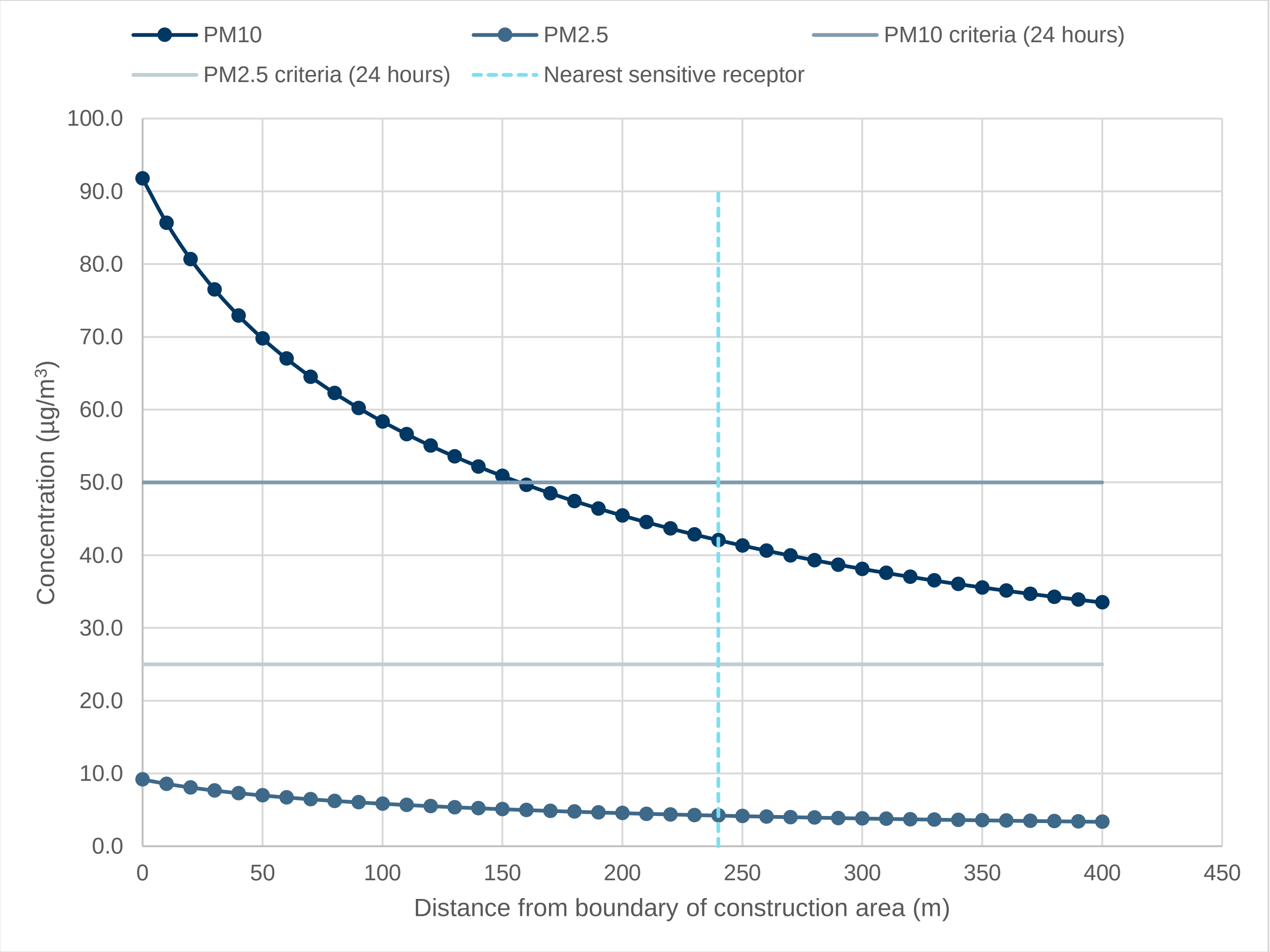

Figure 5.9 ***Scenario 5: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m^3) with distance (m) from boundary of construction area (including background)***

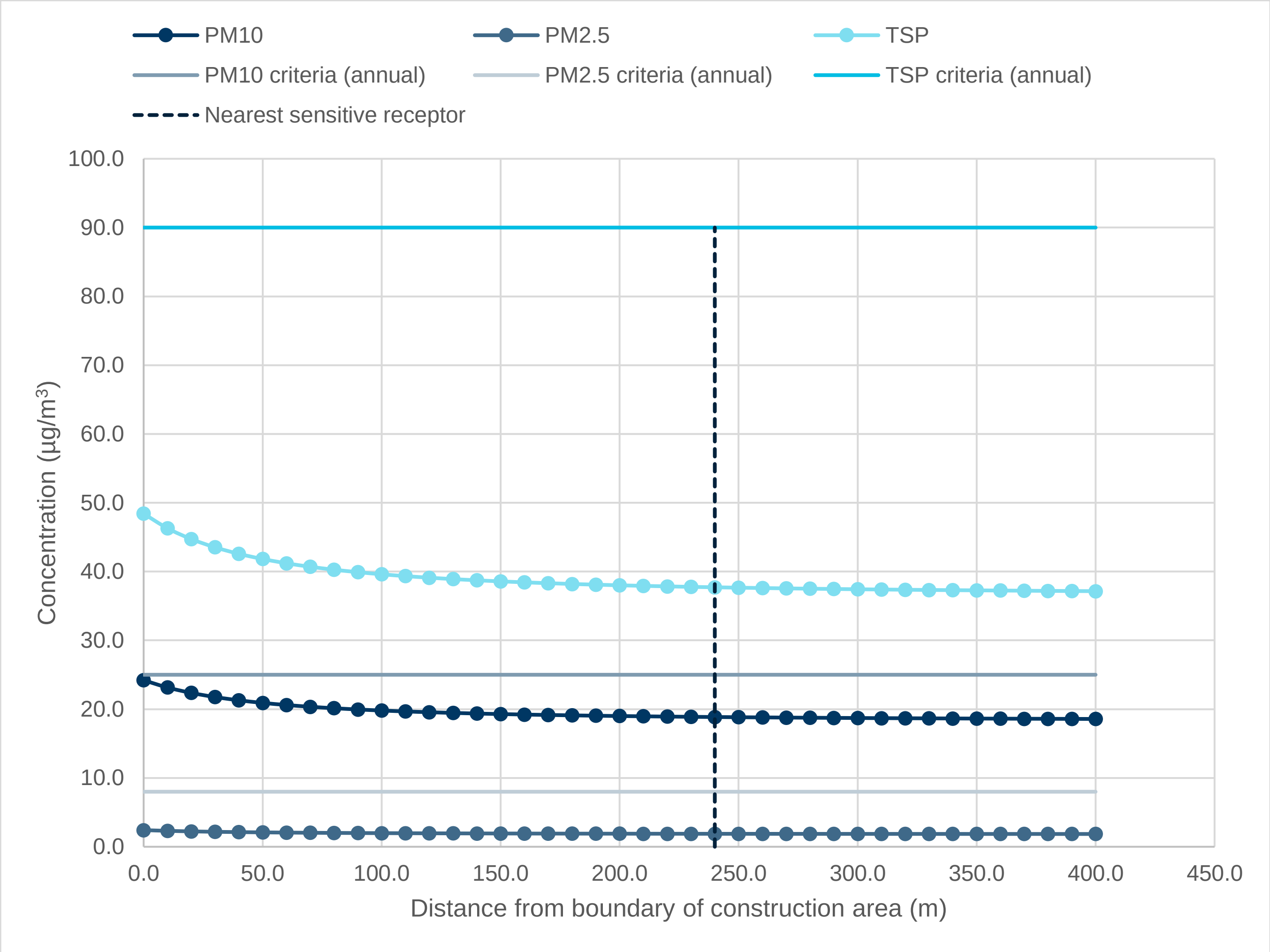

Figure 5.10 ***Scenario 5: Annual PM_{10}, $PM_{2.5}$ and TSP concentrations (µg/m³) with distance (m) from boundary of construction area (including background)***

5.3.6 Scenario 6: Vegetation stockpiles

The results for scenario 6 are shown in Figure 5.11 (daily) and Figure 5.12 (annual). The results indicate the following:

- The daily PM_{10} criteria is met at 20 m from the stockpiles and the daily $PM_{2.5}$ criteria is met at all distances.
- The annual PM_{10}, $PM_{2.5}$ and TSP criteria are met at all distances.

Vegetation stockpiles are located along the ROW, with the nearest distance to a sensitive receptor being 220 m from the stockpile at KP1.5. The nearest sensitive receptor to the ROW has been identified as R12 at a distance of 130 m from the ROW. Hence, both the daily and the annual dust criteria would be met at all sensitive receptors in the study area.

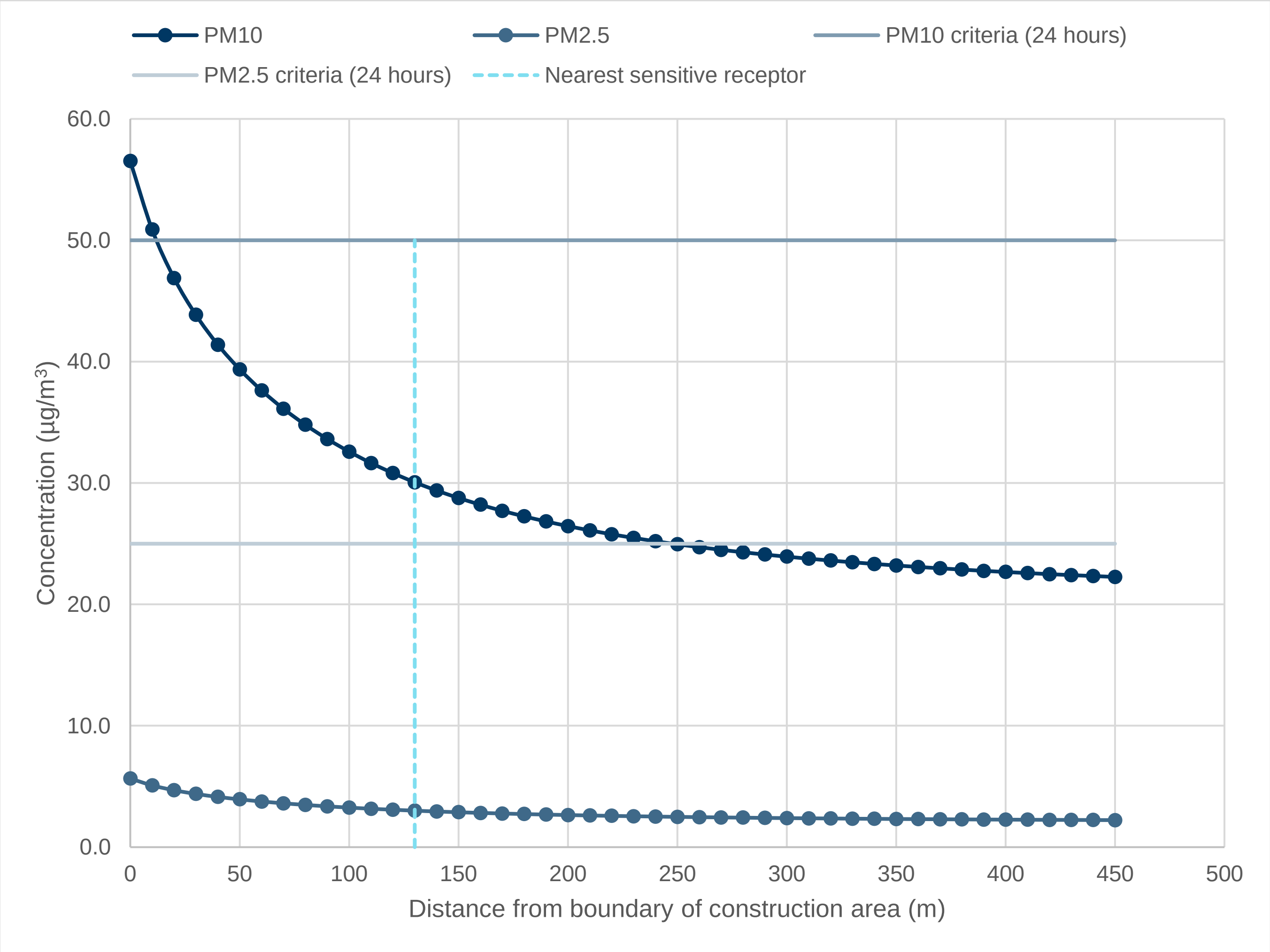

Figure 5.11 ***Scenario 6: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m³) with distance (m) from boundary of construction area (including background)***

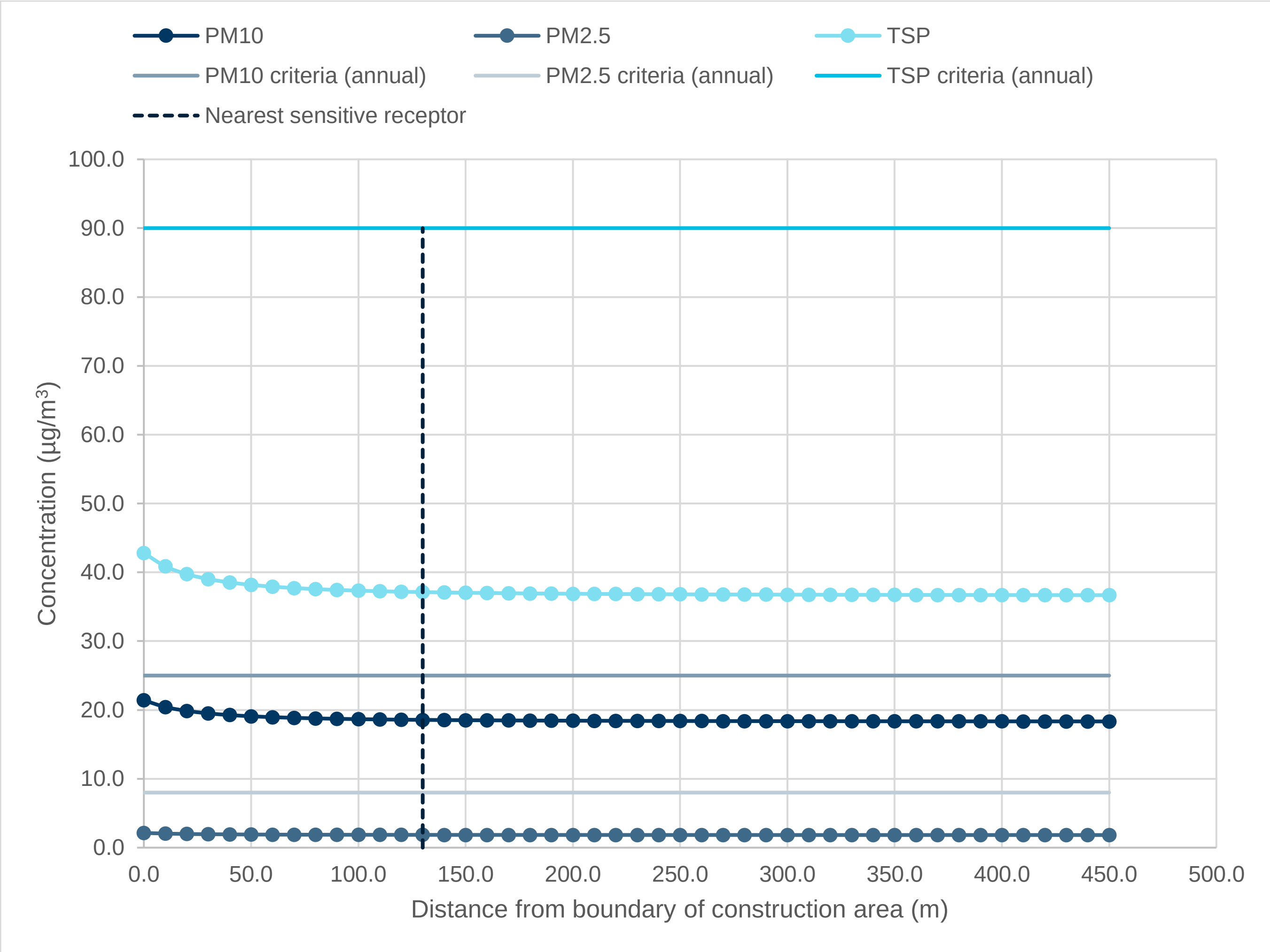

Figure 5.12 ***Scenario 6: Annual PM_{10}, $PM_{2.5}$ and TSP concentrations (µg/m^3) with distance (m) from boundary of construction area (including background)***

5.3.7 Scenario 7: Pipe stockpiles

The results for scenario 7 are shown in Figure 5.13 (daily) and Figure 5.14 (annual). The results indicate the following:

- The daily PM_{10} criteria is met at 80 m from the stockpiles and the daily $PM_{2.5}$ criteria is met at all distances.
- The annual PM_{10} criteria is met at 10 m from the stockpiles and the annual $PM_{2.5}$ and TSP criteria are met at all distances.

The nearest sensitive receptor from the pipe stockpiles has been identified as R01 (6 Dawes Avenue) at a distance of 430 m. Hence, both the daily and the annual dust criteria would be met at all sensitive receptors in the study area.

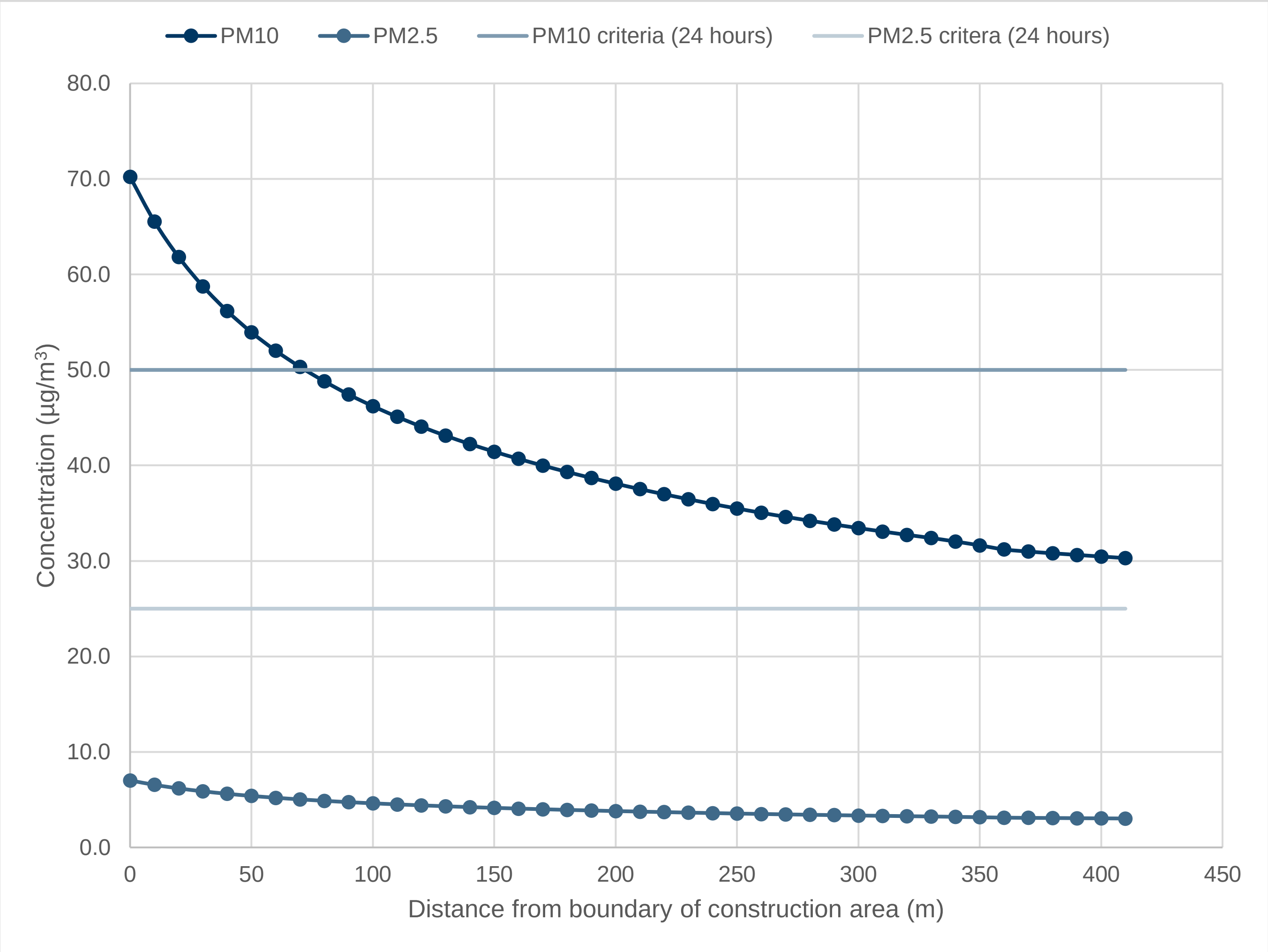

Figure 5.13 ***Scenario 7: Daily PM_{10} and $PM_{2.5}$ concentrations (µg/m^3) with distance (m) from boundary of construction area (including background)***

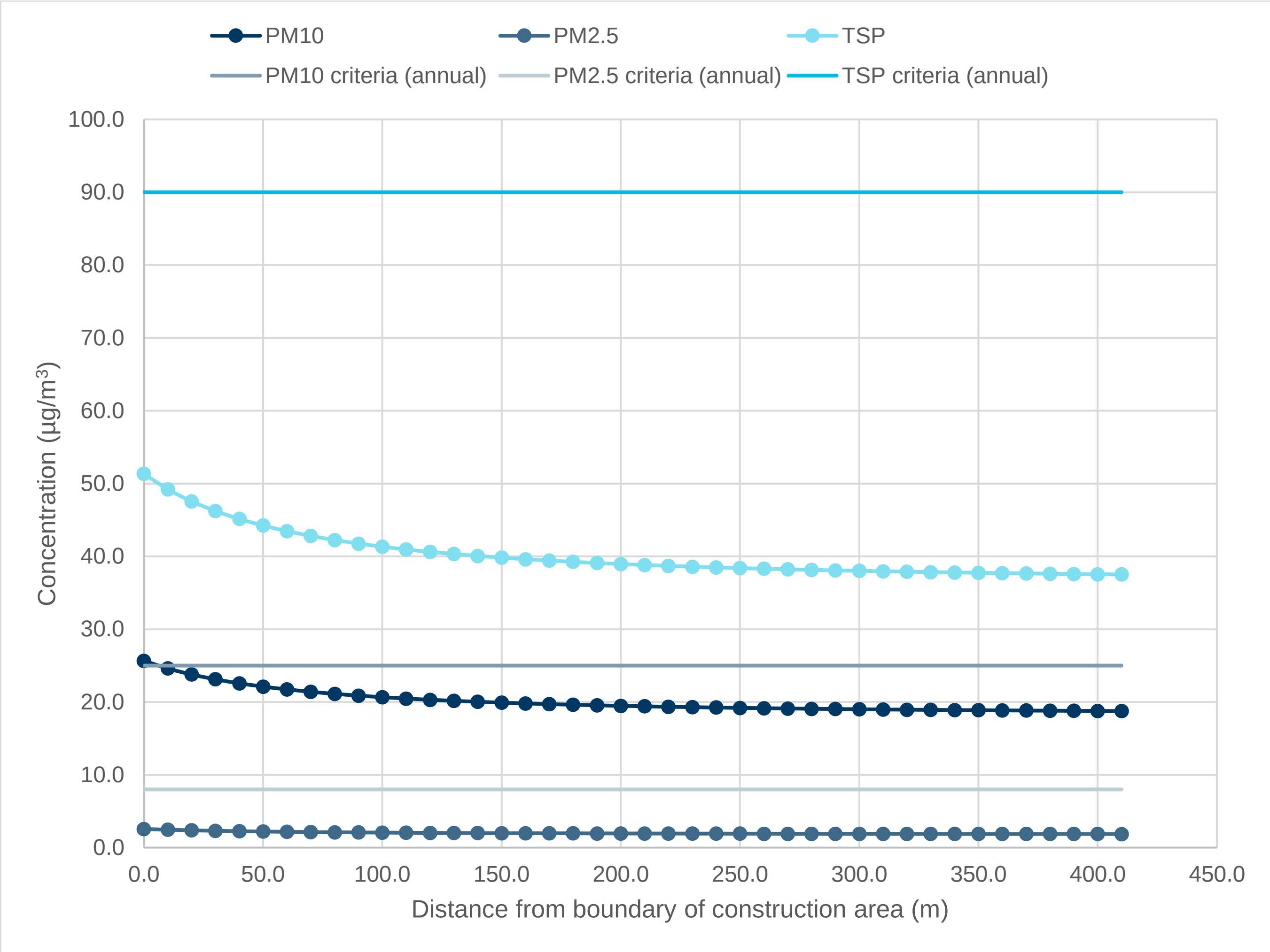

Figure 5.14 ***Scenario 7: Annual PM_{10}, $PM_{2.5}$ and TSP concentrations (µg/m³) with distance (m) from boundary of construction area (including background)***

5.4 Summary of impacts

5.4.1 Construction impacts

The air quality assessment indicates that PM_{10} is the critical constituent of interest. Where the PM_{10} criteria are met, the total suspended particles and $PM_{2.5}$ criteria are also met.

A summary of the assessment results and buffer distances is provided in Table 5.1.

Table 5.1 Summary of impacts of PM_{10}, $PM_{2.5}$ and TSP from each construction scenario

Scenario	Watering level	Buffer distance (m)					Nearest sensitive receptor (m)
		Daily		**Annual**			
		PM_{10}	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**	**TSP**	
1: light and heavy vehicles	Level 1	230	20				110
	Level 2	110	10				
2: transmission pipeline and light vehicles	Level 1	190	0				130
	Level 2	110	0				
3: storage pipeline	NA	380	0	10	0	0	1400
4: fixed construction	NA	30	0	0	0	0	130
5: compressor and delivery stations and JGN offtake and delivery facilities	NA	160	0	0	0	0	240
6: vegetation stockpiles	NA	20	0	0	0	0	220
7: pipe stockpiles	NA	80	0	10	0	0	450

Given the location and distance to receptors from potential sources of odour (acid sulphate soils and the old meat chicken farm), as well as management measures outlined in Section 6 odour impacts are not anticipated.

5.4.2 Operational impacts

A review of surface infrastructure operation and maintenance has been completed and operational air quality impacts (including odour) from the Project are not anticipated.

5.4.3 Cumulative impacts

There is a potential for cumulative air quality impacts where more than one modelled construction scenario is being undertaken in the same area simultaneously. Where cumulative impacts are expected to be significant, they have already been taken into account in the model. These are:

- Combined light and heavy vehicles on unpaved roads (Scenario 1).
- General construction of the transmission pipeline and light vehicle access (Scenario 2).

In other cases, cumulative impacts are not predicted to be significant due to:

- A 1 km general rate of construction along the transmission pipeline. The predicted buffer distances to meet the air quality criteria are significantly less than 1 km meaning the active work areas will quickly move beyond the distance where impacts may occur.
- Distance between different work crews.
- The transient nature of construction activities.

It is more likely that multiple construction activities may occur within overlapping construction buffer zones, such as stockpiles near construction sites. In these cases, the limiting (higher) buffer distances is considered applicable.

There may be additional future sensitive receptors in proximity to the project area such as residential subdivisions. There are currently no known residential developments proposed for construction at the same time and within 300 m of the project construction footprint.

The JGN offtake facility and JGN delivery facility are likely to be constructed simultaneously and they are adjacent to one another. The modelled construction area of 100x100 m is equivalent to the expected area of construction for both facilities combined, and thus the predicted dust impacts to 160 m reflect the potential cumulative impacts of simultaneous construction.

The Black Hill industrial estate is a proposed light industrial precinct (approximately 1x1.3 km area) to be constructed adjacent to the transmission pipeline (between KP1.4 and KP2.6). Approval has been granted for clearing of the entire estate area, excluding a buffer zone of Viney Creek, and significant clearing activities may be occurring simultaneously with construction of the transmission pipeline in this area. Coordinated mitigation measures may be required in this area if construction occurs simultaneously, particularly if simultaneous construction occurs in the south eastern section of the industrial estate as this is closest to sensitive receptors to the east of the M1 Pacific Motorway. Liaison with the Black Hill industrial estate project manager about management of cumulative dust impacts should be undertaken.

Simultaneous construction is likely to occur for the delivery station and compressor station, the KKPS and ongoing works for the smelter remediation project. The HPP EIS (Jacobs 2021 p288) notes that air quality impacts due to construction of the HPP and the adjacent aluminium smelter demolition and remediation project are expected to be insignificant and temporary. Standard construction site management techniques would be used to ensure dust is minimised and kept to acceptable levels at the Proposal Site boundary. Given the large separation distance between the compressor station and delivery station and nearest sensitive receptors (approximately 1000m to R01), and application of standard construction dust control techniques, it is similarly expected that no additional cumulative dust impacts at sensitive receptors will occur during simultaneous construction activities.

There are no other identified large construction projects in close proximity to the pipeline alignment that may contribute to cumulative air quality impacts including dust, odour and other pollutants.

During operation, potential emissions from the delivery station water bath heaters are assumed to be negligible and unlikely to lead to any cumulative air quality impacts when the HPP is operating.

6. Management and mitigation

6.1 General mitigation

General air quality mitigation and management measure for the Project are provided below:

- Preparation of a dust control protocol that forms part of the Construction Environmental Management Plan (CEMP) to detail management measures, a method for recording dust complaints and monitoring requirements. The DCP should include specific measures for works involving contamination, acid sulphate soils and other identified odorous material.
- Plant and equipment will be maintained in good condition to minimise ignition risk, spills and air emissions that may cause nuisance.
- Backfill and vegetate the pipeline construction area as quick as reasonable possible
- Dust suppression will be undertaken as required using water sprays, water extension agents, soil stabilising polymers or other media on:
  - Unpaved work areas subject to traffic or wind;
  - Sand, spoil and aggregate stockpiles; and
  - During the loading and unloading of dust generating materials.
  - Unpaved access tracks
- If the works are creating levels of dust which may significantly impact on residential amenity, the works will be modified or stopped until the dust hazard is reduced to an acceptable level.
- Construction vehicles with potential for loss of loads (such as dust or litter) will be covered when using public roads.

6.2 Specific dust mitigation

Based on the findings of the assessment, there is potential that there may be dust impacts at a number of receptors across the alignment during construction of the transmission pipeline. Receptors identified with highest risk of potential impacts are:

– Receptor 24 (463-457 Cessnock Rd) – 110 metres to an unpaved access track with light and heavy vehicle use
– Receptor 12 (532 Main Rd) – 130 metres from the ROW where there will be construction works and light and heavy vehicles
– Receptor 19 (2 Black Hill Rd) - 170 metres from the ROW where there will be construction works and light and heavy vehicles

As discussed in Section 5.3, due to the proximity of these receptors, additional watering (>2 litres/m^2/h) is recommended in project areas closes to these receptors.

The access track that connects Valley View Lane to the transmission pipeline construction footprint at KP 13.2 is approximately 50 m from Receptor 25. Use of this access track is proposed to be restricted to lower volumes of traffic (23 light vehicle and 5 heavy vehicle movements per day) during periods of wet weather. However level 2 watering is required to meet the daily PM_{10} criteria if dust is being generated. If use of the access track beyond restricted use is proposed, additional mitigation such as reduced speed limits or application of a dust control polymer may also be required.

Additional watering would only be required when works are in proximity to the specific receptors identified, dust is being generated and winds are blowing towards them. These areas are shown in Table 6.1.

Additional mitigation may be required between KP 1.3 and 2.6 if construction of the Black Hill industrial estate occurs simultaneously.

Table 6.1 Sections of the transmission pipeline ROW and access tracks where additional watering is required

Sensitive receptor ID	Sensitive receptor location	Location along transmission pipeline ROW	
R12	532 Main Rd	West of Main Rd, between KP 14.6 and 14.9.	
R19	2 Black Hill Rd	Near the eastern end of the ROW, between KP 1.5 and 1.7.	
R24	463-457 Cessnock Rd (residential cluster)	Approximately 180 m along access track from Cessnock Rd intersection.	

Sensitive receptor ID	Sensitive receptor location	Location along transmission pipeline ROW	
R25	Valley View Ln (residential cluster)	Approximately 120 m along southern end Buttai Creek access track near KP 13.2 from Valley View Lane.	
R27	21-25 Black Hill Rd (residential cluster)	Entire access track at KP 0.4.	

7. Conclusion

An air quality impact assessment of the proposed construction and operation of the Kurri Kurri Lateral Pipeline has been undertaken.

Operational air quality impacts from the Project were not deemed to be significant.

Construction air quality impacts were modelled and assessed for typical construction scenarios. Dust impacts from construction activities have been assessed on the basis of worst case meteorological conditions over a full year, however it is important to note that most construction activities are mobile, transient and intermittent and likely to take place over a shorter period than one year.

The assessment recommends the following separation distances to protect sensitive receptors from ground-level PM_{10} concentrations that may exceed the assessment criteria during construction:

- 230 m for combined light and heavy vehicles on unpaved roads – reduced to 110 m with additional watering
- 190 m for the transmission pipeline and light vehicles on unpaved roads – reduced to 110 m with additional watering
- 380 m for the storage pipeline
- 30 m for fixed construction
- 160 m for the compressor and delivery stations, and JGN delivery and offtake facilities
- 20 m for vegetation stockpiles
- 80 m for pipe stockpiles.

Implementation of further mitigation and management measures to minimise dust will reduce these buffer distances.

Additional mitigation, in the form of watering, is recommended when works are adjacent to four residential receptors along the alignment in order to comply with daily PM_{10} criteria. Additional watering would only likely be required when wind was blowing from the worksite towards these receptors.

The residual air quality risks associated with the Project are minor.

8. References

Australian Government, Department of Agriculture, Water and the Environment (2021) *NPI data.* www.npi.gov.au/npi-data accessed October 2021.

Bureau of Meteorology (2021) *Climate Data Online*. http://www.bom.gov.au/ accessed October 2021.

Countess Environmental (2006). *Western Regional Air Partnership Fugitive Dust Handbook* (WRAP).

DEC (2016). *Technical framework: Assessment and management of odour from stationary sources in NSW*.

Environment Protection Authority of Victoria (EPAV) (1985). *Plume Calculation Procedure*.

Jacobs (2021), *Hunter Power Project Environmental Impact Statement.*

National Environment Protection Council (NEPC) (2016). *National Environment Protection (Ambient Air Quality) Measure* (the Air NEPM).

National Pollutant Inventory (NPI) (2012). *Emission estimation technique manual for mining version 3.1*.

New South Wales Department of Planning, Industry and Environment (DPIE) (2021) *Air quality concentration data.* https://www.dpie.nsw.gov.au/air-quality accessed October 2021.

New South Wales Environment Protection Authority (EPA) (2016). *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*.

Umwelt (Australia) Pty Limited (2021). *EIS Project Description.*

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