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Mamre Road Data Centre Campus (SSD-92743706)

Air Quality Impact Assessment – Main Report

Addressee(s):	Plan Project Management Pty Ltd
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Quality Control

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Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below. A draft report is a working document, is issued without prejudice and is subject to change.

M Doyle **11 December 2025**

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NON-TECHNICAL SUMMARY

Overview of the Proposal

This air quality impact assessment has been performed to assess the potential impacts on air quality resulting from the construction and operation of a proposed data centre campus, at 706-752 Mamre Road, Kemps Creek NSW 2178.

The data centre campus is proposed to be constructed in a number of stages, with earthworks in the western portion of the Proposal site anticipated to begin in early 2027. Once earthworks have been completed in the western portion of the Proposal site, four data centre buildings would be constructed. Once complete, earthworks in the eastern portion of the Proposal site would be performed, and the remaining two data centre buildings would be constructed.

Operation of the data centre campus is to be performed in a number of phases, with each building constructed, commissioned, and then fully operable. Over time, the number of data centre buildings would increase, up to a maximum of six.

During operation of the data centre campus, diesel-fuelled generators would be required to ensure an uninterrupted power supply to the campus, should an electricity outage be experienced. Whilst such an electricity outage is expected to be a rare occurrence, generators are required for back-up power.

The data centre campus would include 846 generators in total and would be supplied by three electricity feeders. Only in the extremely rare circumstance of a regional electricity outage would all generators be required to be operational. A lesser number of generators would be required for a two-electricity feeder outage, and less still for a situation where one electricity feeder at the site experiences an outage.

To ensure that all generators are able to be operable when required, routine maintenance and testing would be required. Up to six generators would be tested concurrently, between the hours of 7:00 am to 6:00 pm.

Why the assessment was performed

The air quality impact assessment is a requirement of the NSW Department of Planning, Housing and Infrastructure, and the Environment Protection Authority. A significant number of requirements specific to this data centre campus proposal have been provided through the Secretary's Environment Assessment Requirements (SEARs). These have been reviewed in detail, and a response has been provided to each within this report.

Importantly, the assessment was required to account for the potential cumulative impacts which might be experienced at surrounding locations due to existing construction activities in the Mamre Road Precinct, and also other data centre developments operating in the area.

What the assessment includes

This air quality impact assessment provides:

- An outline of the assessment requirements provided by Government agencies;
- A description of the staging of the construction and operation of the Proposal;
- A review of the potential sources of emissions to air during both the construction and operation of the Proposal;
- The legislation and regulations associated with air quality relevant to the Proposal;
- A summary of existing conditions surrounding the proposed data centre campus, including the identification of locations which might be sensitive to changes in air quality, existing weather and air quality, and the landscape of the area which may influence the transport of air pollutants from source to receptors.
- A description of the approach adopted to the assessment of impacts resulting from the construction and operation of the Proposal, and how the potential for cumulative impacts has been assessed.

Two modelling scenarios have been developed to assess the potential for impacts in both stages of earthworks activities. A further six scenarios have been subject to assessment to identify potential air quality impacts during the operational phase of the Proposal, when generators would be maintained and tested, and a further six scenarios have been developed to assess the potential air quality impacts during a power outage. These scenarios covering potential impacts during power outages have also considered the number of generators required under each of one, two, or three feeder failures. In total, 26 scenarios have been assessed to fully characterise the potential impacts of the proposed data centre campus throughout all stages of construction and operation.

The potential for cumulative impacts to occur at receptor locations during the construction and operational phases of the Proposal have been quantitatively assessed. A detailed review of other construction activities within the Mamre Road Precinct has been performed, and emissions associated with developments which may overlap with the Proposal have been modelled and assessed.

In relation to the operation of the data centre campus, potential emissions associated with the maintenance and testing of eight data centres in the vicinity of the Proposal have been included in modelling. These potential impacts have been added to the contribution from the Proposal in all phases of development, and regional background air quality conditions, to determine a cumulative impact.

Summary of findings

The construction stage assessment indicates that particulate matter impacts are generally anticipated to be higher during the Stage 1 earthworks. Predicted short-term particulate matter (as PM_{10}) exceedances may occur at several nearby receptors, primarily on days with elevated regional background concentrations, while no exceedances during the second stage of earthworks are predicted. No exceedances of particulate matter (as $PM_{2.5}$ or TSP) criteria are anticipated during either stage of construction. Annual particulate matter (PM_{10}) exceedances are confined to a limited number of receptors which are reflective of the location of earthworks.

Best practice mitigation measures have been applied, and a detailed Construction Air Quality Management Plan with the inclusion of a Trigger Action Response Plan is recommended to guide real-time monitoring and responses to minimise impacts at surrounding receptors.

The operational phase assessment related to ongoing maintenance and generator testing indicates that all air quality criteria would be achieved at all surrounding receptor locations, during all phases of development.

There is the potential for overlap of the second stage of earthworks and operation of a number of data centre buildings at the site. The results of the assessment indicate that the contribution of the Proposal operation to particulate matter concentrations in the area is minimal and would not significantly increase the potential for air quality impacts to be experienced.

In the highly unlikely circumstance when a power outage may be experienced, there exists the potential for elevated concentrations of air pollutants to be experienced. However, an assessment of probability indicates that the coincidence of the potential for an exceedance of air quality criteria to occur, along with a power outage, is minimal (maximum once every 10 000 to 11 000 years).

Mitigation

With regard to the construction stage, emission controls will be employed at the Proposal site. The application of these controls results in quantifiable reductions in the quantity of particulate matter being emitted as part of those activities. Further, a Construction Air Quality Management Plan has been prepared to support the Proposal and minimise the risk of unacceptable air quality impacts during the construction stage.

The Construction Air Quality Management Plan incorporates a suite of mitigation measures such as water application, vehicle speed limits on site, careful handling of materials, an air quality monitoring program at sensitive receptors, and a Trigger Action Response Plan to guide real-time management and reduce potential off-site air quality impacts.

Based on the findings of the dispersion modelling assessment under the modelling scenarios focussed on maintenance testing operations, it is predicted that the operation of the testing schedule would not result in exceedances being experienced at sensitive receptor locations surrounding the Proposal site. Based upon the assumptions presented in this air quality impact assessment, the operation of the Proposal does not necessitate any additional management strategies.

The likelihood of an emergency power outage requiring the use of diesel generators is low, and the likelihood of a concurrent impact at any receptor lower still. However, an assessment of best management practice is included in the appendices to this report.

Conclusion

In conclusion, the construction and operation of the proposed data centre campus can be performed without significant impacts on surrounding receptors. Mitigation, management, and monitoring measures would be included during the construction phase to ensure that exceedances of air quality criteria are not experienced at surrounding sensitive receptor locations. Impacts during normal operations have been comprehensively assessed and are predicted to result in compliance with all adopted air quality criteria at all surrounding receptors, even taking into account the potential operations of surrounding data centres. Predicted impacts during the highly unlikely requirement for emergency use of the diesel generators has been assessed, and whilst exceedances may occur during that circumstance, the data centre campus has been designed with embedded mitigation adopting multiple feeders offering significant risk reduction.

This document is titled as "Mamre Road Data Centre Campus (SSD-92743706) - Air Quality Impact Assessment – Main Report" (file reference: 26.1012.FR1V3). Due to the size of the document the appendices to this document are provided under separate cover called "Mamre Road Data Centre Campus (SSD-92743706) - Air Quality Impact Assessment – Appendices" (file reference: 26.1012.FR2V1). This report should be read in conjunction with the Appendices.

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1. INTRODUCTION

Northstar Air Quality Pty Ltd (Northstar) has been commissioned by Plan Project Management Pty Ltd (PPM) (the Applicant) to perform an air quality impact assessment (AQIA) to accompany the State Significant Development Application (SSDA) for the construction and operation of a data centre campus (the Proposal) at 706-752 Mamre Road, Kemps Creek NSW 2178 (the Proposal site).

The AQIA has been performed to support the SSDA (SSD-92743706) to be submitted to NSW Department of Planning, Housing, and Infrastructure (NSW DPHI).

This AQIA identifies and examines potential air quality (including odour) impacts associated with the construction and operation of the Proposal, aligning with the NSW Planning Secretary's Environmental Assessment Requirements (SEARs), and outlines mitigation and monitoring requirements commensurate with those anticipated impacts to ensure that air quality criteria are achieved at surrounding sensitive receptor locations.

This document is titled as "Mamre Road Data Centre Campus (SSD-92743706) - Air Quality Impact Assessment – Main Report" (file reference: 26.1012.FR1V3). Due to the size of the document the appendices to this document are provided under separate cover called "Mamre Road Data Centre Campus (SSD-92743706) - Air Quality Impact Assessment – Appendices" (file reference: 26.1012.FR2V1). This main report should be read in conjunction with the accompanying appendices.

1.1. Purpose of the Report

The purpose of this AQIA is to assess the potential air quality impacts associated with the Proposal and to identify appropriate mitigation measures to ensure that the required environmental outcomes are achieved during both construction and operation.

The specific objectives of this AQIA are to:

- Identify existing local air quality conditions and the location, extent and sensitivity of nearby receptors;
- Assess the potential impacts of the Proposal on air quality to support approvals under relevant legislation, policies and guidelines; and
- Provide recommendations to avoid or, where avoidance is not practicable, minimise impacts on identified air quality values.

To enable assessment of the level of risk associated with the Proposal in relation to air quality, the AQIA has been performed in accordance with, and with due reference to the following legislation, policy and guidelines (in no particular order):

- *Protection of the Environment Operations Act* 1997 (POEO Act);
- Protection of the Environment Operations (Clean Air) Regulation 2022 (POEO CAR);
- NSW Planning Secretary's Environmental Assessment Requirements (SEARs);
- Penrith City Council Government Authority Advice;
- NSW Environment Protection Authority (NSW EPA) Government Authority Advice; and
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2022).

Appendix A provides a list of abbreviations, nomenclature, and units used in this AQIA.

1.2. NSW Planning Secretary Environmental Assessment Requirements

This AQIA has been prepared to address the specific requirements outlined in the project specific NSW Planning Secretary's Environmental Assessment Requirements (SEARs) that were issued for SSD-92743706 on 30 September 2025. In relation to air quality, the SEARs included input from NSW EPA and Penrith City Council which are outlined in Section 1.3.

Table 1 provides coverage of the SEARs and specifies where each requirement have been addressed herein.

Table 1 SEARs Compliance (SSD-92743706)

Assessment Requirements	Addressed in this AQIA
Air Quality	
A quantitative assessment of the potential air quality, dust and odour impacts of the development (construction and operation) on surrounding sensitive receptors, including educational and aged care facilities, in accordance with relevant Environment Protection Authority guidelines, which includes:	This AQIA has been prepared to address the SEARs directly.
Details of a proposed trigger action response plan (TARP) to be implemented during construction, using mitigation, management and monitoring measures supported by the cumulative quantitative assessment, that are part of an integrated and coordinated plan to manage cumulative dust impacts.	A Construction-phase TARP is presented in report 26.1012.FR3V1, which is supported by the quantitative construction-phase impact assessment that is summarised in Section 7.
Modelling of emissions and air pollutants from predicted operations, including consideration of generator testing, routine maintenance works that require use of generators and emergency scenario(s).	An Operational-phase impact assessment is presented in Section 8 that addresses generator testing, routine maintenance works (Scenario 2), and emergency scenarios (Scenario 1).
A cumulative assessment that considers all proposed and approved developments in the Mamre Road Precinct for both construction and operation (including, but not limited to, other data centre developments in the vicinity of the site).	The cumulative assessment of construction stage air quality impacts is presented in Section 7. The cumulative assessment of operational phase air quality impacts is presented in Section 8.

Assessment Requirements	Addressed in this AQIA
If operation of the development is staged, an assessment of each stage in isolation to accurately represent the predicted the air quality impacts of each stage.	26 scenarios have been assessed to ensure that all stages of the development have been considered (two construction, six operation – maintenance, and 18 operation – emergency).
A description and appraisal of best practice air quality impact mitigation, management and monitoring measures.	Best practice is addressed in Section 9.5.1 for the construction stage, and in Section 9.5.2 for the operational phase.
Airport Safeguarding	
Including a risk assessment of the proposed development on the Western Sydney Airport operations and addressing related matters in the Western Sydney Aerotropolis Plan, State Environmental Planning Policy (Western Parkland City) 2021 and the National Airports Safeguarding Framework and associated guidelines, including (but not limited to) a plume rise assessment and consideration of wildlife hazards, lighting and the prescribed airspace.	An Airport Safeguarding Assessment has been performed for the Proposal by L+R Airport Consulting (L+R, 2025). In relation to the requirement for a 'plume rise assessment', Section 5.7 of this AQIA provides a summary of consultation with the Civil Aviation Safety Authority (CASA) and confirmation that CASA has no objections to the Proposal.

1.3. Government Authority Advice

Attachment 2 of the SEARs includes Government Authority Advice relevant to the assessment. Air quality advisory requirements issued by Penrith City Council (Council) and NSW EPA are summarised in Table 2 alongside where each requirement has been addressed in the AQIA.

Table 2 Government Authority Advisories

Assessment requirements	Addressed in this AQIA
Penrith City Council Response to Request for Advice on SEARs - SSD-92743706 – 19 September 2025	
… air quality impacts considering operational requirements, proposed infrastructure and surrounding sensitive receivers, such as the adjoining schools.	This AQIA has been prepared to address this requirement. The receptor locations utilised in this report are discussed in Section 4.2.
The proposal includes of 846 back-up generators to be powered by diesel fuel. The proposed development will emit additional air pollutants of particulate matter and Nitrogen Oxide. Power interruptions, particularly during the summer period are not uncommon and therefore it is expected that any such application be supported by an Air Quality Assessment.	This AQIA has been provided to address these concerns.

Assessment requirements	Addressed in this AQIA
NSW EPA's Recommended SEARs Mamre Road Data Centre Campus – SSD-92743706 – 16 September 2025	
Key Risk Area - Air Quality	
An Air Quality Impact Assessment for the proposal should provide appropriate modelling for reasonable worst case impacts during construction and operation, including consideration of generator testing, routine maintenance works that require use of generators and emergency scenarios.	This AQIA report provides a quantitative modelling assessment for both the construction and operational phases. The construction stage assessment is presented in Section 7 and the operational phase assessment is presented in Section 8. The impacts of the operation of the Proposal has been assessed as emergency operations in Section 8.1, and from the routine maintenance and testing works in Section 8.2
Where operation of back-up generators exceeds 200hrs per annum, the proposal must be able to demonstrate compliance with the Group 6 emission limits in the Protection of the Environment Operations (Clean Air) Regulation 2022, including the NO_x limit of 450 mg/Nm^3.	The proposed operation of the back-up generators is presented in Section 2.2. The requirements of the POEO (Clean Air) Regulation 2022 are discussed in Section 3.2. The Proposal is anticipated to be a scheduled activity under the Clause 9, Schedule 1, Part 1 of the POEO Act (chemical storage), but the testing requirements are not expected to exceed 200 hours per year. The comparison of anticipated emissions is compared against the standards of concentration imposed under the POEO (Clean Air) Regulation is in Section 8.3.
In accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022), the proposal must demonstrate that operations will not result in any additional exceedances of the impact assessment criteria and that best management practices will be implemented. Regarding the emergency scenario, the potential for local and regional air quality impacts on sensitive receptors is a key concern, and the proposal should consider whether these impacts can be practicably prevented or minimised. The proponent has an obligation under the Protection of Environment Operations Act 1997 (POEO Act) to operated plant and equipment by such practical means as necessary to prevent or minimise air pollution.	The construction stage assessment is presented in Section 7 and the operation phase assessment is presented in Section 8. The requirements of the Approved Methods have also been specifically addressed. Please refer to Table 3.

Assessment requirements	Addressed in this AQIA
Key Risk Area – Cumulative Impacts	
The potential for cumulative air and noise impacts in the surrounding area is a key issue, and the AQIA and NVIA for the proposal will need to provide detailed quantitative assessments on potential for cumulative impacts, including potential overlapping of operational and construction impacts for later stages. The EIS should clearly detail the proposed staging, including plant that is proposed as part of each stage, to assist with assessment of cumulative impacts.	Quantification of potential cumulative air impacts has been carried out in the AQIA, with regard to construction stage and operational maintenance testing activities. Proposed staging is outlined in Section 2.2.
Attachment A – Air Issues	
The EIS must demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the POEO Act and the Protection of the Environment Operations (Clean Air) Regulation 2022. This consideration should include section 129 of the POEO Act concerning control of "offensive odour".	Compliance with the relevant provisions of the POEO Act and the Protection of the Environment Operations (Clean Air) Regulation 2022 is addressed in Section 3. The Proposal is expected to constitute a scheduled activity under Clause 9, Schedule 1, Part 1 of the POEO Act (chemical storage), noting that annual generator testing hours are not anticipated to exceed 200 hours. Assessment of predicted in-stack concentrations against the applicable standards of concentration in the POEO (Clean Air) Regulation is provided in Section 8.3. Consideration of Section 129 of the POEO Act ("offensive odour") is incorporated is incorporated, with potential odour impacts described in Section 2.3.3. Potential odorants associated with generator operation, including VOCs such as toluene (C_7H_8) and xylene (C_8H_{10}), have been evaluated. These compounds have been assessed against the 99.9th percentile 1-hour odour impact assessment criteria to address the potential for odour-related impacts.
The EIS must include an air quality impact assessment (AQIA). The AQIA must be carried out in accordance with the document, Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022).	This AQIA has been prepared for the Proposal in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW. It quantitatively evaluates potential impacts from both the construction and operational phases, including routine operations and worst-case emergency scenarios.

Assessment requirements	Addressed in this AQIA
The EIS must detail emission control techniques / practices that will be employed at the site and identify how the proposed control techniques/practices will meet the requirements of the POEO Act, POEO (Clean Air) Regulation (2022) and criteria within Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022).	Relevant emissions controls are detailed in Section 5.4, with best-practice measures identified in Section 9.5 Additional air quality management strategies are described in Appendix J to support compliance with regulatory requirements and mitigation of potential impacts.

1.4. Requirements of the NSW EPA Approved Methods

Section 9 of the Approved Methods outlines the NSW EPA's requirements for the information to be included in a detailed AQIA. Table 3 summarises each requirement relevant to this type of development proposal and outlines where this information is presented in the AQIA.

Table 3 NSW EPA Approved Methods – impact assessment reporting requirements

Assessment component	Addressed
9.1 Site Plan	
Layout of the site clearly showing all unit operations	Figure 2 - Figure 5
All emissions sources clearly identified	Figure 9 - Figure 15
Plant boundary	Figure 1
Sensitive receptors (e.g. nearest residences)	Figure 6 - Figure 7 Section 4.2
Topography	Figure 8 Section 4.5
9.2 Description of the activities carried out on the site	
A detailed discussion of all unit operations carried out on the site, including all possible operational variability	Section 2.2 Section 2.3
A detailed list of all process inputs and outputs	Section 2.2 Section 2.3
Plans, process flow diagrams and descriptions that clearly identify and explain all pollution control equipment and techniques for all processes on the premises	Section 2.3
A description of all aspects of the air emission control system, with particular regard to any fugitive emission capture systems (e.g. hooding, ducting), treatment systems (e.g. scrubbers, bag filters) and discharge systems (e.g. stacks)	Section 5.4
The operational parameters of all emission sources, including all operational variability, i.e. location, release type (stack, volume or area) and release parameters (e.g. stack height, stack diameter, exhaust velocity, temperature, emission concentration and rate)	Table 21 Section 5.3.2.1

Assessment component	Addressed
9.3 Emissions Inventory	
A detailed discussion of the methodology used to calculate the expected pollutant emission rates for each source	Section 5.3
Detailed calculation of pollutant emission rates for each source	Table 20 Table 21
Tables showing all release parameters of stack and fugitive sources (e.g. temperature, exit velocity, stack dimensions, and emission concentrations and rates)…	Table 21
…and all pollutant emission concentrations with a comparison of the emission concentrations against the relevant requirements of the Regulation	Section 8.3
9.4 Meteorological data	
A detailed discussion of the prevailing dispersion meteorology at the proposed site. The report should typically include wind rose diagrams, an analysis of wind speed, wind direction, stability class, ambient temperature and mixing height; and joint frequency distributions of wind speed and wind direction as a function of stability class	Section 4.3 Appendix C
Demonstration that the site-representative data adequately describes the expected meteorological patterns at the site under investigation (e.g. wind speed, wind direction, ambient temperature, atmospheric stability class, inversion conditions and katabatic drift)	Appendix C
A description of the techniques used to prepare the meteorological data into a format for use in the dispersion modelling	Section 5.1.2 Appendix C
A quality assurance and quality control analysis of the meteorological data used in the dispersion modelling. Provide and discuss any relevant results of this analysis	Appendix C
9.5 Background air quality data	
A detailed discussion of the methodology used to calculate the background concentrations for each pollutant	Section 4.4 Appendix D
Tables summarising the ambient monitoring data	Table 13 Appendix D
9.6 Dispersion modelling	
A detailed discussion and justification of all parameters used in the dispersion modelling and the manner in which topography, building wake effects and other site-specific peculiarities that may affect plume dispersion have been treated	Section 5.1 Section 5.2 Section 5.3
A detailed discussion of the methodology used to account for any atmospheric pollutant formation and chemistry	Section 5.3.2.4
A detailed discussion of air quality impacts for all relevant pollutants, based on predicted ground-level concentrations at the plant boundary and beyond, and at sensitive receptors	Section 6 – Section 8
Ground-level concentrations, hazard index and risk isopleths (contours) and tables summarising the predicted concentrations of all relevant pollutants at sensitive receptors	Section 6 – Section 8

1.5. Alignment with Contemporary Assessments

To align this AQIA with contemporary assessment expectations, recent feedback issued by NSW DPHI and NSW EPA on comparable data centre SSDAs has been reviewed. This includes agency commentary on the Marsden Park Data Centre (SSD-70889211) and the NEXTDC S4 Data Centre at Horsley Park (SSD-6374120). Key items from those reviews are summarised in Table 4.

For context, both projects had SEARs published with Industry SEARs for Data Storage Centres issued on 27 October 2023 for SSD-63741210 and a separate set of SEARs issued for SSD-70889211 on 11 June 2024. These documents have been referenced solely to identify the nature of contemporary requirements applied to recent data centre proposals, and to ensure that these have been addressed within this AQIA.

Table 4 Summary of key air quality matters raised in recent data centre AQIA

Assessment review	Addressed in this AQIA
Marsden Park Data Centre (SSD-70889211)	
NSW EPA Advice on Environmental Impact Statement Marsden Park Data Centre (SSD-70889211) – 11 December 2024	
1. Diesel Generators – Justification and Worst-Case Assessment - Provide rationale for the number and capacity of diesel generators on site. - Assess a worst-case emergency scenario using the maximum load for each generator, ensuring consistency with the reported generator number.	Worst case emergency scenario contained in Section 8.1. Table 20, Section 5.3.2.1 provides details on the number and capacity of standby generators.
2. Generator Testing Scenario - Include the location of the modelled generators. - Justify that the chosen locations represent worst-case conditions. - Specify the number of stacks used. - Provide the emission rates for each modelled point source for the full modelling hour.	Table 20, Section 5.3.2.1 provides details on emission rates applied for this AQIA. Location of modelled generators contained in Section 5.1.4.2, Figure 9 to Figure 15. Sensitivity testing has informed the specified generator locations to inform the maintenance testing scenario (refer Section 8.2). Table 6 presents information regarding the anticipated generator numbers and potential usage (per stage) and Table 7 provides the associated cumulative total. Table 17 outlines the number of generators associated with each phase of the Proposal.
3. Probabilistic Worst-Case Scenario - The AQIA should not adjust hourly NO_2 impacts without clear justification, as the modelling assumes a 60.1-minute average power outage. - The probabilistic worst-case scenario is considered unjustified by the EPA and should be excluded, since hourly NO_2 impacts already represent the worst-case conditions.	No adjustments conducted as the maintenance schedule (refer Table 8) identifies hat each generator will be tested for a duration of up to 60 minutes.
4. In-Stack Emission Compliance - Provide expected in-stack emission concentrations for the generators. - Demonstrate compliance with Group 6 POEO Clean Air Regulation limits.	Section 8.3 contains a comparison of the expected in-stack emissions concentrations for each generator and the corresponding Group 6 emissions standards for scheduled activities.

Assessment review	Addressed in this AQIA
5. Principal Toxics Impacts - Include impacts of relevant principal toxic substances in the emergency and testing scenarios.	Table 11 outlines the NSW EPA impact assessment criteria for the relevant principal and individual toxic pollutants considered in this AQIA namely, Polycyclic Aromatic Hydrocarbons (PAHs), benzene (C_6H_6), toluene (C_7H_8), xylene (C_8H_{10}) and formaldehyde (CH_2O). Potential impacts of principal and individual toxic pollutants have been subject to a preliminary impact screening (refer Section 6.2) for each dispersion modelling scenario. For pollutants that are determined to be significant (i.e. with a significance of either 'moderate', or 'substantial'), detailed reporting of those impacts is presented in Section 8.
6. Stack Emisison Data - Provide modelled stack pollutant emission concentrations and rates	Modelled stack pollutant emission concentrations and corresponding emissions rates are provided in Table 20, Section 5.3.2.1.
NSW EPA Advice on Submissions Report – Marsden Park Data Centre – SSD-70889211 – 11 April 2025	
1. Discharge Points and NO_x Emissions - Provide the number of modelled discharge points. - Provide the NO_x emission rate for the 1-hour time step and explain how this rate is characterised for 15-minute operating periods.	Table 20, Section 5.3.2.1 provides details on emission rates applied for this AQIA. Location of modelled generators contained in Section 5.1.4.2, Figure 9 to Figure 15. Table 6 presents information regarding the anticipated generator numbers and potential usage (per stage) and Table 7 provides the associated cumulative total. With reference to criteria air pollutants with sub-hourly criteria e.g. carbon monoxide (CO), hourly dispersion model outputs have been Power Law adjusted (refer Section 5.3.2.5).
2. NO_2 Impact Mitigation - Incorporate controls or mitigation to address predicted exceedances of NO_2 impact criteria and demonstrate compliance.	Relevant emissions control measures are outlined in Section 5.4. Identified best practice and air quality mitigation measures commensurate to the nature and scale of this Proposal have been specified in Section 9.6.

Assessment review	Addressed in this AQIA
3. Testing Regime Compliance - Demonstrate that the impact assessment criteria can be achieved under the proposed operating / testing regime using additional controls or mitigation.	An impact assessment of potential impacts associated with the maintenance testing regime is presented in Section 6.2.2 and Section 8.2. A discussion of the findings of assessment is provided in Section 9.
4. Cumulative Impacts - Assess potential cumulative impacts with other nearby data centres, focusing on a testing regime already shown to comply with the Approved Methods criteria.	Cumulative impacts during the routine operation of the Proposal have been considered in a quantitative manner taking account of the routine operation of surrounding data centres and including regional background concentrations (for PM and NO_2). Section 5.5 provides further discussion.
5. VOC and PAH Assessment - Confirm that VOC and PAH impacts have been assessed at or beyond the site boundary.	Potential impacts of principal and individual toxic pollutants as PAHs, benzene (C_6H_6), toluene (C_7H_8), xylene (C_8H_{10}) and formaldehyde (CH_2O) have been assessed (refer Section 6.2 and Section 8). As required under section 7.2.2 of the Approved Methods, the criteria for PAH, benzene (C_6H_6), and formaldehyde (CH_2O) identified in Table 11 are required to be assessed at any location at or beyond the Proposal site boundary.
NSW DPHI - Additional Matters for Submissions Report (SSD-70889211) – 14 January 2025	
1. Sensitive Receptors - Update the assessment to include potential impacts to: - Ingenia Lifestyle – Stoney Creek retirement village (north-west of the site). - Residence at Bait-ul-Huda Mosque (used for visiting religious dignitaries, DA-19-01227).	Discrete sensitive receptor locations have been included and described in Section 4.2 and Appendix B. A visual representation is presented in Figure 6 and Figure 7. Identified sensitive receptors have been classified as residential educational, industrial (including other data centres and substation), medical and recreational.
2. Construction Mitigation Measures - Update Section 7 to identify additional project-specific mitigation measures during construction. - Describe how these measures would be applied or adapted across the three development stages.	Construction related mitigation measures have been specified in Section 5.4 in the specification of a Construction Air Quality Management Plan (CAQMP). The CAQMP includes a range of mitigation measures to be employed such as an air quality monitoring program and a Trigger Action Response Plan (TARP) designed to minimise any off-site air quality impacts during construction.

Assessment review	Addressed in this AQIA
3. Back-Up Generators – Worst-Case Scenario Confirm whether back-up generators associated with the Council-approved 5 MW data centre are included in the worst-case emissions scenario. Update the assessment accordingly.	Potential cumulative impacts associated with the routine operations of nearby data centres and the Proposal have been assessed in this AQIA in a quantitative manner (i.e. have been subject to dispersion modelling).
4. Generator PRP and Worst-Case Assessment - Provide commentary on why modelling generators at 50% PRP reflects a realistic worst-case scenario. - Address that NOx emissions are highest at 100% PRP and justify the chosen approach.	Section 5.2.2 explains that the justified worst-case scenarios have been defined to represent the maximum credible air quality impacts associated with the Proposal. The design incorporates a high level of redundancy to minimise reliance on diesel generation under normal operating conditions. In a genuine grid outage, the standby generation system is required to support 100 % of critical and essential loads to maintain uninterrupted data centre operations. Under these conditions, all installed generators would operate at 100 % load for the duration of the outage, subject to diesel storage capacity and resupply arrangements. Consistent with the requirements issued by NSW DPHI and the NSW EPA within the SEARs, the worst-case emergency scenarios modelled in this AQIA therefore represents the most severe and credible outage condition namely, all generators operating at 100 % load. This scenario has been applied across all development stages to ensure that the assessment reflects the maximum potential impacts as required under the SEARs.
5. Non-Criteria Pollutants - Include assessment of non-criteria pollutants, including PAHs and VOCs.	Potential impacts of principal and individual toxic pollutants as PAHs, benzene (C_6H_6), toluene (C_7H_8), xylene (C_8H_{10}) and formaldehyde (CH_2O) have been assessed (refer Section 6.2 and Section 8).
6. Stack Emission Rates - Clarify modelled stack emission rates and concentrations for the proposed back-up generator system.	Modelled stack pollutant emission concentrations and corresponding emissions rates are provided in Table 20, Section 5.3.2.1.

Assessment review	Addressed in this AQIA
7. Generator Testing Scenario – Location and Worst-Case Justification - Provide a figure identifying which back-up generators were modelled in the testing scenario. - Justify why the selected locations reflect a realistic worst-case assessment for all nearby sensitive receptors. - Revise the generator testing scenario so predicted impacts at each receptor are based on the closest back-up generator test (e.g., R1 reflects nearest generator, Wor1 reflects nearest generator, etc.).	Table 20, Section 5.3.2.1 provides details on emission rates applied for this AQIA. Location of modelled generators contained in Section 5.1.4.2, Figure 9 to Figure 15. Sensitivity testing has informed the specified generator locations to inform the maintenance testing scenario (refer Section 8.2). Table 6 presents information regarding generator numbers and potential usage (per stage) and Table 7 provides the associated cumulative total.
NSW EPA Advice on Assessment Marsden Park Data Centre – SSD-70889211 – 3 July 2025	
1. Ozone (O_3) Monitoring and Thresholds - Demonstrate that the 170 µg·m^{-3} ozone threshold addresses predicted exceedances under the monthly testing regime. - Clarify how the proponent intends to manage practical limitations associated with timely access to ozone monitoring data from the NSW network.	An assessment of ozone (O_3) formation and regional influence is contained in Section 9.4.
NEXTDC S4 Data Centre Horsley Park (SSD- SSD-6374120)	
NEXT DC S4 Data Centre Horsley Park (SSD-63741210) EPA Advice on Environmental Impact Statement (EIS) – 3 September 2024	
1. CALPUFF Modelling and Emission Scenarios - Provide sufficient model input file configuration, including model domain, station information, and settings in accordance with the Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System and the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW. - Justify model configuration, including why alternative nearby weather stations were not used for input or validation. - Justify the choice of CALPUFF, considering the location of near-field receptors. - Provide details on release types and whether emission sources are subject to building downwash and confirm whether this was included in the modelling.	Table 14, Section 5.1.1 provides details on the model configuration and modelling domain. Table C3 of Appendix C outlines the parameters used for the meteorological modelling component. Justification for the selected model configuration is presented in Section 5.1. Building downwash effects have been incorporated into the dispersion modelling using the Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME), a component of CALPUFF (refer Section 5.1.4).

Assessment review	Addressed in this AQIA
2. Emissions Scenarios and Calculations - Identify and confirm source locations for all emission scenarios. - Demonstrate that generator locations in the realistic case reflect a worst-case scenario for all sensitive receptors, including results from a sensitivity analysis testing the impact of generator location. - Confirm and, if necessary, update emission rates, incorporating building wake effects. - Provide quantitative information on cumulative air impacts from other nearby data centres under realistic worst-case conditions. - Evaluate in-stack concentrations from the back-up diesel generators for all relevant air pollutants and demonstrate compliance with Schedule 2, Part 2, Division 3, Group 6 of the POEO (Clean Air) Regulation 2022.	Source locations for all operational phase scenarios are identified in Figure 9 to Figure 15. Sensitivity testing has been completed to inform generator locations for the maintenance testing scenarios (refer Section 8.2). Building downwash was incorporated using BPIP-PRIME (refer Section 5.1.4). Potential cumulative impacts from nearby data centres and the Proposal were quantitatively assessed. A cumulative worst-case emergency scenario, with all generators operating at 100 % load across multiple sites, would produce very high impacts and widespread exceedances; however, this represents an overly conservative and unrealistic condition. Routine operation and credible emergency scenarios provide a more representative indication of impacts. In-stack concentrations from the standby diesel generators (refer Section 8.3), demonstrating compliance with Schedule 2, Part 2, Division 3, Group 6 of the POEO (Clean Air) Regulation 2022.
NEXT DC S4 Data Centre Horsley Park (SSD-63741210) EPA Advice on Response to Submissions (RTS) – Additional Comments – 3 October 2025	
Cumulative Impacts from Nearby Data Centres - Quantitative cumulative impacts from other nearby data centres (up to 5 km) have not been fully modelled. The amended AQIA presents additional data centres using a probability assessment rather than full worst-case cumulative modelling. This approach does not fully address the EPA's request for cumulative impact analysis. The outstanding matter will be resolved through conditions on the licence.	Potential cumulative impacts from nearby data centres (within 5 km) have been quantified in the AQIA with regard to construction impacts and the maintenance testing operational scenarios

2. THE PROPOSAL

The following provides a description of the context, location and scale of the Proposal, and a description of the processes and development activities on site. It also identifies the potential for emissions to air associated with the Proposal.

2.1. Environmental Setting

The Proposal site is located at 706–752 Mamre Road, Kemps Creek NSW 2178. It is legally described as Lot 10 in Deposited Plan (DP) 1280592 and covers an area of approximately 52 hectares (ha) (refer Figure 1.)

The Proposal area i.e. 706-752 Mamre Road constitutes the main development site with areas across the shared boundaries to the east and south (described below) utilised to facilitate roadworks and bulk earthworks:

- Gibb Group site to the East known as 1-22 Bakers Lane, Kemps Creek (Lot 40 in DP 709347).
- GPT Group site to the South known as 754 Mamre Road, Kemps Creek (Lot 180 in DP 1290397).

Additionally, power supply lead-in from Sydney-West Substation is proposed as part of the wider Proposal development, which traverses through multiple landholdings.

The Proposal site is regular in shape and occupies a position on the eastern side of Mamre Road and southern side of Bakers Lane.

Currently vacant, the Proposal site includes one residential development which would be demolished as part of the Proposal and includes vegetation which would be cleared.

The Proposal site is located in the Mamre Road Precinct (MRP), which forms part of the Western Sydney Employment Area (WSEA) and was rezoned by the NSW Government in June 2020. The Proposal site is zoned IN1 General Industrial and SP2 Infrastructure within the WSEA pursuant to the State Environmental Planning Policy (Industry and Employment) 2021 (Industry and Employment SEPP).

Mamre Anglican School, Trinity Catholic Primary School, Emmaus Catholic College, and Emmaus Retirement Village are all accessible via Bakers Lane and are located to the north of the Proposal site. Surrounding development to the east, south and west of the site consists of existing and emerging industrial / commercial development, including warehouses, logistics hubs and a data centre. Three residential properties are located approximately 60 metres (m) to the north of the Proposal site along Mamre Road and Bakers Lane, which are anticipated to be utilised for industrial land uses in the future.

A full description of the sensitivity and uses of the surrounding land, and the identification of discrete receptor locations used in the AQIA is provided in Section 4.2.

Figure 1 Proposal site location

Source: Northstar

2.2. Proposal Overview

The Proposal for development under SSD-92743706 comprises of:

- Approximately 26 shells across four-storeys data centre buildings (4x four shells and 2x five shells), including six technical office buildings, plus a campus office.
- Incoming and internal electrical substations and associated infrastructure; and
- Site preparation, including earthworks, stormwater, sewer, roads, and associated infrastructure.

Figure 2 presents the Proposal site layout, with Figure 3 providing an indication of the Proposal staging. Figure 4 provides a typical section of each building, with Figure 5 providing a 3-dimensional (3D) visualisation of the Proposal site. More detailed versions of these figures are found in the main EIS.

It is important to note that the Proposal would be constructed and operated in a staged manner, over a period of approximately 10 years. Presented in Table 5 is a summary of the staging of the Proposal, including construction and operational phases, and includes detail related to site access arrangements. Of note:

- Earthworks and construction activities for all 26 data centre buildings would not be performed at the same time. Major earthworks would be performed in two main stages, approximately seven to eight years apart. Minor earthworks would be performed progressively as the Proposal site is developed.
- Construction traffic would not access the Proposal site via Bakers Lane during any phase of construction activities.
- Data centre buildings within each sub-parcel would be progressively constructed and commissioned over a period of approximately 10 years.

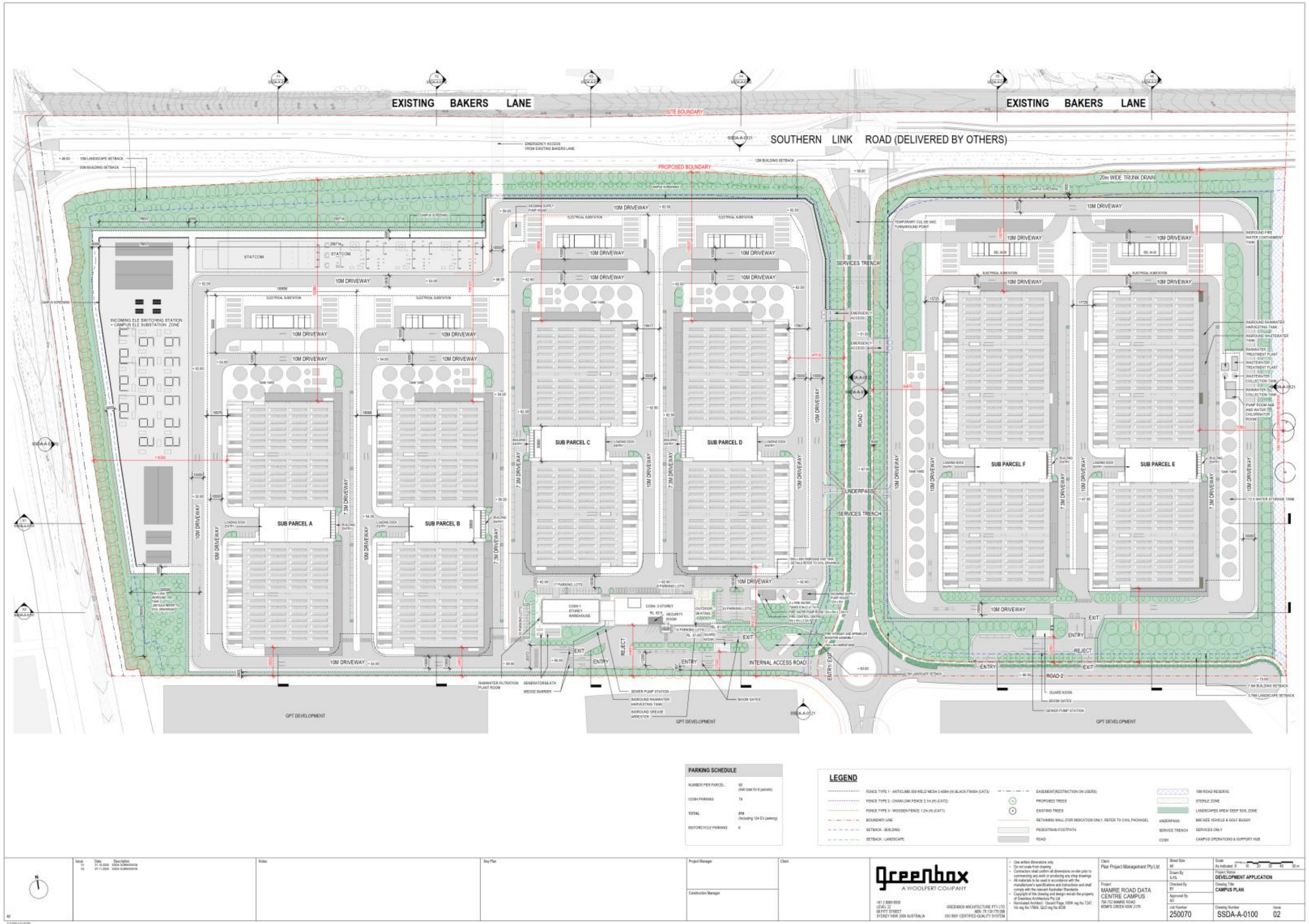
The assessment of potential impacts from construction works has been considered in a staged manner and provides a realistic approximation of the anticipated impacts at nearby sensitive receptors.

Emissions of air pollutants from the maintenance and / or emergency operation of installed generators would be limited to those buildings being commissioned or operational, following the staging as described above and in Table 5. This AQIA has been performed to provide predicted air quality impacts at sensitive receptor locations across all proposed phases of development, include the ultimate phase of full development (i.e. all 26 data centre buildings being operational).

Table 5 Description of Proposal staging (construction and operation)

Timing (indicative)	Stage	Phase	Land parcel	Description		Site Access
				Construction	Operation	
0 to 2 years	1	0	A, B, C, D	Earthworks in the western portion of the Proposal site. This would prepare land for the construction of the sixteen data centre buildings to the west of the internal road, and closest to Mamre Road.	No operations.	Temporary construction access from Mamre Road to the south western corner of the site.
2-6 years		1	A	Construction of the data centre building in Parcel A plus the campus offices.	No operations.	Construction and operational access via the GPT development to the south.
		2	B	Construction of data centre building in Parcel B.	Commissioning / operation of Parcel A.	
		3	C	Construction of data centre building in Parcel C.	Operation of Parcel A. Commissioning / operation of Parcel B	
		4	D	Construction of data centre building in Parcel D.	Operation of Parcels A and B. Commissioning / operation of Parcel C.	
7-10 years	2	5	E,F	Earthworks in the eastern portion of the Proposal site, with temporary access from the south for construction vehicles. This would prepare land for the construction of 10 data centre buildings to the east of the internal road.	Operation of Parcels A, B, C, and D.	
			E	Construction of data centre building in Parcel E.	Operation of Parcels A, B, C and D.	
		6	F	Construction of data centre building in Parcel F.	Operation of Parcels A, B, C and D. Commissioning / operation of Parcel E.	
		-	-	Construction finalised	Operation of Parcels A, B, C, D and E. Commissioning / operation of Parcel F.	
10+ years	3	7	-	Construction of north-south road.	Full development	Operational access via GPT development to the south.

Figure 2 Proposal site plan

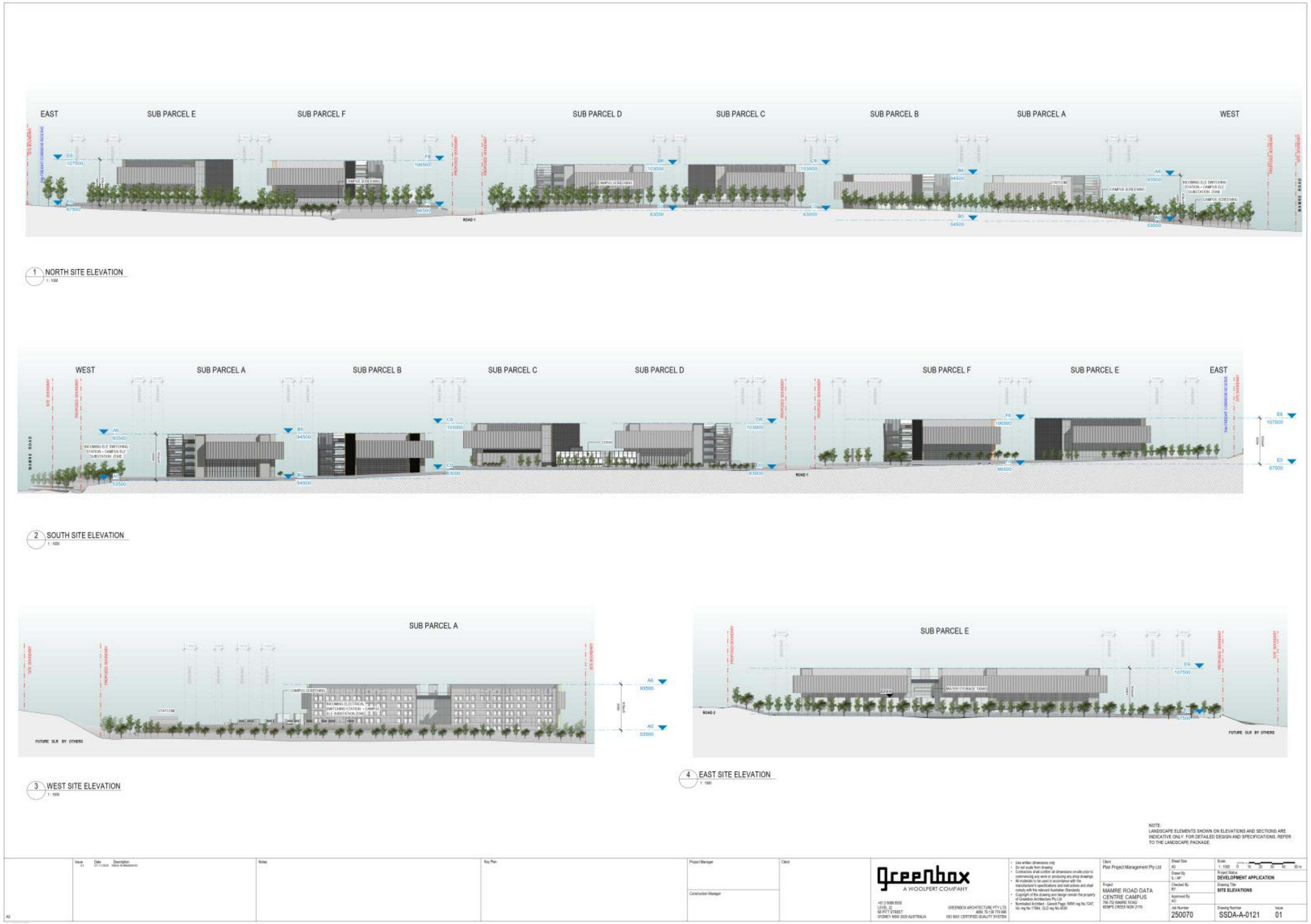


Source: Greenbox (250070 SSDA-A-0100 02)

Figure 3 Proposal staging plan

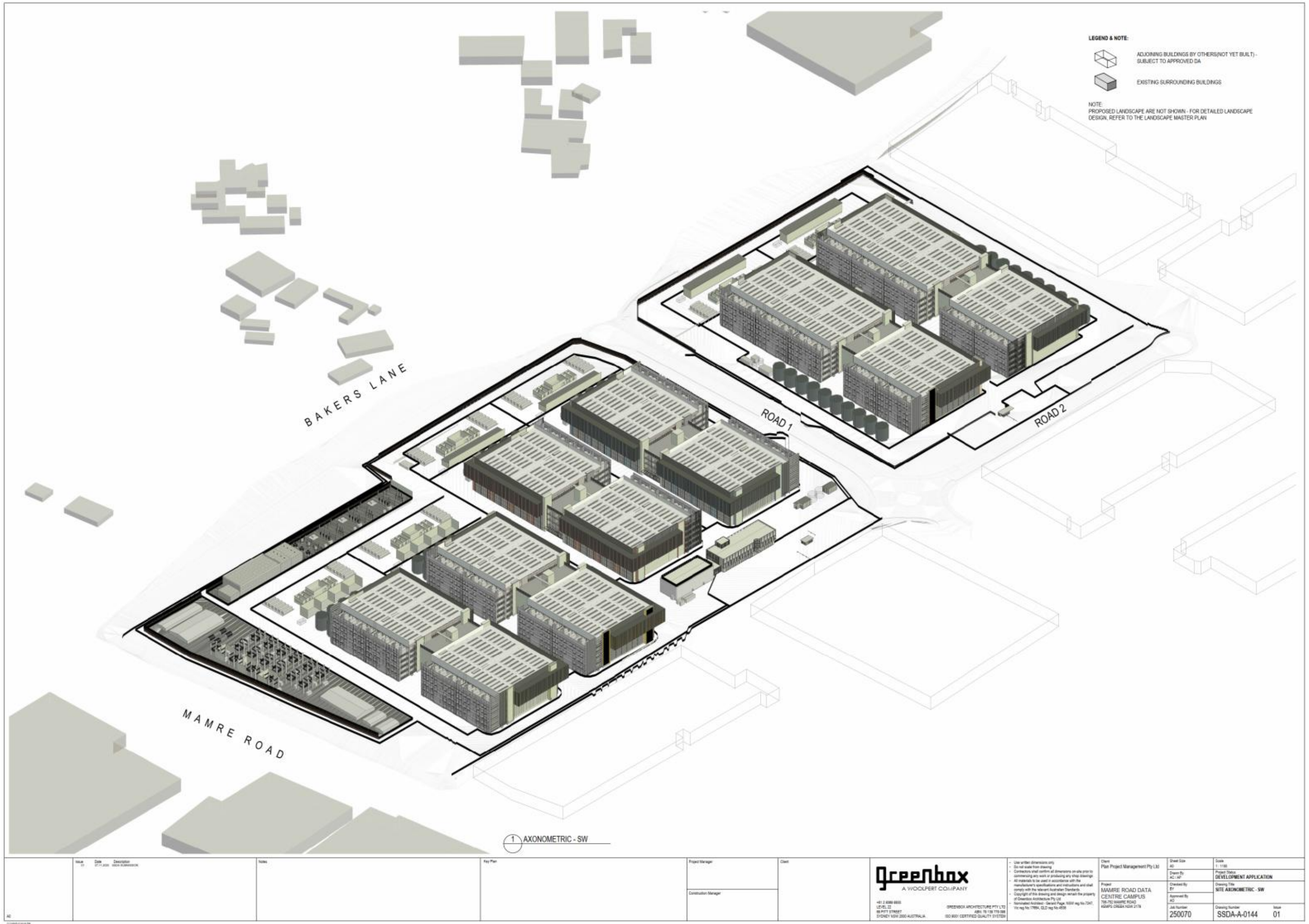
Source: Greenbox (250070 SSDAA-A-0030 Issue 01)

Figure 4 Proposal site layout – typical building sections



Source: Greenbox (250070 SSDA-A-0121 Issue 01)

Figure 5 Proposal site layout – three-dimensional perspective



Source: Greenbox (250070 SSDA-A-0144 Issue 01)

2.3. Identification of Emissions to Atmosphere

The Proposal is likely to generate air emissions during the various construction stages and operational phases (refer to Table 5), as outlined below.

2.3.1. Construction Stage

During construction stage activities, the Proposal would include site preparation works including vegetation clearing, bulk earthworks across the site, road construction, and staged construction of each of the 26 data centre buildings.

Prevalent sources of emissions to air during the construction stage of the Proposal would include (in no order):

- Excavation and filling (cut / fill) of topsoil and overburden (earthworks);
- Haulage of materials on unpaved access roads;
- Wind erosion of exposed surfaces and stockpiles; and
- Diesel fuel combustion from heavy vehicles, plant and equipment.

Each of the activities identified above would be anticipated to generate emissions of particulate matter (PM), which has been assessed as:

- Total suspended particulates (TSP);
- Particulate matter with a diameter of 10 micrometres or less (PM_{10});
- Particulate matter with a diameter of 2.5 micrometres or less ($PM_{2.5}$); and
- Deposited dust.

Under usual circumstances, a qualitative risk-based assessment of potential air quality impacts during construction stage activities is generally sufficient to characterise any potential risk to surrounding receptor locations and allow the identification of the mitigation measures which would be implemented to manage that risk.

Given the nature and location of the Proposal, and following a request by NSW DPHI and NSW EPA, a quantitative assessment of potential air quality impacts during the staged construction works has been performed as part of this AQIA.

The Mamre Road Precinct is currently undergoing significant development, and the potential for concurrent earthworks to be performed at several sites in the area has the potential to contribute to cumulative impacts at sensitive receptor locations. It is understood that NSW DPHI and NSW EPA consider that the most appropriate way to identify those risks and ensure that appropriate mitigation measures are applied, is through the performance of a quantitative assessment.

The methodology adopted is presented in Section 5, and an assessment of air quality impacts resulting from construction stage earthworks activities is presented in Section 7. A Construction Air Quality Management Plan (CAQMP) including a Trigger Action Response Plan (TARP) has also been developed to support SSD-92743706 and this is documented under separate cover in the Construction Air Quality Management Plan (file reference 26.1012.FR3V1).

2.3.2. Operational Phase

Operational emissions from the data centre on a day-to-day basis would be anticipated to be negligible, except for potential emissions from diesel-fuelled back-up generators during periodic maintenance testing or during a power outage event. Additionally, there is the potential for minor fugitive emissions from the storage of diesel at the Proposal site.

2.3.2.1. Emissions from Generator Use

The Proposal includes the installation of 846 no. 2 megawatt (MW) (approximately) standby generators to support the critical IT load within the data halls, office / front-of-house (FOH) and associated safety services, providing a total IT load capacity of up to 1 000 MW.

The 846 generators are housed across the data centre campus, comprising of 26 building shells within six (6) sub parcels. The exact make and model of generators have not yet been selected for use as part of the Proposal, although four candidate generators have been identified:

- Cummins C2750D5BE (2 200 kW);
- MTU 16V4000G84F (2 185 kW);
- Stirling 20M33GD2500/5 (2 010 kW); and
- Caterpillar 3516B (2 000 kW).

The worst-case operational characteristics of these four generators have been selected and adopted in the modelling assessment (refer Section 5.3.2.1) to provide maximum flexibility during final selection (i.e. highest emission rate, lowest emission temperature, lowest emission velocity) in an 'envelope analysis'.

On this basis, the final selection of generator is not defined by this AQIA which presents a worst-case assumption from the four candidate generators. On the understanding that (a) the final selection is any one of the four candidates, or (b) the environmental performance of the final generator selection is not less than that assumed, the final generator selection would not necessitate re-performance of this AQIA.

The Proposal will be served by a new 330 kilovolt (kV) substation, located in the northwest corner of the site. This substation will be directly fed from the Sydney West Bulk Supply Point Substation (Sydney West BSP) via three (3) redundant, 330 kV feeders in an N-1 configuration, sized so that the full site load can be accommodated on 2 of the 3 feeders, stepping voltages down to 132 kV via three (3) 330/132 kV transformers. The outgoing transformer supplies are connected to 132 kV Gas-insulated switchgear (GIS) in a breaker-and-a-half configuration allowing for dedicated 132 kV supplies reticulating around site with N-1 redundancy across all development stages of the Proposal. This configuration ensures extremely high availability and reliability for distribution of mains power supply for the site, such that the loss of one redundant utility supply to the site does not trigger any requirement for generators to provide emergency power. It is noted that in the event of feeder failure, some generators would be required to be operated temporarily (15 to 20 minutes) whilst a medium voltage changeover occurs in the rings.

Sydney West BSP is operated by Transgrid and is located approximately 4.5 kilometres (km) northeast of the Proposal site. This infrastructure is subject to a Category 2 level of redundancy under NSW Transmission Reliability and Performance Standard (2017) and has a maximum allowable unserved energy (USE) of one (1) minute per year. However, it is highlighted that Sydney West BSP has maintained 100 % uptime since 2005 as per panel analysis of Australian Energy Market Operator (AEMO) data outlined in Australian Energy Market Commission (AEMC) Reliability Panel Annual Report (AEMR, 2023).

Information provided by the Applicant indicates that during one, two, or three feeder failures, the number of generators (as no.) outlined in Table 6 and Table 7 would be required to be operated. Note that Table 6 presents the information associated with each individual phase (refer Table 5), with the cumulative values representing progressive development presented in Table 7.

Table 6 Anticipated generator numbers and potential usage (per phase)

Phase	Year	Buildings	Generators	Generators (no.) required during feeder failure(s)		
				1 failure	2 failures	3 failures
Phase 1	1	4	132	67	132	132
Phase 2	2-6	4	130	66	130	130
Phase 3	2-6	4	130	0	64	130
Phase 4	2-6	4	130	66	66	130
Phase 5	7-8	5	162	0	80	162
Phase 6	9-10	5	162	82	82	162
Total	**-**	**26**	**846**	**281**	**554**	**846**

During periods when the standby generators may be required to provide power during mains power outage events, short-term emissions of combustion related pollutants will be generated. Emissions from diesel-fuelled back-up generators may include various air pollutants, as listed in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual (NPI EETM) for combustion engines (NPI, 2008).

Table 7 Anticipated generator numbers and potential usage (cumulative)

Phase	Year	Buildings	Generators	Generators (no.) required during feeder failure(s)		
				1 failure	2 failures	3 failures
Phase 1	1	4	132	67	132	132
Phase 2	2-6	8	262	133	262	262
Phase 3	2-6	12	392	133	326	392
Phase 4	2-6	16	522	199	392	522
Phase 5	7-8	21	684	199	472	684
Phase 6	9-10	26	846	281	554	846
Total	**-**	**26**	**846**	**281**	**554**	**846**

The pollutants of concern from the operation of the standby generators includes (in no order):

- Particulate matter (PM);
- Oxides of nitrogen (NO_X);
- Carbon monoxide (CO);
- Sulphur dioxide (SO_2);
- Polycyclic aromatic hydrocarbons (PAHs);
- Volatile organic compounds (VOCs), as benzene (C_6H_6), toluene (C_7H_8) and xylene (C_8H_{10}); and
- Formaldehyde (CH_2O).

In addition to the potential operation as a secondary back-up during a power outage event as described above, the generators would be required to be run during short-term and planned routine maintenance testing.

The Applicant has provided a maintenance testing schedule for the 846 standby generators. This schedule indicates that up to six (6) generators would be operated simultaneously during periodic testing. Table 8 reflects this schedule.

Table 8 Proposed standby generator maintenance schedule

Parameter	Detail
Total number of generators to be tested	846 no.
Testing frequency	Annual (once per year)
Operational testing hours	Daytime hours (7:00 am to 6:00 pm (Monday to Sunday))
Generators tested simultaneously	Six (6) no.
Tests per period	141 no.
Duration per test	60 mins per test$^{(A)}$
Total testing time per year	8 460 mins·yr^{-1}
Total testing hours per year	141 hrs·yr^{-1}

Note (A): The test duration of 60 mins per test includes warm-up and cool-down periods.

This assumes that each generator will be tested for a duration of up to 60 minutes. Additional information provided by the Applicant indicates that testing will take place during daylight hours which are assumed to be between 7:00 am and 6:00 pm. These hours are generally consistent with other data centre operations in the area (seven of the eight datacentres within a 5 km radius are conditioned to, or propose to test generators between 7:00 am and 6:00 pm, with only the CDC data centre in Eastern Creek having more stringent testing hours of 9:00 am to 4:00 pm).

Section 5.2.2 provides discussion around the six generators which have been selected for quantitative assessment purposes. For the purposes of the dispersion modelling assessment, it has been assumed that six (6) generators will undergo maintenance testing simultaneously on any given day. In practice, total annual generator testing is expected to be limited to no more than 200 hours, making this a conservative basis for assessing operational phase impacts.

The generator testing schedule is not anticipated to have a cumulative total of more than the 200-hour exemption limit outlined in Schedule 1 Clause 17 of the NSW *Protection of the Environment Operations Act* 1997 (refer Section 3.1), in addition to Part 5, Division 6, Clause 73 of the POEO (Clean Air) Regulation 2022 (refer Section 3.2).

2.3.2.2. Emissions from Fuel Storage

The Proposal will be provided with a new dedicated and appropriately sized on-site fuel storage system, which may contribute to air emissions through fugitive VOCs during filling and dispensing of fuel, as well as from potential accidental spillages and leaks that may occur.

The Proposal site would have the capacity to store up to 18 056 kilolitre (kL) (equivalent to 15 361 tonnes (t)) of diesel, split between 5 no. 132 kL tanks, 34 no. 1 kL tanks, and additional 2 no 1 kL day tanks (for shells with tech space) associated with each of the 26 shells.

The storage tank configuration at the Proposal site will include adequate containment (in the form of double-walled tanks and tertiary bunding containment) and automated leak detection measures, in compliance with relevant Australian and New Zealand Standards (AS/NZS), including AS/NZS 1940:2017 (Storage and Handling of Flammable and Combustible Liquids) and AS/NZS 1692:2006 (Steel Tanks for Flammable and Combustible Liquids).

The standby generators are anticipated to use low-sulphur diesel fuel during operations. Spill containment measures will also be provided around tank fill connections, pumps, and filters where necessary. Given the low potential for fugitive emissions from fuel storage and the minimal risk of off-site impacts, no further quantification of these emissions has been included in this AQIA.

2.3.3. Odour

Construction stage activities may include the operation of plant and machinery, that may pose an insignificant risk of odour in the event of accidental fuel spillage which can be effectively managed through the provision of spill kits to promptly manage any spillages.

Operational phase activities would not result in any odorous emissions, with the exception of the periodic operation of the diesel-fuelled generators for testing and tertiary back-up power generation purposes only, as outlined above.

Air emissions of VOCs from the standby generators have been assessed as benzene (C_6H_6) as a principal toxic air pollutant, with anticipated emissions of toluene (C_7H_8) and xylene (C_8H_{10}) assessed and compared against the relevant odour impact assessment criteria.

2.4. Alternative Options for Power Generation

Currently, diesel generators remain the most reliable and practical solution for large-scale data centre standby operations due to their proven reliability, rapid startup, and robust power delivery under high-load conditions.

While renewable energy is central to clean energy transitions, it alone cannot meet data centre baseload and peak demands. Challenges include renewable intermittency and the limited scalability of energy storage and backup systems. Consequently, most data centres will currently continue relying on fossil fuels in some form. Although many operators have committed to 100 % renewable energy by 2030[1], such commitments often rely on purchasing renewable energy credits or power purchase agreements rather than direct renewable generation.

Due to the high load density and steady load profile, solar panels covering the entire roof would only meet a small portion of the site's power needs, and mechanical equipment further limits available space for solar installations.

Alternative technologies such as large-scale Battery Energy Storage Systems (BESS), hydrogen fuel cells (HFC), and renewable fuels like Hydrotreated Vegetable Oil (HVO) may offer alternative solutions.

BESS offers rapid response and zero onsite emissions but requires significant initial investment and depends on grid electricity, which may not always be renewable. Hydrogen (H_2) fuel cells provide clean and efficient power, but face challenges related to H_2 supply infrastructure and currently high costs. HVO offers an immediate pathway to emissions reduction when used as a renewable substitute in existing diesel generator sets, requiring minimal retrofit. Emission assessments indicate up to a 90 % lifecycle CO_2 reduction with HVO

[1] https://www.pv-magazine-australia.com/2025/10/15/dealing-with-demands-of-power-hungry-data-centres/

compared to fossil diesel. Both BESS and HFCs provide near-zero local emissions, consistent with long-term sustainability goals. Initial cost analyses show BESS incurs higher upfront capital costs but benefits from low operating expenses, whereas HVO provides a cost-effective mid-term option balancing emissions reductions with operational practicality.

Given current technological and financial constraints, diesel generators remain essential for standby power at data centre developments. Alternative technologies, particularly renewable fuels like HVO that could be progressively integrated as they become commercially viable, advancing environmental outcomes in line with Best Available Technology (BAT) obligations.

Further discussion with regard to the feasibility of BAT measures is provided in Section 9.5.

3. LEGISLATION, REGULATION AND GUIDANCE

The following provides an overview of the legislation and air quality criteria which are applicable to the activities being performed at the Proposal site.

3.1. Protection of the Environment Operations Act

The *Protection of the Environment Operations Act* 1997 (POEO Act) sets the statutory framework for managing air quality in NSW, including establishing the licensing scheme for major industrial premises (scheduled activities) and a range of air pollution offences and penalties.

Schedule 1, Part 1 of the POEO Act provides definitions for scheduled activities, and the associated threshold activity rates. For the Proposal, the thresholds relevant to chemical storage (clause 9) and electricity generation (clause 17) are relevant, given the use of standby diesel-fuelled generators and storage of diesel fuel at the Proposal site.

3.1.1. Chemical Storage

Clause 9 of Schedule 1, Part 1 of the POEO Act states:

9 Chemical storage

(1) This clause applies to the following activities--

"general chemicals storage", meaning the storage or packaging in containers, bulk storage facilities or stockpiles of any chemical substance classified as a dangerous good in the Transport of Dangerous Goods Code , other than the following--

...

"petroleum products storage", meaning the storage or packaging of petroleum or petroleum products in containers, bulk storage facilities or stockpiles.

(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.

Table

Column 1	***Column 2***
Activity	*Criteria*
...	
petroleum products storage	*capacity to store more than 200 tonnes (liquified gases) or 2,000 tonnes (chemicals in any other form)*

The Proposal may be deemed to be a scheduled activity due to the quantity of diesel fuel stored at the Proposal site. Should the Proposal have the capacity to store more than 2 000 tonnes (t) of diesel fuel (equivalent to 2 350 kL assuming a fuel density of 850.8 kg·m^{-3}), then the Proposal may be deemed to be a scheduled activity under Schedule 1, Part 1 Clause 9 of the POEO Act.

As outlined in Section 2.2, the Proposal is to include capacity to store up to 18 056 kL of diesel fuel. Given the chemical storage threshold specified in the POEO Act, the Proposal would therefore be considered to be a scheduled activity and correspondingly, an Environment Protection Licence (EPL) would be required, on this basis.

3.1.2. Electricity Generation

Clause 17 of Schedule 1, Part 1 of the POEO Act states:

17 Electricity generation

(1) This clause applies to the following activities:

...

metropolitan electricity works (internal combustion engines), meaning the generation of electricity by means of electricity plant:

(a) that is based on, or uses, an internal combustion engine, and

(b) that is situated in the metropolitan area or in the local government area of Port Stephens, Maitland, Cessnock, Singleton, Wollondilly, or Kiama.

(1A) However, this clause does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year.

(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.

During times of stable external supply of electricity, the back-up generators will only operate during scheduled maintenance events (refer Section 2.3.2). On this basis, the Proposal is not anticipated to exceed the 200-hour limit, on the generation of electricity by means of electricity plant that is emergency stand-by plant and is not deemed to be a scheduled activity under Schedule 1, Part 1, Clause 17 of the POEO Act.

3.1.3. Equipment Maintenance

Part 5.4 of the POEO Act outlines a number of requirements associated with air pollution. These requirements generally relate to the appropriate maintenance of plant and equipment in an efficient condition and dealing with materials in a manner as to not cause air pollution.

3.2. Protection of the Environment Operations (Clean Air) Regulation

The Protection of the Environment Operations (POEO) (Clean Air) Regulation 2022 (POEO CAR) establishes requirements and concentration standards for air emissions from industrial activities in NSW. It regulates air quality issues related to various sources, including burning activities, motor vehicle fuels, fuel usage and transfer, air impurities from activities and plants, and the storage of volatile organic liquids.

Part 5 of the POEO CAR specifically addresses air impurities from activities and plant, referring to Schedule 2 to set concentration standards for both scheduled and non-scheduled premises. The standards are in-stack emission limits and are the maximum emissions permissible.

As previously discussed in Section 3.1, if the Proposal is deemed to be a scheduled activity under the POEO Act, the general standards of concentration for scheduled activities as outlined in the POEO CAR would apply. In any event, the generators would be required to achieve the Schedule 2, Part 3 standard of concentration for non-scheduled activities.

Clause 73, Part 5, Division 6 of the POEO CAR provides the following in regard to the regulation of emissions from emergency electricity generation:

> *73 Exemption relating to emergency electricity generation*
>
> *Emergency standby plant is exempt from the air impurities standard for nitrogen dioxide and nitric oxide specified in Schedule 2, Part 2, Division 3 for the plant if –*
>
> *(a) the plant comprises a stationary reciprocating internal combustion engine for generating electricity, and*
>
> *(b) it is used for a total of not more than 200 hours per year.*

As outlined in Section 2.3.2, the generators would be operated for less than 200 hours per year, and the exemption above would therefore apply to the Proposal.

The standards of concentration, and whether they are applicable to the Proposal, are summarised in Table 9.

Part 4 Clause 20 of the POEO CAR requires that motor vehicles do not emit excessive air impurities which may be visible for a continuous period of more than 10-seconds when determined in accordance with the relevant standard.

All vehicles, plant and equipment to be used either at the Proposal site or to transport materials to and from the Proposal site will be maintained regularly and in accordance with manufacturers' requirements, where these vehicles are under the operational control of the Applicant.

Table 9 POEO CAR standards of concentrations for applicable air impurities

Air impurity	Activity or plant	Concentration	Applicable
Schedule 2, Part 2, Division 2 – Electricity generation (Group 6)			
Solid particles (Total)	An activity or plant using a liquid or solid standard fuel or a non-standard fuel	50 $mg \cdot Nm^{-3}$ (A)	Yes. Proposal would be a scheduled activity.
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	A turbine operating on a fuel other than gas, being a turbine used in connection with an electricity generating system with a capacity of 30 MW or more	90 $mg \cdot Nm^{-3}$ (A)	No. Proposal would be a scheduled activity but would not operate turbines and would operate for less than 200 $hrs \cdot yr^{-1}$.
Schedule 2, Part 2, Division 3 - Scheduled premises (Group 6)			
Solid particles (Total)	An activity or plant	50 $mg \cdot Nm^{-3}$ (A)	Yes. Proposal would be a scheduled activity.
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	Stationary reciprocating internal combustion engines	450 $mg \cdot Nm^{-3}$ (A)	No. Proposal would be a scheduled activity but would operate for less than 200 $hrs \cdot yr^{-1}$.
Volatile organic compounds (VOCs), as *n*-propane	A stationary reciprocating internal combustion engine using a liquid fuel	1 140 $mg \cdot Nm^{-3}$ (A) VOCs *or* 5 880 $mg \cdot Nm^{-3}$ (A) CO	Yes. Proposal would be a scheduled activity.
Smoke	An activity or plant in connection with which liquid or gaseous fuel is burnt	20 % opacity	Yes. Proposal would be a scheduled activity.
Schedule 2, Part 3 - Non-scheduled premises (Group C)			
Solid particles (Total)	An activity or plant	100 $mg \cdot Nm^{-3}$ (B)	No
Smoke	An activity or plant in connection with which liquid or gaseous fuel is burnt	20 % opacity	No

Notes: (A) POEO CAR Sch2, Pt 3, Div 1: dry, 273 K, 101.3 kPa, 7 % O_2

(B) POEO CAR Sch 2, Pt 2, Div 2: dry, 273 K, 101.3 kPa, 7 % O_2

3.3. NSW EPA Approved Methods

State air quality guidelines are prescribed by the NSW EPA in the Approved Methods which has been consulted during the preparation of this AQIA (refer Table 3).

The Approved Methods lists the statutory methods that are to be used to assess emissions of criteria air pollutants in NSW. Section 7.1 and Section 7.2 of the Approved Methods clearly outlines the impact assessment criteria for those key pollutants of interest and both individual and principal toxic air pollutants. Principal toxic air pollutants are defined in the Approved Methods on the basis that they are carcinogenic, mutagenic, highly persistent, or highly toxic in the environment.

The criteria listed in the Approved Methods are derived from a range of sources (including National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC], and World Health Organisation [WHO]).

The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW. The standards adopted to protect members of the community from health impacts in NSW for relevant individual air pollutants are presented in Table 10.

To assess the potential impact of emissions of Total Volatile Organic Compounds (VOC) (which is a complex mixture of hydrocarbons), the 99.9th percentile 1-hour impact assessment criterion for benzene (C_6H_6) of 0.029 mg·m^{-3} (29 µg·m^{-3}) as outlined in table 12 of the Approved Methods has been adopted. Benzene (C_6H_6) is one of the primary components of TVOC emissions resulting from diesel combustion engines and correspondingly, compliance with the benzene (C_6H_6) criterion (refer Table 10) would generally result in compliance with all VOC components from a health-perspective. Formaldehyde (CH_2O) is assessed as a discrete VOC.

VOC emissions have additionally been assessed against the 99.9th percentile 1-hour odour impact assessment criteria for toluene (C_7H_8) of 0.36 mg·m^{-3} (360 µg·m^{-3}) and xylene (C_8H_{10}) of 0.19 mg·m^{-3} (190 µg m^{-3}) to address the potential for odour impacts. Table 11 provides a summary of impact assessment criteria for principal toxic, and both individual odorous and toxic pollutants that are referenced within this AQIA, as outlined in Section 7.2 of the Approved Methods.

Table 10 NSW EPA impact assessment criteria

Pollutant	Averaging period	Criterion ($\mu g \cdot m^{-3}$)[(a)]	Notes
Sulphur dioxide (SO_2)	1 hour	215	Numerically equivalent to the AAQ NEPM [(b)] standards and goals
	24 hours	57	
Nitrogen dioxide (NO_2)	1 hour	164	
	Annual	31	
Particulates (as PM_{10})	24 hours	50	
	1 year	25	
Particulates (as $PM_{2.5}$)	24 hours	25	
	1 year	8	
Particulates (as TSP)	1 year	90	-
Pollutant	**Averaging period**	**Criterion ($mg \cdot m^{-3}$) [(c)]**	**Notes**
Carbon monoxide (CO)	15 minutes	100	Numerically equivalent to the AAQ NEPM [(b)] standards and goals
	1 hour	30	
	8 hours	10	
Pollutant	**Averaging period**	**Criterion ($g \cdot m^{-2} \cdot month^{-1}$)**	**Notes**
Particulates (as dust deposition)[(d)]	1 year[(e)]	2	Assessed as insoluble solids as defined by AS 3580.10.1
	1 year[(f)]	4	

Notes: (a): micrograms per cubic metre of air

(b): National Environment Protection (Ambient Air Quality) Measure

(c): milligrams per cubic metre of air

(d): only considered in the construction stages

(e): maximum increase in deposited dust level

(f): maximum total dust level

Table 11 NSW EPA impact assessment criteria for principal and individual toxic pollutants

Pollutant	Averaging period	Criterion		Notes
		$mg \cdot m^{-3}$ [(A)]	$\mu g \cdot m^{-3}$ [(B)]	
Polycyclic Aromatic Hydrocarbon (PAH) as benzo(a)pyrene	1 hour	0.0004	0.4	
Benzene (C_6H_6)	1 hour	0.029	29	
Toluene (C_7H_8)	1 hour	0.36	360	Odour
Xylene (C_8H_{10})	1 hour	0.19	190	Odour
Formaldehyde (CH_2O)	1 hour	0.02	20	

Notes: (a): milligrams per cubic metre of air

(b): micrograms per cubic metre of air

As required under section 7.2.2 of the Approved Methods, the criteria for PAH, benzene, and formaldehyde identified in Table 11 are required to be assessed at any location at or beyond the Proposal site boundary.

3.4. Mamre Road Precinct Development Control Plan 2021

The Mamre Road Precinct Development Control Plan (DCP) 2021 provides specific planning guidelines for industrial development within the Mamre Road Precinct, located in the Western Sydney Employment Area (WSEA).

In regard to air quality, the objectives of the Mamre Road Precinct DCP 2021 are as follows:

> *a) To maintain existing air quality or improve local air quality to protect public health.*
>
> *b) To ensure future development does not adversely affect existing air quality.*

The controls associated with air quality for the Mamre Road Precinct DCP 2021 are presented in Table 12, including the section of this report where they have been addressed.

Table 12 Mamre Road Precinct DCP controls

Control	Addressed
Any development likely to, or capable of, generating air emissions must comply with the *Protection of the Environment Operations Act* 1997 and associated regulations.	Section 3.1, Section 3.2 and Section 8.3
An Air Quality and Odour Assessment is required for development that may have an adverse impact on local and regional air quality, including construction impacts on adjoining rural-residential areas.	Section 6, Section 7 and Section 8
The Air Quality and Odour Assessment should be in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2017) and/or The Technical framework - assessment and management of odour from stationary sources in NSW (EPA 2006) and include but not be limited to: • Characterisation of all emissions; • Measures to mitigate air impacts, including best practice measures; and • Details of any monitoring programs to assess performance of any mitigation measures and to validate any predictions as a result of the assessment.	Section 2.3 Section 9.6 Section 9.6, CAQMP
Developments that involve back up power generation of electricity with diesel equipment that has the capacity to burn more than 3 megajoules of fuel per second must include a best practice review of reasonable and feasible diesel emission reduction technology.	Section 9.5 Appendix J

3.5. NSW Government Air Quality Planning

NSW EPA has formed a comprehensive strategy with the objective of driving improvements in air quality across the State. This comprises several drivers, including:

- **Legislation**: formed principally through the implementation of the POEO Act and POEO CAR. The overall objective of the legislative instruments is to achieve the requirements of the National Environment Protection (Ambient Air Quality) Measure;
- **Clean Air for NSW**: The 10-year plan for the improvement in air quality;
- **Inter-agency Taskforce on Air Quality in NSW**: a vehicle to co-ordinate cross-government incentives and action on air quality;
- **Managing Particles and Improving Air Quality in NSW**; and
- **Diesel and Marine Emission Management Strategy**.

In regard to the relevance of the NSW Government's drive to maintain and improve air quality across the State and this AQIA, it is imperative that the Proposal would lead to the development of the NSW economy (in terms of activity and employment) and concomitantly not cause a detriment in air quality in achieving its objectives.

4. EXISTING CONDITIONS

The following information provides context around the location of sensitive receptor locations surrounding the Proposal site, the prevailing meteorology and air quality of the surrounding area and identifies other sources of air pollutants which have the potential to impact cumulatively with the Proposal.

4.1. Surrounding Land Sensitivity

The Proposal site is situated within an IN1 General Industrial zone under the SEPP (WSEA) for MRP.

The land use immediately surrounding the Proposal site includes other IN1 areas and SP2 Infrastructure (Classified Road) directly to the west. Other land uses proximate to the Proposal site include C2 Environmental Conservation as well as RE1 Public Recreation, RE2 Private Recreation and ENZ Environment and Recreation areas to the west.

4.2. Sensitive Receptor Locations

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors, refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed.

The Approved Methods defines a sensitive receptor location to be:

> *'A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area'.*

It is noted that the assessment criteria applied to particulate matter (PM) and sulphur dioxide (SO_2) (refer Table 10) are for a 24-hour averaging period, and as such the predicted impacts need to be interpreted at commercial and industrial receptor locations with care. It is considered to be atypical for a person to be at those locations for a complete 24-hour period and as such, the exposure risks associated with those pollutants at those locations would be over-estimated by adoption of those locations in the modelling assessment.

It is important to note that the selection of discrete receptor locations does not aim to cover all sensitive receptors within the study area. Rather, the selected locations are intended to be representative of their broader surroundings and can reasonably be assumed to reflect conditions in the immediate vicinity. In cases where multiple sensitive receptors exist in close proximity (such as a school adjacent to a medical centre) the receptor closest to the emission source is typically chosen to assess potential risks to other sensitive land uses in the area.

Beyond the identified discrete receptors, the entire modelling area has been overlaid with a grid of uniform receptor points to map predicted impacts in a comprehensive manner. As such, the accidental omission of a particular sensitive location does not invalidate the AQIA or render it incapable of assessing potential risks.

In accordance with the requirements of the Approved Methods, several receptors have been identified and are presented in Appendix B and illustrated in Figure 6 and Figure 7. Appendix B is not intended to represent a definitive list of sensitive land uses, but a cross section of available locations, that are used to characterise larger areas, or selected as they represent more sensitive locations, which may represent people who are more susceptible to changes in air pollution.

To ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the premises reside, population density data has been examined. Population density data based on the 2024 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km^2) grid, covering mainland Australia (ABS, 2025).

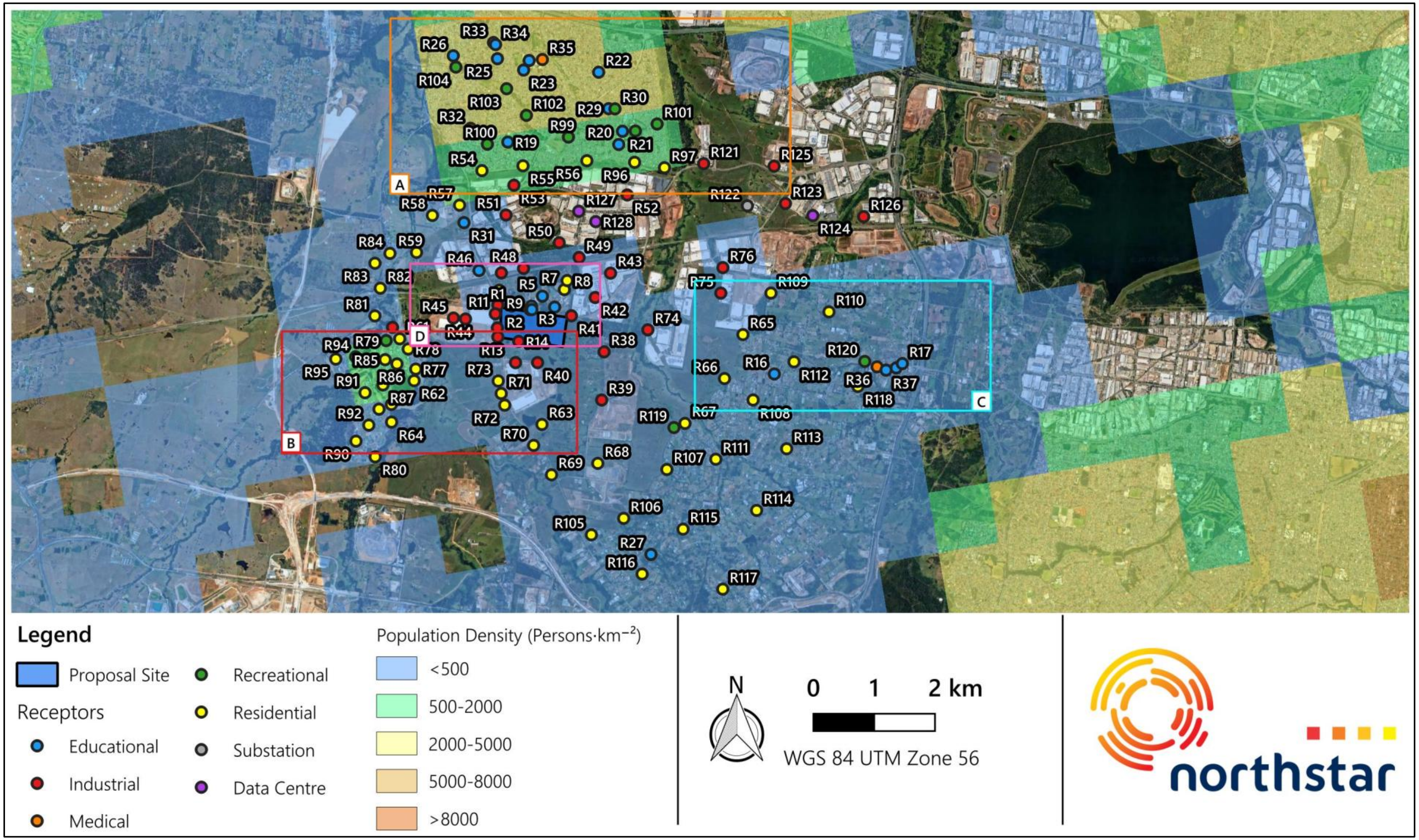
Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities (refer Figure 6).

For clarity, the ABS use the following categories to analyse population density ($persons{\cdot}km^{-2}$):

- No population — Zero (0).
- Very low — Up to 500.
- Low — Between 500 and 2 000.
- Medium — Between 2 000 and 5 000.
- High — Between 5 000 and 8 000.
- Very high — More than 8 000.

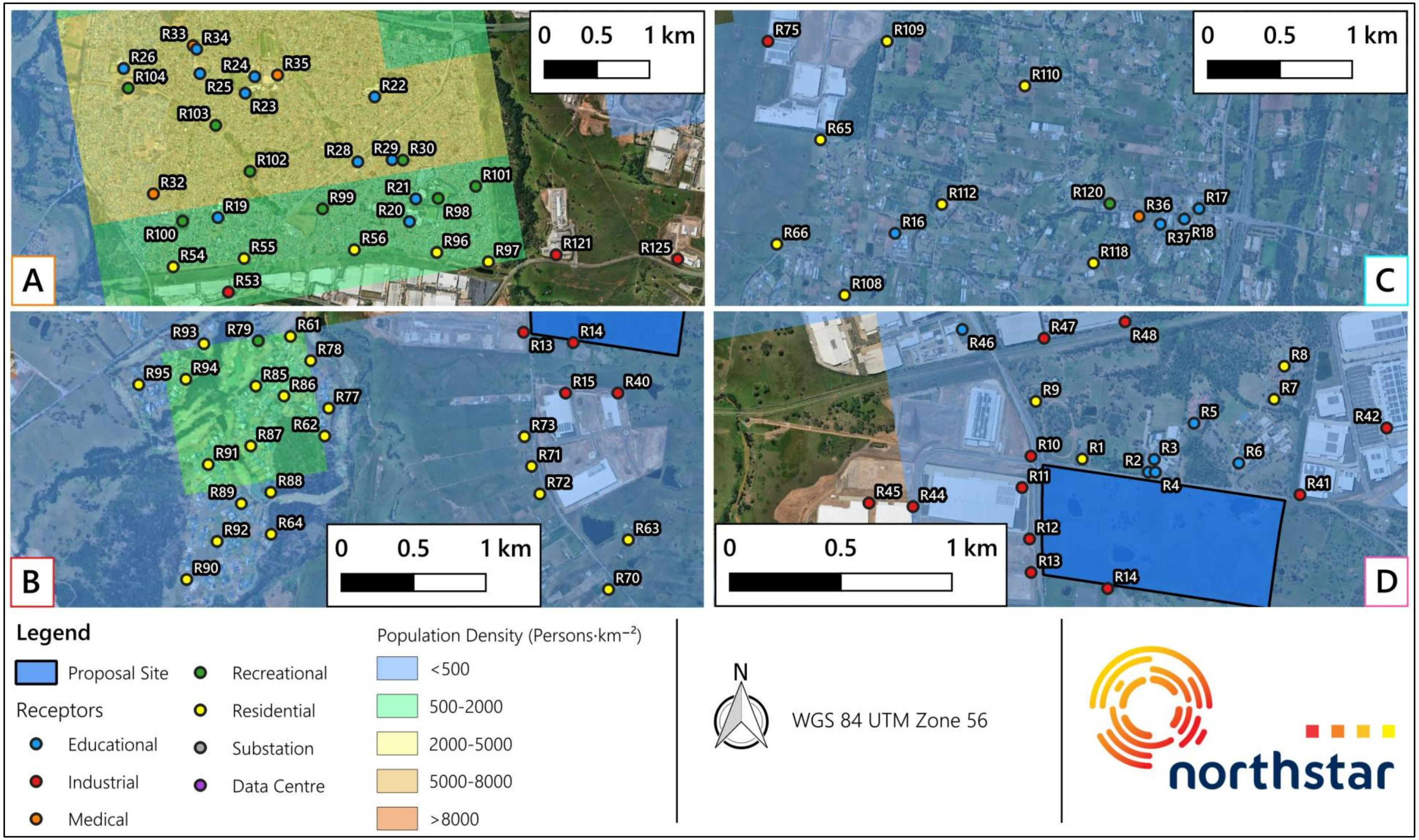
Using the ABS data in a GIS, the population density around the Proposal site and its immediate vicinity is categorised as very low (i.e. between zero and less than 500 $persons{\cdot}km^{-2}$), indicating a predominantly industrial area. Areas of higher population density are located to the north (St Clair and Erskine Park), south east (Abbotsbury, Bossley Park), and south west (Luddenham).

Figure 6 Sensitive receptors surrounding the Proposal site and population density (Part 1)



Source: Northstar

Figure 7 Sensitive receptors surrounding the Proposal site and population density (Part 2)



Source: Northstar

4.3. Meteorology

In accordance with the requirements of the Approved Methods, the AQIA is required to describe and account for the influence of the prevailing meteorological conditions.

The meteorology experienced within an area can govern the generation (in the case of wind-dependent emission sources), dispersion, transport and eventual fate of pollutants in the atmosphere. The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at surrounding Automatic Weather Stations (AWS).

To characterise local conditions, meteorological data from the Horsley Park Equestrian Centre AWS (Horsley Park AWS), operated by the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW), located approximately 6.4 km west north west of the Proposal site has been analysed. Specifically, meteorological data for the period 2020 to 2024 (the most recent five years of complete records) collected at Horsley Park AWS has been adopted. A comprehensive summary of the data is presented in Appendix C.

Annual wind roses indicate a consistent wind distribution pattern across these years, with predominant south-westerly winds. The majority of wind speeds range between 0.5 $m{\cdot}s^{-1}$ and 5.5 $m{\cdot}s^{-1}$, with higher speeds (more than 5.5 $m{\cdot}s^{-1}$) occurring in only 2.2 % of recorded hours, primarily originating from northwest directions. Calm conditions (less than 0.5 $m{\cdot}s^{-1}$) are more frequent, averaging 19.4 % of recorded hours.

Although the Horsley Park AWS is nearby, on-site meteorological analysis is needed to establish baseline conditions for the Proposal. In the absence of on-site data, site-representative conditions were generated using the TAPM and CALMET models for use in CALPUFF (refer Section 5.1.2).

To ensure representativeness, a correlation analysis of observed wind direction and wind speed at Horsley Park AWS, and NO_2 concentrations measured at St Marys Air Quality Monitoring Station (AQMS) was conducted (refer Appendix C). Based on this analysis, 2021 was selected as the most representative year for meteorological modelling.

For this AQIA, CALMET was run in no-observations (‘no-obs’) mode using gridded prognostic data generated by The Air Pollution Model (TAPM, v 4.0.5), developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), to determine surface and wind characteristics at the Proposal site. A summary of the inputs and outputs of the meteorological modelling assessment, including validation of those outputs is presented in Appendix C.

4.4. Background Air Quality

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional and global). The relative contributions of sources at each of these scales to the air quality at a location, will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant, should also be assessed. These 'background' (sometimes called 'baseline') air quality conditions will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

The most representative AQMS relative to the Proposal site, with data available for the year 2021 (consistent with the selected representative year for meteorological modelling [refer Appendix C]) is situated at St Marys AQMS. It is noted that St Marys AQMS however, does not measure concentrations of carbon monoxide (CO) and sulphur dioxide (SO_2), which are required as part of this assessment (refer Section 3.3). Correspondingly, for the purposes of this AQIA, CO and SO_2 concentration data has been adopted from Prospect AQMS.

A summary of the air quality monitoring data and assumptions used to produce this AQIA are presented in Table 13. It is noted that although impacts of ozone (O_3) have not been considered in this assessment, O_3 data collected at St Marys AQMS have been adopted to assist in calculating the conversion of NO_X to NO_2 for the dispersion modelling assessment (refer Section 5.3.2.4).

It is noted that the St Marys or Prospect AQMS do not measure concentrations of TSP. As this pollutant is of relevance to the expected emissions from the Proposal, other sources of data have been adopted to allow representation of the TSP environment in the area surrounding the Proposal site, and a discussion is provided in Appendix D.

In addition, a number of pollutants assessed as part of this AQIA are not routinely monitored at AQMS locations in NSW including:

- Polycyclic aromatic hydrocarbons (PAH).
- Benzene (C_6H_6), toluene (C_7H_8), and xylene (C_8H_{10}); and
- Formaldehyde (CH_2O).

For the purposes of this AQIA, it has been assumed that background concentrations of the abovementioned pollutants are negligible. In any case, section 7 of the Approved Methods only requires the assessment of the 99.9^{th} percentile 1-hour incremental impacts for the pollutants outlined above.

Appendix D provides further analysis of the background air quality monitoring data used in this AQIA.

Table 13 Summary of background air quality data used in the AQIA

Pollutant	Averaging period	Units	Measured value	Notes
Particles (as TSP)	Annual	$\mu g \cdot m^{-3}$	33.4	Estimated on a TSP:PM_{10} ratio of 2.0551:1
Particles (as PM_{10})	24-hour	$\mu g \cdot m^{-3}$	Daily varying	The 24-hour maximum for PM_{10} in 2021 was 54.9 $\mu g \cdot m^{-3}$
	Annual	$\mu g \cdot m^{-3}$	16.2	
Particles (as $PM_{2.5}$)	24-hour	$\mu g \cdot m^{-3}$	Daily varying	The 24-hour maximum for $PM_{2.5}$ in 2021 was 40.3 $\mu g \cdot m^{-3}$
	Annual	$\mu g \cdot m^{-3}$	5.8	
Nitrogen dioxide (NO_2)	1-hour	$\mu g \cdot m^{-3}$	Hourly varying	The 1-hour maximum for NO_2 in 2021 was 67.7 $\mu g \cdot m^{-3}$
	Annual	$\mu g \cdot m^{-3}$	8.1	
Carbon monoxide (CO)	15-minutes	$mg \cdot m^{-3}$	2.1	Calculated from 1-hour data (Section 5.3.2.5)
	1-hour	$mg \cdot m^{-3}$	1.6	Hourly maximum 1-hr average in 2021
	8-hour	$mg \cdot m^{-3}$	1.3	Maximum 8-hr rolling average in 2021
Sulphur dioxide (SO_2)	1-hour	$\mu g \cdot m^{-3}$	42.9	Hourly maximum 1-hr average in 2021
	24-hour	$\mu g \cdot m^{-3}$	8.6	The 24-hour maximum for SO_2 in 2021

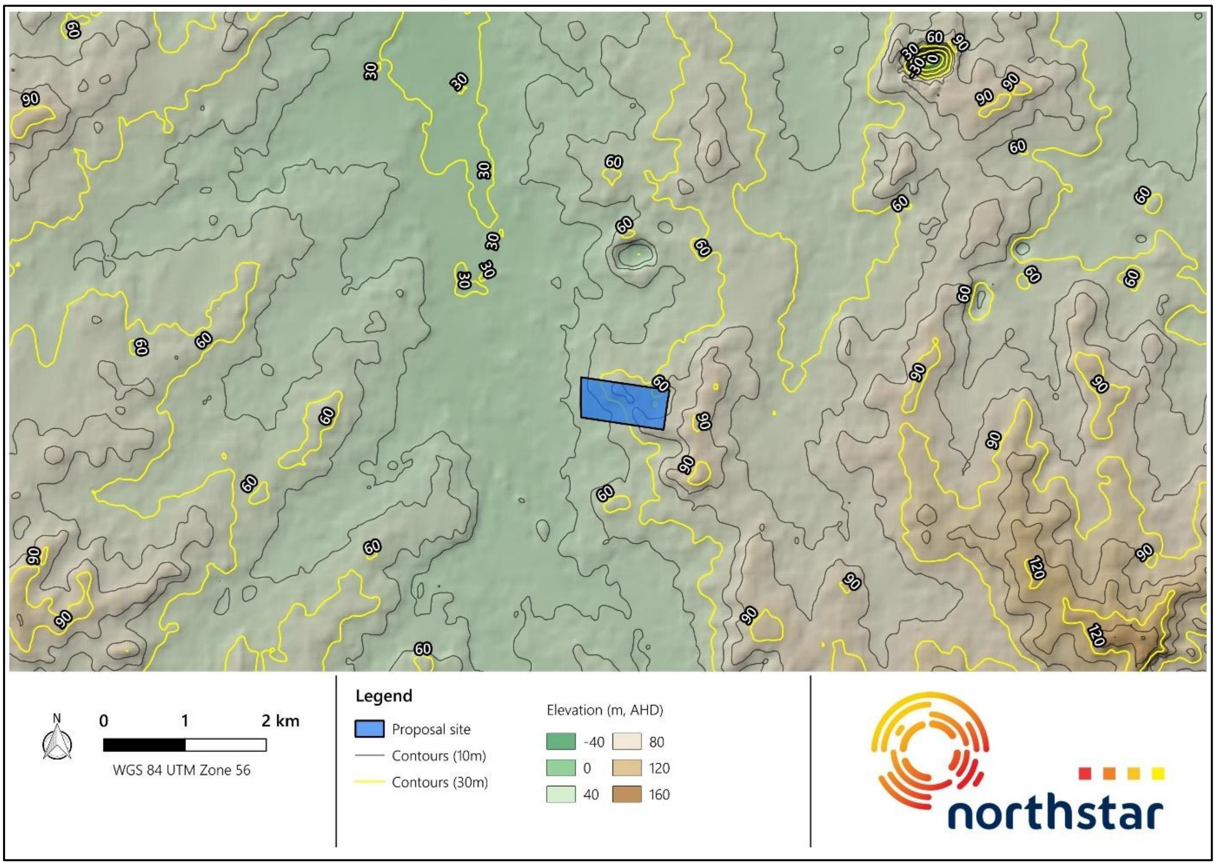
The background air quality data adopted from St Marys AQMS and Prospect AQMS is assumed to not include the impact of other data centre operations in the area. Additional dispersion modelling of surrounding data centres has been performed to fully quantify the potential cumulative impacts associated with those developments as requested by NSW DPHI and NSW EPA, and further details are provided in Section 5.5.

In circumstances where missing air quality data is present in downloaded background data, this has been processed by using the previous hour value (in the case of a single missing hour) ("persistence") or being filled with the average of the nearest values on either side of the missing data (in the case of multiple missing hours) ("trending").

4.5. Topography

The elevation of the Proposal site ranges between approximately 50 m and 80 m Australian Height Datum (AHD) (refer Figure 8). The topography between the Proposal site and nearest sensitive receptor locations is uncomplicated (from an AQIA perspective). Nonetheless, the influence of topography has been included in the dispersion modelling assessment as described in Section 5.1.3.

Figure 8 Local topography



Source: Northstar

5. APPROACH TO ASSESSMENT

This report provides a quantitative assessment of potential air quality impacts during both the construction stage (refer Section 2.3.1) and operational phase (refer Section 2.3.2), in accordance with the SEARs (refer Table 1) and NSW EPA Approved Methods requirements.

The following sections outline the approach adopted in detail.

5.1. Dispersion Modelling Approach

The air emissions assessment for this Proposal was completed using quantitative dispersion modelling. This section outlines the dispersion modelling methodology applied.

5.1.1. Dispersion Model

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF atmospheric dispersion model. CALPUFF is recognised in the Approved Methods as a widely accepted model for regulatory applications in NSW and it is considered to be applicable and appropriate for this AQIA. CALPUFF is used to predict pollutant concentrations from various sources typically found at industrial facilities.

The CALPUFF model uses hourly meteorological data to define conditions for plume rise, transport, diffusion, and deposition. It estimates concentrations or deposition values for each source-receptor combination on an hourly basis and calculates user-selected short-term averages. CALPUFF also accounts for local terrain, making it well-suited for modelling complex terrains, including slope flows, valley flows, terrain blocking, and kinematic effects.

Section 3.2 of (Barclay & Scire, 2011) states that, *"CALPUFF is a Lagrangian Gaussian Puff model and is well suited for modelling complex terrain when used in conjunction with CALMET which includes a diagnostic wind field model which contains treatment of slope flows, valley flows, terrain blocking effects and kinematic effects – the speed up over hills."*

Since most air quality standards are based on averages or percentiles, CALPUFF enables further analysis of results for comparison. The CALPUFF-percent post-processing utility calculates the maximum concentration of a pollutant at a specific percentile over a given period, across all receptors. This percentile approach helps omit unusual short-term meteorological events that may cause elevated concentrations, providing a more accurate representation of likely pollutant concentrations over the averaging period.

Table 14 provides the model input configuration to assess the impact of generator emissions from the Proposal, in consideration of the Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for inclusion into the Approved Methods (Barclay & Scire, 2011).

Table 14 General model parameters for CALPUFF dispersion modelling

Model parameter	Input
Model mode	CALPUFF Refined Mode CALMET No-Observations (No-Obs) Mode
Meteorological data	Prognostic Data (TAPM) (.apl)
Terrain topography	SRTM1
Model / Grid domain size	14 km × 14 km × 4 km
Grid resolution / spacing	0.1 km

(Barclay & Scire, 2011) recommend using CALMET 'no-obs' mode for regulatory screening when good-quality gridded prognostic meteorological data are available, which has been applied in the dispersion modelling process.

Given the variable topography, the terrain radius of influence was set at 10 km, with a minimum of 0.1 km. Terrain data with a 1 arc-second resolution (approximately 30 m) were used, in consideration of (Barclay & Scire, 2011). The dispersion model was run over a 14 km × 14 km grid at ground level, encompassing the nearest sensitive receptors (refer Section 4.2), covering all potentially impacted nearby land uses.

Table 15 summarises the key CALPUFF dispersion modelling switches recommended by (Barclay & Scire, 2011) and those adopted for this AQIA.

Table 15 List of key CALPUFF dispersion model switches

Option	Parameter	Recommended value(s)	
		Table A-4 (Barclay & Scire, 2011)	Proposal
Vertical distribution used in the near field	MGAUSS	1	1
Terrain adjustment method	MCTADJ	3	3
Sub grid-scale complex terrain	MCTSG	0	0
Near-field puffs modelled as slugs	MSLUG	0	0
Transitional plume rise	MTRANS	1	1
Stack tip downwash	MTIP	1	1
Method to compute plume rise	MRISE	1	1
Method to simulate building downwash	MBDW	2	2
Vertical wind shear modelled above stack top	MSHEAR	0	0
Puff splitting allowed	MSPLIT	0	0
Chemical transformation	MCHEM	1	0
Aqueous phase chemistry	MACHEM	0	0
Wet removal modelled	MWET	1	1
Dry deposition modelled	MDRY	1	1
Plume tilt	MTILT	0	0
Dispersion coefficients	MDISP	2	2
σv / σθ and σw measurements	MTURBVW	3	3

Option	Parameter	Recommended value(s)	
		Table A-4 (Barclay & Scire, 2011)	Proposal
Dispersion when turbulence data are missing	MDISP2	3	3
Lagrangian time scale for σy	MTAULY	0	0
Turbulence σv and σw profiles	MCTURB	1	1
PG σy , σz adjusted for roughness	MROUGH	0	0
Partial plume penetration (elevated inversions)	MPARTL	1	1
Partial plume penetration (buoyant area sources)	MPARTLBA	1	0
Strength of temperature inversion	MTINV	0	0
Probability density function (PDF)	MPDF	1	1
Sub-Grid TIBL model used for shoreline	MSGTIBL	0,1	0
Boundary conditions modelled	MBCON	0	0
Fog module	MFOG	0	0
Minimum turbulence velocities, sigma v and sigma w for stability class over land and water	SVMIN	0.2	0.5
	SWMIN	default	Default

Regarding chemical transformation (MCHEM), the MESOPUFF II scheme was not enabled because it is intended for long-range (10 – 20 km+) transformation of SO_2 and NO_X species, which is not required. The NO_X to NO_2 conversion method applied is described in Section 5.3.2.4.

The partial plume-penetration option (MPARTLBA) was not used, as it is designed for very hot, buoyant area sources (such as forest fires) and is not applicable with regard to the source emission characteristics considered in this AQIA.

The SVMIN parameter was set to 0.5 rather than the recommended 0.2 as calm or stagnation conditions are not a defining feature of the Proposal site, and the default lateral plume spread is suitable for the meteorological conditions being modelled.

5.1.2. Meteorological Modelling

Section 4 of the Approved Methods requires one-year of site-specific meteorological data or site-representative meteorological data, in the absence of site-specific data, to be used for dispersion modelling.

The 3-D meteorological dataset was derived using gridded prognostic data generated from The Air Pollution Model (TAPM, v 4.0.5) as developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), in conjunction with CALMET (refer Appendix C). Section 4.5 of the Approved Methods identifies TAPM as a commonly used prognostic meteorological model in NSW.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rainwater and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field and thus the final wind field reflects the influences of local topography and current land uses.

Appendix C contains details on the meteorological model configuration and input parameters.

5.1.3. Terrain Effects

The CALPUFF model incorporates terrain information with heights being applied to all receptors and sources. In order to account for the potential influence on pollution dispersion and varying receptor elevations across the modelling domain, a gap filled and filtered (vegetation and obstacles removed) topography file with 1 second resolution (approximately 30 m) derived from the Shuttle Radar Topography Mission (SRTM) data was processed using CALPUFF's terrain pre-processing tools to prepare it for use in the dispersion modelling.

5.1.4. Building Wake Effects

5.1.4.1. Construction Stage

Building wake effects have not been considered for the construction stage. The most significant emissions sources associated with construction stage (earthworks) impacts would be located at ground level and would be fugitive in nature. Building wake effects associated with buildings located on surrounding land would be minor in nature and are also not able to be characterised in the dispersion modelling assessment.

5.1.4.2. Operational Phase

For dispersion modelling assessments, the influence of surrounding buildings on emission transport from elevated discharge points is a material consideration. Nearby buildings can create turbulence and a building wake that can influence pollutant dispersion and cause premature plume grounding ('building downwash'). The ratio of stack height to building height also impacts this effect. If the discharge height is less than 2.5× building height, downwash effects are considered.

Section 5.3 of the Approved Methods outlines the following requirements for determining which buildings to consider within a dispersion modelling assessment:

> *"The location and dimensions of buildings located within a distance of 5L (where L is the lesser of the height or width of the building) from each release point for buildings with a height greater than 0.4 times the stack height…"*

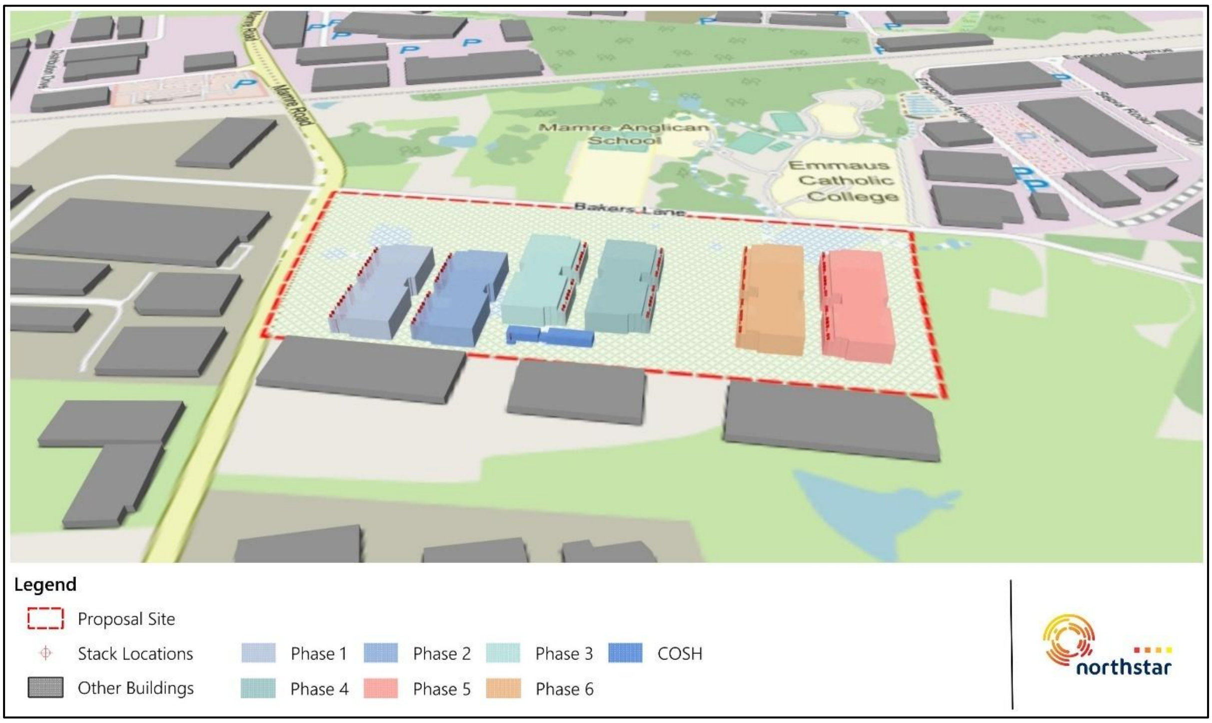
The Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME) uses building heights and corner locations near the stack to simulate effective dimensions. The BPIP-PRIME downwash algorithm computes these dimensions in ten-degree intervals, allowing CALPUFF to assess the impact on plume dispersion and ground-level concentrations. While simplified, this building geometry offers a reasonable estimate of how structures disrupt wind flow nearby.

Therefore, to analyse downwash effects from point sources mimicking air emissions, the buildings surrounding the Proposal site were incorporated into the CALPUFF model, representing each stage of development.

With reference to the requirements outlined in the Approved Methods, Figure 9 to Figure 15 illustrate the locations of the buildings included in the BPIP-PRIME model for downwash calculations, which are subsequently incorporated into the CALPUFF dispersion modelling process. Also shown are the emission discharge points for each scenario modelled (Figure 9 for the emergency scenarios, and Figure 10 to Figure 15 for each maintenance scenario) (refer Section 5.2.2).

Note that the generator flues shown for the maintenance scenarios (M1 to M6) represent the combination that results in the maximum 1-hour NO_X impact at any of the 128 receptors. The assessment has considered the individual flue combination that results in the maximum 1-hour NO_X impacts at each receptor (e.g. 1, 2, 3, 4, 8, 9 at receptor 45, or 55, 58, 59, 120, 123, 150 at receptor 62 etc.).

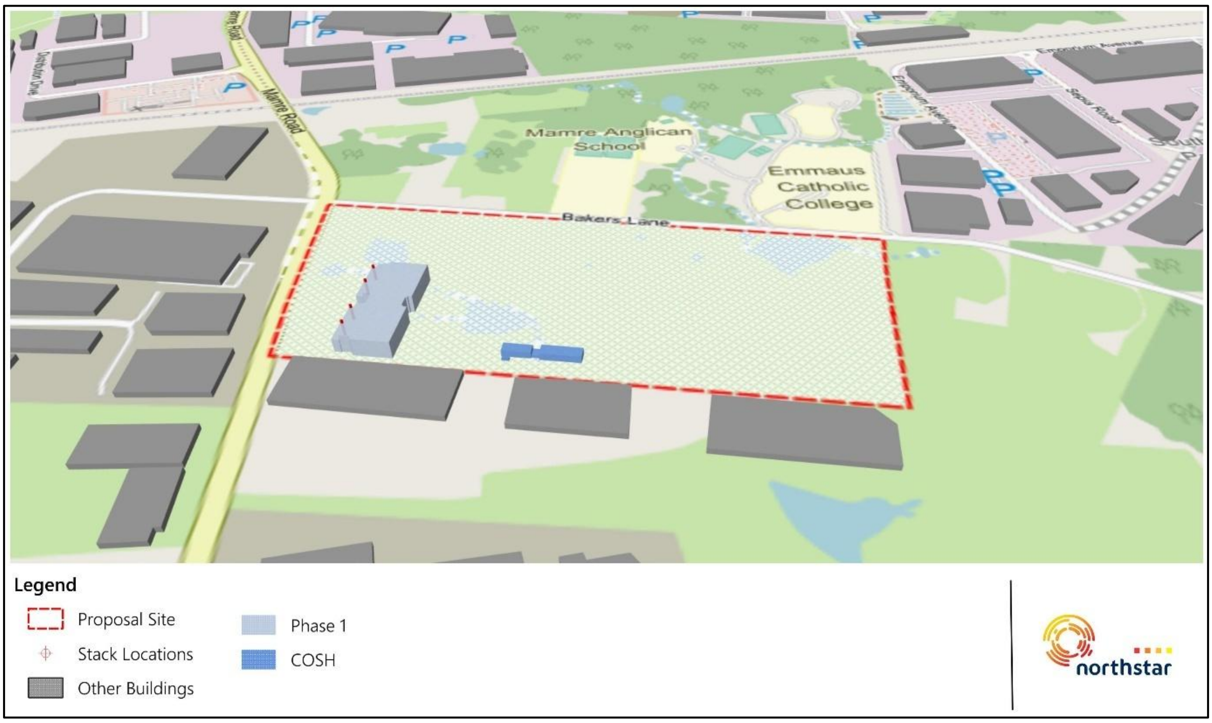
Figure 9 Building and discharge point configuration (Stage E1 – E6)



Source: Northstar

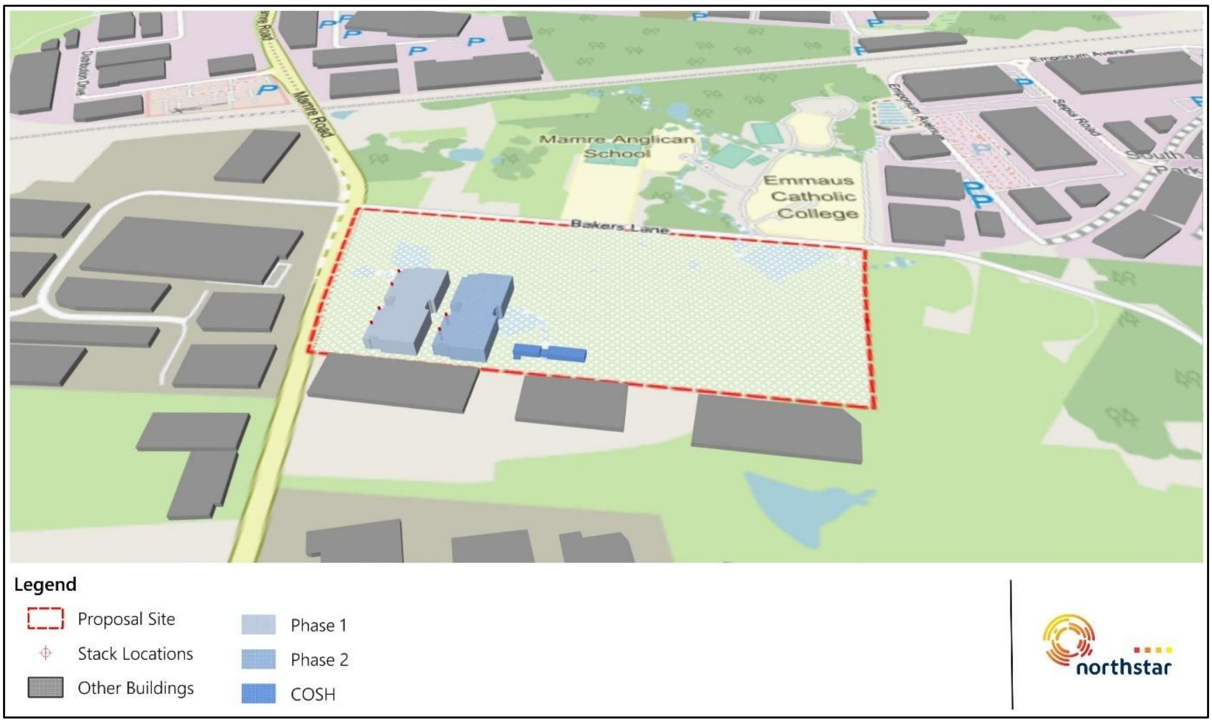
Note: All generator flues shown for Phase 6 ultimate development. Buildings associated with each individual phase shown by colours.

Figure 10 Building and discharge point configuration (Stage M1)



Source: Northstar

Figure 11 Building and discharge point configuration (Stage M2)



Source: Northstar

Figure 12 Building and discharge point configuration (Stage M3)

Source: Northstar

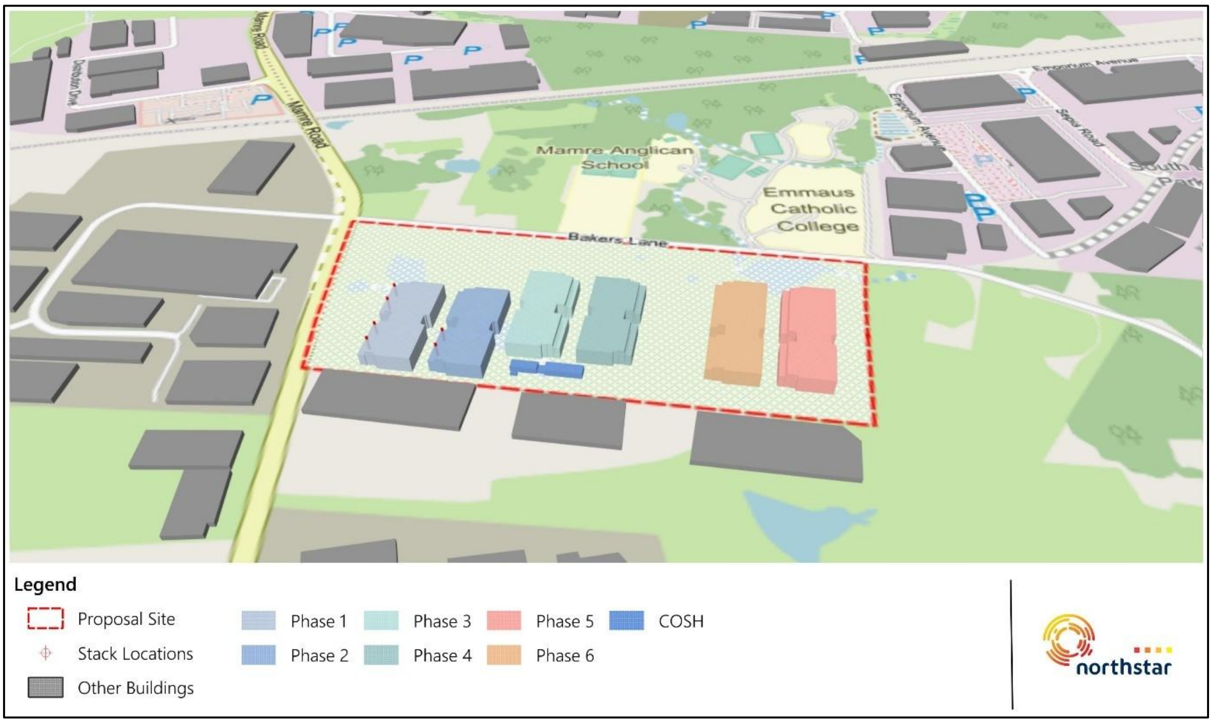
Figure 13 Building and discharge point configuration (Stage M4)

Source: Northstar

Figure 14 Building and discharge point configuration (Stage M5)

Source: Northstar

Figure 15 Building and discharge point configuration (Stage M6)



Source: Northstar

It is noted that the BPIP-PRIME model has a number of limitations. It identifies a single influencing building/tier for 36 no 10° wind directions, and depending on the wind direction, the algorithm selects the largest of the building width or length, which effectively overrides any intricacies in the buildings which may be presented in the model. The model uses the maximum building dimensions (length, width, and height). Even with tiered structures, the algorithm applies analytical rules to merge adjoining buildings and derive a single effective length, width, height, and position relative to the stack(s).

The BPIP-PRIME algorithm has been shown in some studies to result in the overprediction of concentrations by a factor two to eight for certain building types, whilst result in underpredictions for certain building and terrain configurations (Petersen, 2017). In conclusion, the use of the BPIP-PRIME algorithm is required by the NSW Approved Methods, although is not an advanced method such as computational fluid dynamics, or wind tunnel modelling. Any minor disparities in building length, height, width and stack locations are most likely within the large margin of error associated with the use of the BPIP-PRIME algorithm.

5.2. Modelling Scenarios

Modelling scenarios have been prepared to allow the predicted air quality impacts of the Proposal to be presented across all stages of development, as requested by NSW DPHI and NSW EPA. A summary of those scenarios is presented in Table 16, with further detail provided in the following sections. The scenario identifiers (e.g. C1, E1, M1 etc.) represent the scenarios associated with **C**onstruction, **E**mergency operation, and under **M**aintenance testing, respectively.

Table 16 Summary of modelling scenarios

Scenario		Stage	Phase
Construction			
C1	Construction	Stage 1	Phase 0
C2	Construction	Stage 2	Phase 5
Operation - emergency			
E1	Justified worst case	Stage 1	Phase 1
E2	Justified worst case		Phase 1 + Phase 2
E3	Justified worst case		Phase 1 + Phase 2 + Phase 3
E4	Justified worst case		Phase 1 + Phase 2 + Phase 3 + Phase 4
E5	Justified worst case	Stage 2	Phase 1 + Phase 2 + Phase 3 + Phase 4 + Phase 5
E6	Justified worst case		Phase 1 + Phase 2 + Phase 3 + Phase 4 + Phase 5 + Phase 6
Operation – maintenance testing			
M1	Maintenance testing	Stage 1	Phase 1
M2	Maintenance testing		Phase 1 + Phase 2
M3	Maintenance testing		Phase 1 + Phase 2 + Phase 3
M4	Maintenance testing		Phase 1 + Phase 2 + Phase 3 + Phase 4
M5	Maintenance testing	Stage 2	Phase 1 + Phase 2 + Phase 3 + Phase 4 + Phase 5
M6	Maintenance testing		Phase 1 + Phase 2 + Phase 3 + Phase 4 + Phase 5 + Phase 6

It is noted that Stage 2 construction works would be performed concurrently with the operation of the Stage 1 development (phases 1 to 4). The potential for cumulative impacts between the construction stages and operational phases has been considered and is discussed in Section 9.

5.2.1. Construction Stage

5.2.1.1. Scenarios C1 and C2

As outlined in Section 2.2, Section 2.3.1, and Table 5, the Proposal is to be constructed in two stages. The earthworks component of the Proposal construction would have the highest potential for fugitive dust emissions, and this component of construction has been subject to assessment.

Scenarios C1 and C2 have been formulated to provide an assessment of potential construction stage impacts on air quality across both stages of construction (e.g. Year 1-2, and [approximately] Year 12).

As requested by NSW DPHI and NSW EPA, a quantitative cumulative assessment has been provided, which includes the potential impacts of construction stage activities across other developments in the area, including those situated within the Mamre Road Precinct.

The assessment of cumulative impacts during the first stage of construction (Years 1-2) has been guided by publicly available information which provides an indication of developments in the area which are either approved and being constructed, approved with construction yet to commence, or proposed. The usual timeframes between a proposal being submitted, approved, and then constructed is around one to two years. Determination of construction activity in the area surrounding the Proposal site during stage 2 of construction (in approximately 12 years' time) is not currently possible, although an approach is presented in Section 5.5.

5.2.2. Operational Phase

The following sections describe the scenarios that have been prepared to allow assessment of the potential impact under anticipated operation of the Proposal.

As discussed previously, the Proposal would be constructed in six phases. Potential air quality impacts during each of those six phases is presented within this AQIA as requested by NSW DPHI and NSW EPA. The number of operational backup diesel generators would vary according to the operational stage, which limits the number which could either be operated in an emergency scenario, or subject to maintenance testing. The relevant information relating to each phase is presented in Table 17. Further discussion is presented in the following sections.

Table 17 Generators associated with each phase of Proposal

Phase	Year(A)	Buildings	Generators(B)	Max number of generators to be tested at one time	Generators (no) required during feeder failure(s)(E)		
					1 failure	2 failures	3 failures
Phase 1	1	4	132	4(D)	67	132	132
Phase 2	2-6	8	262	6	133	262	262
Phase 3	2-6	12	392	6	133	326	392
Phase 4	2-6	16	522	6	199	392	522
Phase 5	7-8	21	684	6	199	472	684
Phase 6(C)	9-10	26	846	6	281	554	846
Total	-	**26**	**846**	-	**281**	**554**	**846**

Note: (A): Anticipated year of operation

(B): 130 generators in each of Parcels A, B, C, and D. 162 generators in each of Parcels E, and F. Two additional generators associated with the COSH operational in Phase 1.

(C): Full development at Phase 6.

(D): Number of generators which would be tested at one time is limited by the number of available load banks. Only four load banks are available in Phase 1.

(E): Generators required during feeder failure present the total across the Proposal site.

5.2.2.1. Scenarios E1 to E6 – Justified Worst Case Scenarios

The justified worst-case scenarios have been developed to represent the potential maximum air quality impacts associated with the development. This Proposal differs from many other data centre developments, in that a significant level of redundancy is built into the design to ensure that the use of diesel generators is minimised.

For example, other data centres may be connected to the electricity supply grid by one feeder only, such that any interruption to that supply would require full deployment of back-up power via diesel generators. In this case, as described in Section 2.3.2.1, three feeders would supply the Proposal site, and generators would only be required for a short time, should supply from one or two feeders fail.

The formulation of a worst-case scenario has considered:

- One feeder failure:
    - An annual unplanned outage period of < 1 minute per year, consistent with the Sydney West BSP maximum allowable unserved energy (USE) of one (1) minute per year.
    - This represents service availability of 99.999 %.
    - Sydney West BSP has maintained 100 % uptime since 2005 which demonstrates that N-1 contingencies at the BSP have been successfully managed without customer outages.
    - Some generators would be required to be operated temporarily (15 to 20 minutes) whilst a medium voltage changeover occurs in the rings (refer Table 6 and Table 7). Generators would only be used until the electricity supply is reconnected or whilst the changeover occurs.
    - For the purposes of determining a probability of one feeder outage, 1 minute per year has been adopted, in addition to the reliability of the power network as provided in the latest information contained in the Endeavour Energy 2024 Distribution Annual Planning Report (DAPR) (Endeavour Energy, 2024). Refer to Section 9.2.1 for further information and discussion.

- Two feeder failures:
    - The electricity network supplying the site is designed and operated to an N-1 contingency standard, meaning the loss of one feeder can be absorbed without loss of supply. In the highly unlikely event of a second concurrent feeder failure, the remaining feeder would continue to supply the site, with automatic load transfer occurring via the BSP and zone substation rings, ensuring continuity of supply.
    - In this scenario, further and temporary generator support would be initiated (refer Table 6 and Table 7) to maintain full site load during switching and load balancing operations. Generator operation would again be generally short-duration and controlled, until the network has been reconfigured and supply redundancy is restored.

- Such events are extremely rare in the Sydney metropolitan network due to multiple independent transmission paths, transformer redundancy, and automated protection systems built into the BSP and associated zone substations.
- Given that this is a highly unlikely situation, appropriate probabilities are not available. To provide a conservative assessment, a two-feeder outage has been assumed to occur for 1 minute every 80 years.

- Three feeder failures:
  - The Proposal has been designed such that the level of redundancy is so high that the only scenario in which all electricity supply would be lost is one in which the entire regional network has failed. The probability of this is extremely low.
  - In this event, all standby generation would operate to supply 100 % of critical and essential loads, ensuring continuity of data centre operations for the duration of the grid outage, subject to available diesel fuel storage and resupply logistics.
  - Given that this is a highly unlikely situation, appropriate probabilities are not available. To provide a conservative assessment, a three-feeder outage has been assumed to occur for 1 minute every 150 years.

Considering the above, and the NSW DPHI and NSW EPA SEARs requirements (refer Section 1.2), the worst-case scenario modelled in this AQIA reflects the most serious of potential outages, where all generators at the Proposal site would be required to be operational at 100 % load. This worst-case scenario is presented for all stages / phases of the development as requested in the SEARs.

A discussion of the potential air quality impacts under the other, less impactful emergency scenarios (one and two feeder failures) is also provided. Whilst these scenarios have not been explicitly modelled, impacts are considered to be proportional to the number of generators operating, and the results have been scaled accordingly. This is appropriate, given that the locations of the generators to be operated under those scenarios cannot not be known.

The approach to modelling is outlined below:

- Each of the generators in each phase were modelled as operating continuously for all 8 760 hours of the year. In reality, any outage-driven operation is expected to last for a duration of 10 to 15 minutes, making this scenario highly conservative in nature.
- As the standby generators are intended for short-duration use, only assessment against the short-term impact assessment criteria has been performed. Annual average concentrations are not presented, as results would be essentially meaningless.
- The AQIA contextualises the likelihood of any exceedance of air quality criteria, considering the improbability of full-capacity operation through catastrophic failure.
- The potential for cumulative impacts to occur during an emergency power outage has been considered and is discussed in Section 5.5.2.

5.2.2.2. Scenarios M1 to M6 – Realistic (Maintenance Testing) Scenarios

The anticipated testing schedule involves either 4 no. (during phase 1) or 6 no. two (2) MW generators operating at 100 % load (phase 2 onwards) within the specified testing hours.

- This scenario is likely to occur periodically as detailed in Table 8, where generators would be tested simultaneously at any one time during daytime hours (assumed to occur at any time between 7:00 am and 6:00 pm [11 hours]).
- The combination of generators (up to 846) which result in the maximum incremental and cumulative impacts at each receptor vary, and detailed analysis has been performed to confirm that the impacts predicted and presented within this AQIA represent those potential maximum impacts (refer further discussion on the approach below).
- Comparison of impacts against both short- and long-term criteria are performed, providing another level of conservatism, as the testing schedule is modelled as occurring for every one of the hours between 7:00 am and 6:00 pm, on each and every day of the year (4 015 hours). As outlined in Table 8, testing hours are anticipated to be limited to 141 hours per year (of an allowable 200 hours). This approach is required to be performed in this manner to account for all potential combinations of emissions, meteorology and background conditions. Annual average incremental predictions could therefore be weighted by actual operating hours (141 / 4 015) or maximum allowable operating hours (200 / 4 015) over those modelled to account for annual average emission loads, and this scaling has been performed (at 200 / 4 015, which is conservative).

As required within the SEARs, full justification of the selection of the maintenance scenario modelled in each phase is required, to provide confidence that the combination of stack locations assessed provides a potential worst-case impact at surrounding receptor locations. The analysis framework adopted implements a comprehensive combinatorial optimisation approach to determine the worst-case locations of generator flues resulting in maximum incremental and cumulative impacts at surrounding receptors during each phase of operation.

The following provides a summary of the approach adopted:

- Information provided by the Applicant indicates that of the 846 generators in phase 6 development, a maximum of 26 could possibly be tested at any one time. This is an operational constraint limited by the number of load banks at the Proposal site (26). Only one generator can be connected to each load bank at one time, limiting the maximum number of generators which could physically be tested concurrently.
- The locations of the load banks (one in each of 26 shells), therefore provides a spatial limitation on the generators which could be tested concurrently.

- The number of possible generator testing combinations is 230 230 at the phase 6 development stage, determined by the equation:

  $C_{(n,k)} = n! \times (k! \times (n-k)!)^{-1}$

  Where:

  n = total number of generators which could physically be tested concurrently (26)

  k = number of generators being tested simultaneously (6)

  $n!$ = factorial of n (n × (n -1) × (n -2) × … × 1)

- The location of each generator within each shell has been assumed to remain constant and located at the northern-most part of each shell. This provides the lowest separation distance between the relevant generator flues and the sensitive receptors to the north of the Proposal site (i.e. schools and retirement homes). This approach has been adopted as the number of possible combinations to be tested assuming that the total sample size is 846 generators (rather than 26) would be computationally impossible (i.e. 5.00 × 10^{14} combinations). The approach adopted above (230 230 combinations) provides a manageable yet robust dataset for analysis.

- Incremental 1-hour NO_2 impacts at each receptor associated with each of the 26 flue locations were modelled individually. Tier 1 (regional background) and Tier 2 (other data centre impacts), and the incremental impacts from the Proposal (Tier 3 data) (refer Section 5.5) were analysed using the combinatorial optimisation approach. NO_2 impacts were determined through the use of the NO_X to NO_2 approach outlined in Section 5.3.2.4, taking into account the varying distances between emission points and receptors for all 26 stack locations at the Proposal site, and for each of the eight data centres included in the cumulative assessment.

- The highest incremental 1-hour NO_2 impact at each receptor resulting from the Proposal operation under maintenance testing operations, and the stack combination resulting in that impact was output.
- The highest cumulative 1-hour NO_2 impact at each receptor, the incremental contribution from the Proposal, the stack combination resulting in that impact, and the background data (regional and other data centre) was output.

- Additional analysis was also performed with a focus on 24-hour PM_{10} and $PM_{2.5}$ impacts, with that analysis confirming that the limiting pollutant and averaging period was 1-hour NO_2 concentrations. For clarity, the analysis of 24-hour PM_{10} and $PM_{2.5}$ impacts demonstrated that 26 generators could be tested at one time without causing additional exceedances of the relevant criteria, even accounting for impacts associated with other data centres, and including a regional background.

- The above approach has been performed for each phase of development, as requested within the SEARs.

- Table 18 presents the generators available for testing in each phase assessed (cumulative), the available load banks (which limits the number of generators which could be tested at one time), the generators to be tested concurrently, and the number of combinations of generators which could be tested. All of these combinations have been assessed as part of this AQIA.

Table 18 Generator maintenance and testing – potential combinations of generators

Phase	Generators available for testing	Available load banks	Generators to be tested concurrently	Total number of combinations analysed
Phase 1	132	4	4	1
Phase 2	262	8	6	28
Phase 3	392	12	6	924
Phase 4	522	16	6	8 008
Phase 5	684	21	6	27 132
Phase 6	846	26	6	230 230

5.3. Emissions Estimation

The following provides a description of the approach to emissions estimation adopted for both the construction and operational phases of the Proposal.

5.3.1. Construction Stage

The estimation of emissions from a process is typically performed using direct measurement or through the application of factors which appropriately represent the processes under assessment. This assessment has adopted emission factors contained within the US EPA AP-42 emission factor compendium (US EPA, 1995 and updates) and the National Pollutant Inventory Emission Estimation Technique Manual (NPI EETM) for Mining Version 3.1 (NPI, 2012) to represent the emission of PM resulting from earthworks activities occurring at the Proposal site. These factors are appropriate for adoption in Australia and are routinely adopted in the assessment of developments of this nature.

Given that earthworks are anticipated to have the most significant potential for emissions to air during the construction stages of the Proposal, the assessment focuses on bulk earthworks to evaluate compliance with both long-term (annual average) and short-term (24-hour) particulate matter criteria.

The expected construction stage sources associated with earthworks considered as part of the dispersion modelling assessment are as follows:

- Topsoil scraping;
- Excavation;
- Materials handling (loading / unloading);
- Grading;
- Materials haulage (topsoil export and fill import); and

- Wind erosion.

A summary of the earthworks activities occurring at the Proposal site is provided in Table 19.

Table 19 Summary of earthworks activities

Activity	Stage 1	Stage 2	Units
Existing topsoil removal	79 871	44 799	tonnes (t)
Excavation of existing dam and creeks	40 400	28 482	t
Excavation of sediment and erosion basins	76 760	38 380	t
Net cut	1 811 940	1 216 444	t
Net fill	1 890 922	828 402	t
Balance	-118 049	-499 703	t
Construction period	24	18	months
Working days per year	276	276	days
Area	33.8	18.5	ha
Average haulage distance assumed (1-way)	450	290	m
Haulage truck capacity	30.2	30.2	t

Notes: Data taken from Earthworks Strategy Report (AT&L, 2025)
Assumed bulk density of topsoil 1 370 $kg \cdot m^{-3}$
Assumed bulk density of cut and fill materials 2 020 $kg \cdot m^{-3}$
Assumed 5.5 days per week, 52 weeks per year, less 10 public holidays

With reference to the volumes outlined in Table 19, estimated emissions of all volume sources considered for the assessment have been combined, and subsequently divided by the total area of the earthworks activity boundary to develop an area emission rate. The area of earthworks activities considered for this assessment is illustrated in Figure 16.

A full description of the emission sources included in the construction stage assessment, and the emission factors adopted are presented in Appendix F.

5.3.2. Operational Phase

5.3.2.1. Generator Emission Rates and Source Characteristics

As noted in Section 2.3.2.1, four candidate standby generators have been specified for the Proposal site. A review of critical parameters in relation to air quality impacts has been performed and is presented in Table 20.

The selection of specifications associated with one generator over another would result in uncertainty in the results of the assessment, and therefore a conservative 'envelope analysis' has been performed which adopts the worst features of each generator (i.e. lowest exit temperature and velocity, greatest emission rate, highlighted in Table 20). Whilst these combined values do not represent any generator in particular, it provides confidence that should any of the generators be selected for installation and operation as part of the Proposal, air quality impacts predicted within this AQIA would be likely to be the same as, or greater than those experienced in reality.

Table 20 Review of critical parameters from candidate generator specifications

Parameter	Units	Cummins C2750D5BE	MTU 16V4000G84F	Stirling 20M33G2500	Caterpillar 3516B
% load	%	100	100	100	100
Power	kW	2 200	2 185	2 010	2 000
Exit temperature	K	753.2	763.2	780.2	792.1
Exit velocity(a)	$m \cdot s^{-1}$	23.9	15.3	21.2	31.8
Pollutant emission rates					
NO_X (b)	$g \cdot s^{-1}$	3.72E+00	8.01E+00	4.57E+00	4.84E+00
CO (b)	$g \cdot s^{-1}$	2.14E+00	4.86E-01	2.06E-01	5.14E-01
TVOC (b)	$g \cdot s^{-1}$	1.96E-01	1.21E-01	2.57E-02	8.94E-02
PM (PM_{10} and $PM_{2.5}$) (b)(d)	$g \cdot s^{-1}$	1.22E-01	3.28E-02	1.34E-02	2.24E-02
SO_2 (c)	$g \cdot s^{-1}$	1.18E-06	6.01E-07	6.12E-07	5.64E-06

Notes: (a): Assuming stack diameter of 0.6 m

(b): Emission rates based on values contained in technical specifications (refer Appendix E).

(c): Based on permissible level of sulphur content in non-road diesel fuel (10 ppm).

(d): 100 % of PM is emitted as $PM_{2.5}$, and $PM_{2.5}$ = PM_{10}.

A summary of the standby generator stack design components used to model each scenario is provided in Table 21. Details of the technical specifications for the standby generators is provided in Appendix E.

Table 21 Standby generator emissions and stack parameters

Parameter	Units	Scenario 1: E6 (justified worst case)	Scenario 2: M6 (realistic case)
Hour start	hr	00:00	07:00
Hour end	hr	24:00	18:00
% load	%	100	100
Standby generator model		**As per Table 20**	**As per Table 20**
Number of generators active	no.	846	6
Diesel consumption rate (per gen.)	$L \cdot hr^{-1}$	526.8 (a)	526.8 (a)
Power	kW	2 098 (b)	2 098 (b)
Stack height	m AGL	36.4	36.4
Stack diameter	mm ID	600	600
Actual discharge rate	$Am^3 \cdot s^{-1}$	4.3	4.3
Exit temperature	°C	480	480
Exit velocity	$m \cdot s^{-1}$	15.3	15.3
Pollutant emission rates			
NO_X (c)	$g \cdot s^{-1}$	8.01E+00	8.01E+00
CO (c)	$g \cdot s^{-1}$	2.14E+00	2.14E+00
TVOC (c)	$g \cdot s^{-1}$	1.96E-01	1.96E-01
PM (PM_{10} and $PM_{2.5}$) (c)(f)	$g \cdot s^{-1}$	1.22E-01	1.22E-01
SO_2 (d)	$g \cdot s^{-1}$	5.64E-06	5.64E-06
Benzene (C_6H_6) (e)	$g \cdot s^{-1}$	1.90E-03	1.90E-03
Toluene (C_7H_8) (e)	$g \cdot s^{-1}$	6.84E-04	6.84E-04
Xylene (C_8H_{10}) (e)	$g \cdot s^{-1}$	4.77E-04	4.77E-04
PAH (e)	$g \cdot s^{-1}$	2.81E-08	2.81E-08
Formaldehyde (CH_2O) (e)	$g \cdot s^{-1}$	1.93E-04	1.93E-04

Notes: (a): Average of four generators (maximum 566.9 $L \cdot hr^{-1}$ [Cummins], minimum 509 $L \cdot hr^{-1}$ [MTU])

(b): Average of four generators (maximum 2 200 kW [Cummins], minimum 2 000 kW [CAT])

(c): Emission rates based on values contained in technical specifications (refer Appendix E).

(d): Based on permissible level of sulphur content in non-road diesel fuel (10 ppm).

(e): Emission rates based on emission factors from Table 43 of (NPI, 2008). Refer Section 5.2.4.

(f) :100 % of PM is emitted as $PM_{2.5}$, and $PM_{2.5}$ = $PM_{10.}$

5.3.2.2. Speciated VOCs

The technical specification documents presented in Appendix E presents data for total VOCs, which includes a range of speciated VOCs. To appropriately factor the emissions for benzene (C_6H_6), toluene (C_7H_8), and xylene (C_8H_{10}), reference has been made to the emission factors (EF) presented in table 43 of (NPI, 2008) which relate to stationary large (more than 450 kW) diesel engines.

The emission factors for TVOC and the respective speciated VOCs have been factored to calculate the mass fractions of those species within TVOC. Table 22 presents the speciated VOC fraction assumptions that are used for this assessment. The impacts of odorants (toluene (C_7H_8) and xylene (C_8H_{10})) have been similarly assessed on a pro-rata basis as a fraction of TVOC as published in the NPI (NPI, 2008) multiplied by the measured source-specific TVOC emission rate.

Table 22 Speciated VOC fractions

Species	Emission rate (kg·$m^3_{(fuel)}$) Table 43 of (NPI, 2008)	Emission rate relative to HC
TVOC (as HC)	1.32E+00	1.00E+00
Benzene (C_6H_6)	1.28E-02	9.70E-03
Toluene (C_7H_8)	4.62E-03	3.50E-03
Xylene (C_8H_{10})	3.22E-03	2.44E-03
PAHs	1.90E-07	1.44E-07
Formaldehyde (CH_2O)	1.30E-03	9.58E-04

5.3.2.3. Particle Size Fractions

In regard to particulates from diesel, virtually 100 % of diesel particles are less than 1 µm in diameter (i.e. PM_1) and consequently particulates from diesel combustion are assessed as $PM_{2.5}$. In this AQIA, the emission rate of $PM_{2.5}$ will be the same as PM_{10}, as all of the PM_{10} particles are assessed as being ≤2.5 µm in diameter ($PM_{2.5}$).

5.3.2.4. NO_X to NO_2 Conversions

Emissions of NO_X have been calculated, with subsequent ground-level concentrations predicted using dispersion modelling techniques. Given that NO_X is a mixture of NO_2 and nitric oxide (NO), conversion of NO_X predictions to NO_2 concentrations is necessary to appropriately assess potential NO_2 impacts.

NO_X from a combustion process will be emitted as NO and NO_2. Over time and after the point of discharge, NO in ambient air will be transformed by secondary atmospheric reactions with atmospheric ozone (O_3) to form NO_2, and this reaction often occurs at a considerable distance downwind from the point of emission, and by which time the plume will have dispersed and diluted significantly from the concentration at point of discharge.

AQIAs need to account for the conversion of NO to NO_2 to enable a comparison against the air quality criteria for NO_2. The Approved Methods outlines various methods of assessment, which range from the simple to the more detailed.

The three methods outlined in the Approved Methods are briefly outlined below:

- **Method 1** – 100 % conversion: the most conservative assumption is to assume that 100 % of the total NO_X emitted is discharged as NO_2, and that further reactions do not occur.
- **Method 2** - Ozone limiting method (OLM): this method uses contemporaneous ozone data to estimate that rate at which NO is oxidised to NO_2 hour-on-hour using an established relationship.
- **Method 3** – NO to NO_2 conversion using empirical relationship: an empirical relationship between NO and NO_2 may be used to derive 'steady state' relationships. A relationship has been developed by (Janssen, Van Wakeren, Van Duuren, & Elshout, 1988) associated with power plant plumes.

Section 8.1 of the Approved Methods outlines the approach to NO_2 assessment, which clearly indicates that each stage should be performed sequentially. That is, Method 1, Level 1 should be performed first and if the impact assessment criteria are exceeded, a more refined assessment should be undertaken and/or additional management practices or emission controls applied.

If exceedances are predicted, then Method 1, Level 2 should be performed, with the same assessment of the potential for exceedance of the 1-hour NO_2 criterion applied. The process then continues through Method 2 (Level 1 and Level 2), and Method 3 (Level 1 and Level 2).

This AQIA utilises Method 3 to approximate the conversion of NO_X to NO_2, in accordance with the empirical equation described in the Approved Methods:

$$NO_2 \ / NO_x = A(1 - \exp(-\alpha x))$$

Where:

x = distance from the source (km)

A and α are classified according to O_3 concentration, wind speed and season, with (Janssen, Van Wakeren, Van Duuren, & Elshout, 1988) providing values for A and α.

At each receptor, the hourly varying NO_2/NO_X relationship has been calculated, based on the season, hourly varying O_3 concentration, and wind speed. Results are presented in Section 6 and Section 8 for the maximum predicted incremental NO_X / NO_2 concentration and the maximum predicted cumulative NO_2 concentration using the relevant NO_X / NO_2 conversion method(s).

5.3.2.5. Short Term Pollutant Concentrations

With reference to criteria air pollutants with sub-hourly criteria (CO, refer Section 3.3), hourly dispersion model outputs are required to be adjusted to allow provision of data on those timescales. The following Power Law adjustment has been applied:

$$C_{p,t} = C_{p,60} \left[\frac{60}{t}\right]^{0.2}$$

Where:

$C_{p,t}$ = concentration of pollutant (p) at averaging time (mins) (t)

$C_{p,60}$ = concentration of pollutant (p) at averaging time ($60\ mins$)

t = time (mins)

5.4. Emissions Controls

5.4.1. Construction Stage

Emission controls are to be employed during construction works. The application of these controls results in quantifiable reductions in the quantity of particulate matter emitted during proposed earthworks activities.

A summary of the emission reduction measures that would be expected as part of the Proposal construction is presented in Table 23. These emission reductions are reflected in the National Pollution Inventory Emission Estimation Technique Manual for Mining, Version 3.1 (NPI, 2012) and Compilation of Air Pollutant Emission Factors, Chapter 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (US EPA, 2006).

Table 23 Summary of emission control methods adopted as part of the construction stage works

Emission control method	Control efficiency (%)	Activities control method applied to:	Reference
Water sprays keeping materials damp	50	• Scraping • Excavation; • Grading; and • Wind erosion.	(NPI, 2012)
Water carts keeping haulage route surface damp (level 2 watering)	75	• Material haulage.	(NPI, 2012)
Water sprays	50	• Loading/unloading.	(NPI, 2012)
Minimise drop heights	30	• Loading/unloading.	(NPI, 2012)
Vehicle speed limits of 15 $km{\cdot}h^{-1}$	85	• Material haulage	(NPI, 2012)

Furthermore, a detailed Construction Air Quality Management Plan (CAQMP) has been developed for the Proposal, which includes a Trigger Action Response Plan (TARP). The TARP is designed to identify, through real-time air quality monitoring, those period when particulate concentrations may be elevated as a result of the activities at the Proposal site. A tiered approach to management of those impacts is provided to allow the construction contractor to apply additional targeted emission controls, reduce activity rates if required, or cease operations until impacts are demonstrated to be below assigned trigger levels. In this way, impacts at all surrounding sensitive receptor locations would be minimised.

The CAQMP is presented under separate cover to this AQIA.

5.4.2. Operational Phase

During the operational phase, emissions will be predominantly controlled through the limited use of the generators. Other than periodic testing for 141 hours per year, emissions will essentially be negligible unless there are multiple feeder failures, the probability of which is extremely low.

The candidate generators have been selected based upon various operational performance metrics, including compliance with US EPA Tier 2 emission standards.

5.5. Approach to Assessment of Cumulative Impacts

5.5.1. Construction Stage

The area surrounding the Proposal site includes a number of facilities currently undergoing approval or development which have been considered within this AQIA. The identified developments have been presented in Table 24 and Figure 16 including their associated State Significant Development Application (SSDA) or Development Application (DA) number.

Review of the documentation supporting the SSDA or DA for the identified proximate facilities show that emissions during construction would be likely to be similar to those assessed for the Proposal. Given the significant number of identified facilities surrounding the development site as outlined above, there is potential for construction stage emissions to result in cumulative impacts at proximate sensitive receptors, if not appropriately managed.

Where available, earthwork plans outlined in relevant SSDA or DA documentation for each development identified have been reviewed. This has been performed to provide a detailed quantitative assessment of the potential cumulative air impacts, including potential overlapping of operational and construction impacts for later stages. This has been performed to satisfy NSW EPA requirements.

Additionally, the anticipated construction schedules for the proximate facilities have been reviewed and are presented in Table 25. It is noted that construction for Stage 1 of the Proposal is anticipated to begin in Q1 of 2027. The earthworks activities anticipated to be performed concurrently with the construction stage assessment scenarios C1 (Construction - Stage 1) and C2 (Construction – Stage 2) have been quantified and assessed in this AQIA. These have been highlighted in Table 24 and identified in Figure 16.

The assessed facilities activity rates have been calculated based on the relevant earthworks plans identified above. For SSDA with multiple modifications, earthworks plans have been taken for the most up to date and / or relevant modification. The activity rates for the modelled facilities have been presented in Table 26. For facilities C and H, where relevant earthworks plans weren't available, activity rates were calculated based on the averages for the surrounding facilities and then adjusted for the site areas.

For stage 2 construction works for the Proposal (anticipated to begin in more than 10 years), the level of construction stage activity in the MRP cannot be known. However, it might reasonably be expected that the larger proportion of the area would be fully developed, or at least earthworks would have been completed. Given the uncertainty, and in the absence of any additional information, the potential for cumulative impacts with other earthworks activities in the MRP have been assumed to be consistent with those assessed under Stage 1 construction activities. This is a conservative assumption.

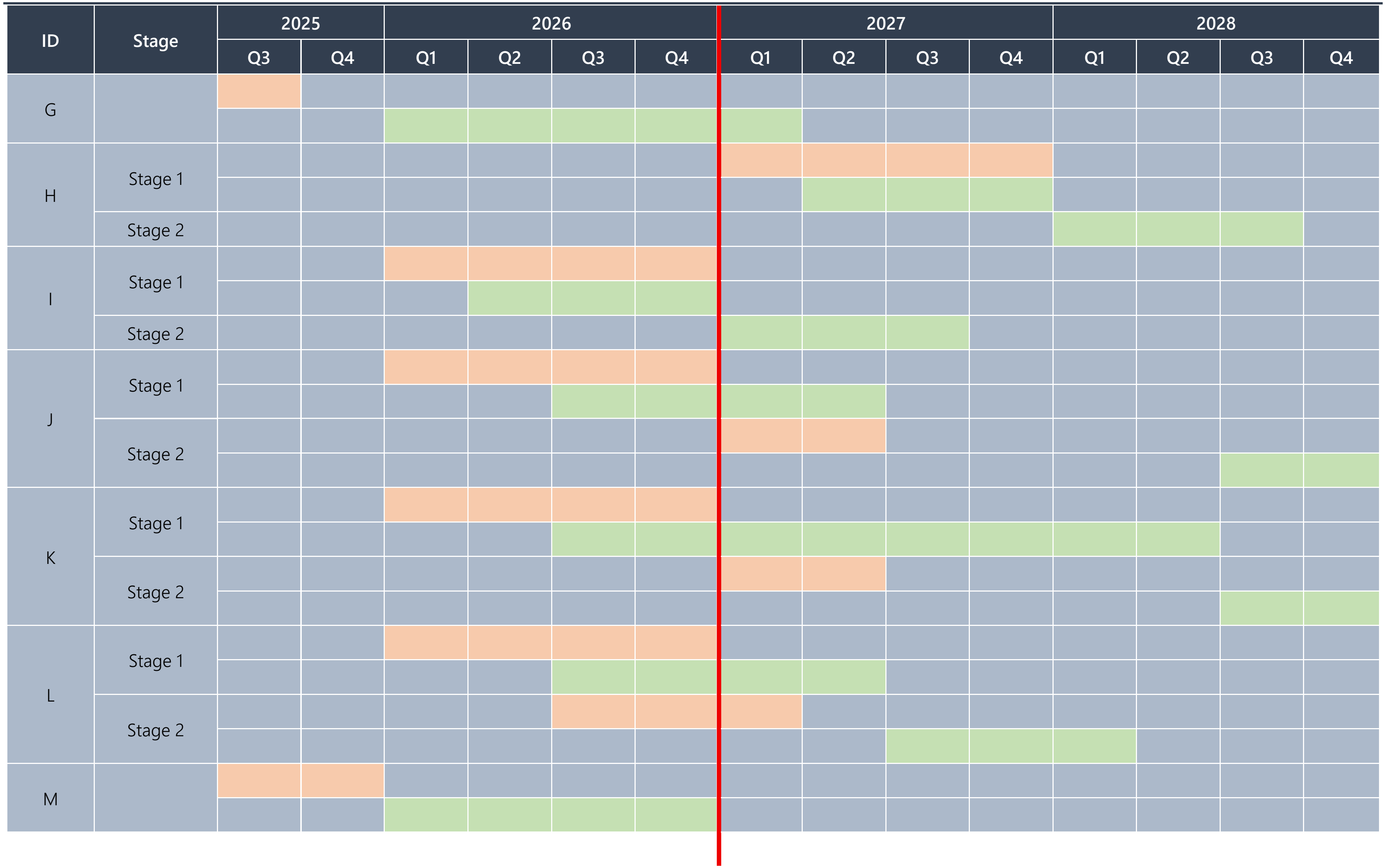
Table 24 Surrounding facilities undergoing approval and development

ID	Development	SSD/DA	Status
A	The Yards	SSD-9522	Approved, undergoing earthworks / construction
B	Kemps Creek Data Centre	SSD-10101987	Approved, undergoing earthworks / construction
C	Yiribana Industrial Estate West	DA23/0067	Stage 1 approved, Stage 2 not yet under assessment
D	Yiribana Industrial Estate East	SSD-10272349	Warehouse 1 and 3 approved, remaining warehouses not yet under assessment
E	805-817 Mamre Road Warehouse & Distribution Centre	SSD-30871587	Undergoing assessment
F	Aspect Industrial Estate	SSD-10448	Approved, undergoing earthworks / construction
G	Access Logistics Park	SSD-17647189	Approved, undergoing earthworks / construction
H	1-51 Aldington Road Industrial Estate	SSD-7484709	Undergoing assessment
I	99-111 Aldington Road Warehouse & Distribution Centre	DA25/0411	Undergoing assessment
J	113-153 Aldington Road Industrial Estate	SSD-32722834	Stage 1 approved, Stage 2 not yet under assessment
K	The Edge Estate	SSD-17552047	Stage 1 Approved, Stage 2 not yet under assessment
L	Westgate Industrial Estate	SSD-23480429	Stage 1 Approved, Stage 2 not yet under assessment
M	74-104 Aldington Road	DA22/0530	Approved, undergoing earthworks / construction
N	200 Aldington Road Industrial Estate	SSD-10479	Approved, undergoing earthworks / construction
O	BAPS Temple	DA17/1247	Approved, undergoing earthworks / construction
P	244-280 Aldington Road	DA24/0268	Approved, undergoing earthworks / construction
Q	Westlink Industry Park	SSD-9138102 (Stage 1) SSD-46983729 (Stage 2)	Stage 1 and 2 approved, undergoing construction
R	Westlink Industry Park Lot 10	DA24/0703	Approved, undergoing construction

Note: ID relate to Figure 16

Table 25 Surrounding facilities construction schedules

ID	Stage	2025		2026				2027				2028			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
A	Lots 1, 4, 19														
	Lot 3														
B	Stage 1														
	Stage 2														
	Stage 3														
C	Stage 1														
	Stage 2														
D	WH 1 & 3														
	Remaining WHs														
E	WH 1 & 2														
F	WH 6 & 7														
	WH 4 & 5														


ID
Stage
2025
2026
2027
2028
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
G
H
Stage 1
Stage 2
I
Stage 1
Stage 2
J
Stage 1
Stage 2
K
Stage 1
Stage 2
L
Stage 1
Stage 2
M

ID	Stage	2025		2026				2027				2028			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
N															
O	Stage 1														
	Stage 2														
P															
Q	Stage 1														
	Stage 2														
	Stage 3														
This Proposal	Stage 1														
	Stage 2														

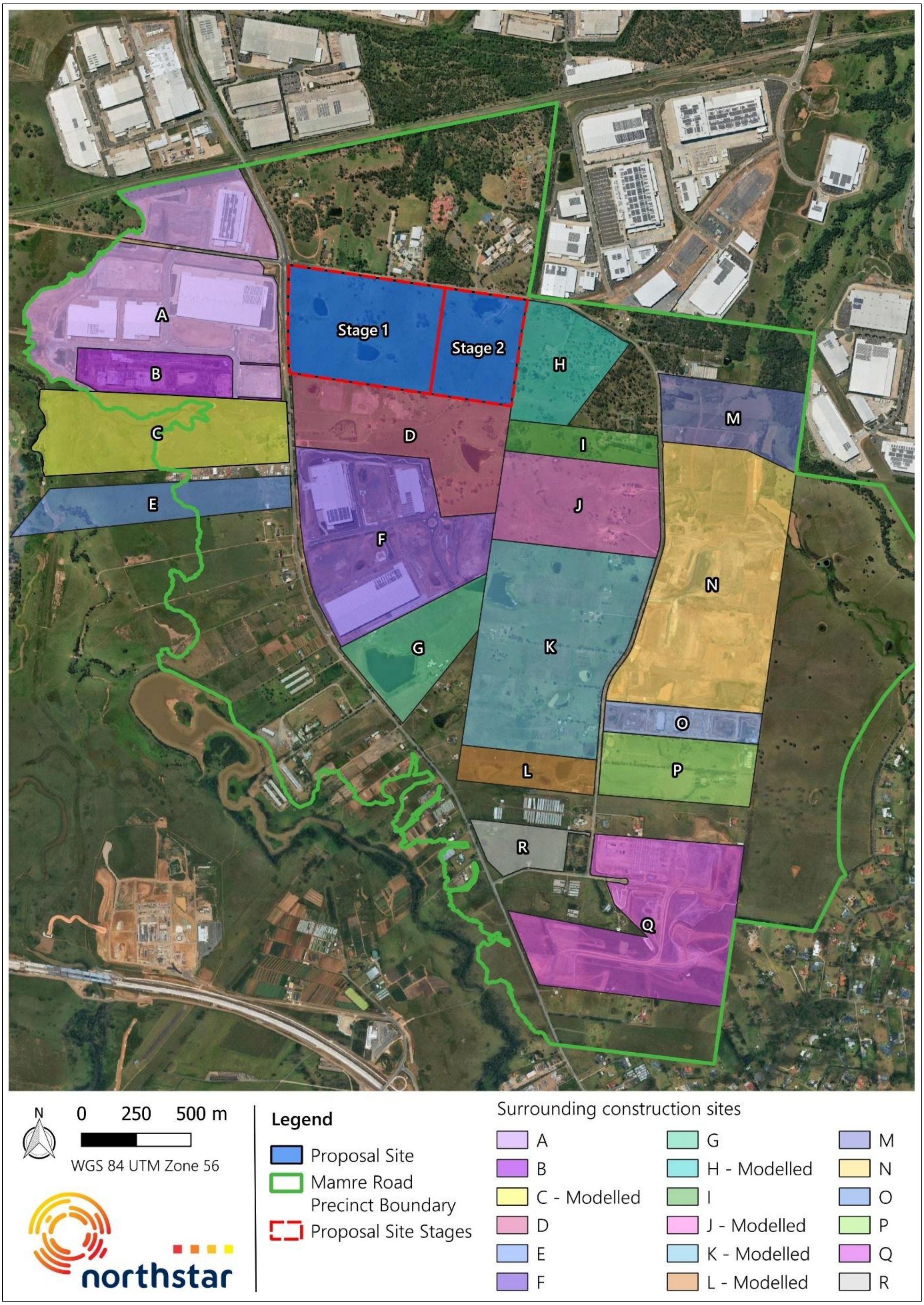
Note: Orange = Earthworks, Green = Construction, WH = Warehouse

ID R (Westlink Industry Park Lot 10) construction falls under Stage 3 of ID Q (Westlink Industry Park).

Table 26 Modelled facilities activity rates

ID	Existing topsoil strip (m^3)	Excavation of existing creeks and dams (m^3)	Net cut (m^3)	Net fill (m^3)	Balance (m^3)	Notes
C	-56 447	-2 520	-283 129	365 861	23 765	Earthworks plans were only available for Stage 1 which have been completed. For Stage 2, activities were calculated by taking the average of the earthworks for surrounding construction sites and adjusted for the site area.
H	-37 219	-4 085	-231 423	449 069	177 212	No earthworks plan available yet as not yet under assessment. Activities were calculated by taking the average of the earthworks for surrounding construction sites and adjusted for the site area.
J	-50 073	-12 557	-1 380 752	615 473	-827 909	-
K	65 917	-15 000	-1 318 580	1 296 848	29 185	-
L	-21 500	-	-20 000	210 000	190 000	Balanced was calculated from only net fill -net cut to match what was listed in the earthworks plans

Figure 16 Surrounding facilities undergoing approval / development



Source: Northstar

5.5.2. Operational Phase

A standard approach to the assessment of cumulative impacts is to use existing background air quality data collected at a representative AQMS (refer Section 4.4) on the assumption that the background air quality data includes contributions from all potential proximate sources. This provides a dataset which is taken to be representative of the air quality environment without the impact of the project under assessment. The incremental impacts from a project are then added to that background data to derive a potential cumulative impact which is then compared against criteria (refer Section 3).

Whilst this is usually a reasonable assumption, in this case, data collected at the St Marys AQMS is not likely to include the potential impact of proximate sources located near a number of sensitive receptors adopted within this AQIA, and a more refined approach has been applied within this AQIA.

5.5.2.1. Emergency Operation

Cumulative impacts during a potential emergency scenario have been limited to the assessment of Tier 1 and Tier 3 data only. The likelihood of a power outage affecting any of the surrounding data centres is individually low, with the likelihood of all data centres experiencing an outage at the same time being negligible.

The potential impacts during an emergency power outage are predicted to be significant (refer Section 8.1) but given the low likelihood of occurrence, the overall risk is considered to be low (refer Section 9.2.1).

5.5.2.2. Maintenance Testing

The assessment of potential cumulative impacts at sensitive receptor locations has been performed in this AQIA through the adoption of a multi-tiered quantitative assessment approach:

1. **Tier 1** – Data collected at the St Marys and Prospect AQMS has been adopted to represent regional background conditions. It is assumed that this data includes the impacts of road traffic, industrial, commercial, and residential sources of emissions, but is assumed not to include the impacts of other data centre operations. This Tier 1 data provides a temporally variable, but spatially non-variable dataset (i.e. the data collected at the AQMS is assumed to be representative of the entire modelling domain).
2. **Tier 2** – Impacts associated with surrounding data centre operations within a five (5) km radius of the Proposal site. These data have been derived through dispersion modelling (refer Appendix F). This provides a spatially and temporally variable dataset (i.e. impacts at each receptor vary hour-by-hour according to the modelled impact of all other data centres in the area).
3. **Tier 3** – Impacts associated with the Proposal, determined through dispersion modelling (refer Section 5.1). This again provides a spatially and temporally variable dataset.

Calculation of a cumulative impact at each receptor requires the addition of Tier 1, Tier 2, and Tier 3 data. For comparison, standard AQIA only adopt Tier 1 plus Tier 3 data.

A detailed description of the derivation of the Tier 2 data is presented in Appendix G. This approach has been adopted for the assessment of potential cumulative impacts during routine generator testing only (refer Section 5.5.2.1).

5.6. Presentation of Results

5.6.1. Receptors

The results of the quantitative assessment of potential air quality impacts resulting from construction stage and operational phase activities are presented in more detail in Appendix H. For brevity, results are presented in the main body of the report for the maximum impacted receptor associated with each land use type:

- Residential;
- Educational;
- Industrial (including other data centres and substation);
- Medical;
- Recreational; and
- Boundary receptors (only applicable to PAH, benzene (C_6H_6), and formaldehyde (CH_2O)

For clarity, predicted impacts at the maximum impacted receptors within each land use type are presented in the tables in the main body of the report, and reference should be made to Appendix H for further information.

5.6.2. Preliminary Impact Screening

Due to the large volume of results contained within this AQIA (128 receptors × 26 scenarios × 17 combinations of pollutants and averaging periods = > 56 000 results), the results summary presented as the maximum predicted concentrations at each receptor category (residential, educational, industrial, medical, recreational, boundary) have been subjected to a preliminary impact screening assessment, which is described below and summarised in Section 6. This process allows the AQIA to focus on the more important / significant air quality issues.

The assessment of air quality impact significance has been undertaken with reference to the Environmental Protection UK (EPUK) and UK Institute of Air Quality Management (IAQM) guidance on the assessment of significance (EPUK/IAQM, 2017). This framework provides a consistent basis for evaluating the potential impacts of pollutant concentrations at sensitive receptors.

With application of this approach, the magnitude of change in pollutant concentrations resulting from the construction and operation of the Proposal is expressed as a percentage of the relevant impact assessment criteria (IAC) as outlined in Section 3.3. The percentage change is then considered alongside the absolute concentration (as a percentage of IAC) to determine the overall descriptor of impact. It is noted that the guidance refers to the Air Quality Assessment Level (AQAL), whereas this AQIA uses the term IAC for relevance to the Approved Methods, although the two terms may be considered to be interchangeable in meaning.

This AQIA has considered both the incremental change in pollutant concentrations and the cumulative concentration with the Proposal in place, in accordance with EPUK/IAQM guidance (2017). The incremental impact (Proposal only) is expressed as the percentage change relative to the relevant IAC, providing a measure of the additional contribution from the Proposal. This is then considered alongside the total predicted concentration (background plus Proposal) to ensure that both the magnitude of change and the overall compliance with IACs are considered. The EPUK/IAQM guidance does not provide an 'incremental only' screening criterion, and impacts must be considered in the context of existing air quality.

For example, a small change in a location with good air quality may be described as negligible, whereas the same increment in an area already close to or exceeding an IAC may represent a more significant impact. The final judgement on significance is therefore based on both the incremental and cumulative impacts, together with contextual factors such as the number and sensitivity of receptors affected, and the duration and reversibility of the effect.

The criteria adopted are presented in Table 27. It is important to note that an incremental change of less than 0.5 % is considered a 'negligible' impact, regardless of concentration.

Table 27 EPUK / IAQM Impact Descriptors for Individual Receptors

Long term average concentration at receptors in assessment year	Percentage (%) change in concentration relative to IAC				
	<0.5	1	2 - 5	6 - 10	> 10
75 % or less than IAC	Negligible	Negligible	Negligible	Slight	Moderate
76 – 94 % of IAC	Negligible	Negligible	Slight	Moderate	Moderate
95 – 102 % of IAC	Negligible	Slight	Moderate	Moderate	Substantial
103 – 109 % of IAC	Negligible	Moderate	Moderate	Substantial	Substantial
More than 110 % of IAC	Negligible	Moderate	Substantial	Substantial	Substantial

Notes: IAC – Impact Assessment Criterion (also Air Quality Assessment Level [AQAL]), which corresponds to a respective criterion, standard or limit value. Where the % change in concentrations is less than 0.5%, the change is described as 'negligible' regardless of concentration. When defining the concentration as a percentage of the IAC, 'without Proposed Development' concentration should be used where there is a decrease in pollutant concentration and the 'with Proposed Development' concentration where there is an increase. Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.

The EPUK / IAQM guidance notes that the criteria in Table 27 should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for.

Overall significance as per (EPUK/IAQM, 2017) should be based on professional judgement, considering other factors including:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

Section 6 provides a summary of the preliminary impact screening for both the construction and operational phases.

5.6.3. Results

For both the construction and operational phase impact assessment, the results of the dispersion modelling assessment use the following terminology:

- **Incremental impact** – relates to the concentrations predicted as a result of the operation of the Proposal in isolation.
- **Cumulative impact** – relates to the incremental concentrations predicted as a result of the operation of the Proposal PLUS the background air quality concentrations discussed in Section 4.4, and that associated with other surrounding facilities, where relevant.

The results are presented in this manner to allow examination of the likely impact of the Proposal in isolation and the contribution to air quality impacts in a broader sense.

In the presentation of results, the tables included shaded cells which represent the following:

Model prediction	Pollutant concentration / deposition rate less than the relevant criterion	Pollutant concentration / deposition rate equal to, or greater than the relevant criterion

For clarity, examples of the presentation of results are provided below. These are presented in this manner in accordance with the requirements of the Approved Methods

For particulate matter with an annual average criterion, results are presented as shown in Table 28. In the results, the maximum concentration (increment, background, and cumulative) at each non-Proposal related receptor is compared to the criterion and presented as a percentage. This is not shown in the example table below.

Table 28 Example - predicted annual average TSP, PM_{10} and $PM_{2.5}$ concentrations

Receptor	Annual average particulate matter concentration ($\mu g{\cdot}m^{-3}$)								
	TSP			PM_{10}			$PM_{2.5}$		
	Incr.	Bkg.	Cumul.	Incr.	Bkg.	Cumul.	Incr.	Bkg.	Cumul.
Criterion	90			25			8		
16	0.2	32.1	32.3	<0.1	13.7	13.8	<0.1	9.2	9.3

This is the model prediction (increment [Incr.]) and represents the contribution of the Proposal at the identified receptor. It does not include any impact of existing conditions.

It can be considered as the predicted change in air quality resulting from the Proposal.

Incremental impacts are not compared to criteria. These are shown as blue shaded boxes.

This is the existing background / baseline (Bkg.) air quality which would be expected whether the Proposal was operational or not.

Background air quality is presented as a blue shaded box, as comparison to criteria is not relevant for the assessment. However, in periods when the background is already exceeding the criteria, this is shown as a yellow shaded box – see Bkg. for $PM_{2.5}$ on the right.

This is the cumulative impact (Cumul.) and represents the sum of the increment (Incr.) and background (Bkg.). It is the air quality at that receptor which is predicted once the Proposal is operational.

Green boxes demonstrate predicted compliance with the relevant criterion.

Yellow boxes demonstrate predicted exceedance of the criterion.

For pollutants where no background concentrations are required to be assessed, impacts are presented as incremental only and shown in blue shaded boxes.

5.7. Plume Rise Assessment

As required by the SEARs (refer Table 1), an airport safeguarding assessment is required to be provided to support the Proposal, including a plume rise assessment, potential hazard to wildlife, lighting and the prescribed airspace. An Airport Safeguarding Report (L+R, 2025) has been provided as part of the EIS.

With specific relation to plume rise, the Civil Aviation Safety Authority (CASA) was contacted on 24 October 2025, with Form 1247 provided (refer Appendix I) for review.

A response was provided by CASA on 27 October 2025:

> *"CASA has reviewed the data as provided for the plume at 706-752 Mamre Road Kemps Creek as requested. The CASA assessment toll indicates that the plume will reduce to a vertical velocity of 4.3 m/s at a height of 51 m AGL. Ground height at the site is approx. 75 m AHD. Total height will be approx. 126 m AHD. The OLS at this location is 231 m AHD. Therefore, the plume from this development will not be a hazard to aircraft operations and no CASA mitigation are required. CASA has no objection to the proposal as detailed below."*

6. PRELIMINARY IMPACT SCREENING

To focus the AQIA on the most relevant air quality risks, a preliminary screening assessment has been conducted. Detailed atmospheric dispersion modelling was completed for all pollutants listed in Section 2.3.

The screening compared predicted incremental impacts with published significance thresholds. Pollutants classified as 'moderate' or 'substantial' are reported in detail in Section 7 (construction stage scenarios) and Section 8 (operational phase scenarios).

The screening results presented here indicate whether further assessment is required and are not a compliance evaluation. These preliminary outputs exclude detailed source attribution and cumulative contributions, which are addressed in the detailed assessments in Section 7 and Section 8.

6.1. Construction Stage

The following tables present the impact significance associated with construction of the Proposal, with cumulative impacts including the influence of surrounding sources as outlined in Section 5.5.1.

A summary of the maximum assessed impact significance for each stage is presented in Table 29.

For each pollutant and averaging period, additional detail on the potential impact significance is presented in Section 6.2.1.2 for particulate matter, and Section 6.2.1.3 for all other pollutants assessed.

Table 29 Summary of significance analysis – Construction

Pollutant	Averaging period	Construction scenario	
		C1	C2
TSP	Annual	Moderate	Moderate
PM_{10}	24-hour	Substantial	Substantial
	Annual	Substantial	Substantial
$PM_{2.5}$	24-hour	Substantial	Substantial
	Annual	Moderate	Moderate
Deposited dust	Annual	Moderate	Moderate

6.1.1. Particulate Matter

Further detail associated with the assessed impact significance of particulate matter (TSP, PM_{10}, $PM_{2.5}$, and deposited dust) under each modelled construction scenario is presented in the following tables. These provide the potential maximum impact significance associated with each receptor category.

Table 30 Preliminary impact screening – Construction – Stage 1 – annual average PM significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average TSP					
Residential	13.6	1	53.2	1	Moderate
Educational	22.4	2	62.0	2	Moderate
Industrial	6.4	14	59.2	39	Slight
Recreational	0.3	99	38.5	79	Negligible
Medical	0.2	32	37.8	32	Negligible
Annual average PM_{10}					
Residential	22.6	1	93.6	1	Moderate
Educational	37.2	2	107.8	2	Substantial
Industrial	12.0	14	91.7	13	Moderate
Recreational	1.0	99	68.6	79	Negligible
Medical	0.4	35	66.9	32	Negligible
Annual average $PM_{2.5}$					
Residential	8.8	1	82.8	1	Moderate
Educational	14.4	2	88.5	2	Moderate
Industrial	4.7	14	80.5	13	Slight
Recreational	0.4	99	72.8	16	Negligible
Medical	0.2	35	72.8	16	Negligible
Annual average deposited dust					
Residential	16.1	1	58.9	1	Moderate
Educational	24.7	4	64.9	2	Moderate
Industrial	6.3	14	63.7	39	Slight
Recreational	0.1	101	50.3	79	Negligible
Medical	0.9	40	50.1	32	Negligible

Note: The maximum predicted impact at any receptor in each category is presented. Cumulative impact includes other construction sources and regional monitoring data.

Table 31 Preliminary impact screening – Construction – Stage 1 – 24-hr average PM significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	32.6	1	126.6	77	Substantial
Educational	41.8	2	133.7	2	Substantial
Industrial	30.6	14	135.1	39	Substantial
Recreational	3.1	79	113.1	30	Substantial
Medical	1.9	35	111.6	35	Substantial
Maximum 24-hour average $PM_{2.5}$					
Residential	8.3	1	164.8	1	Substantial
Educational	10.2	4	165.1	2	Substantial
Industrial	7.9	14	167.4	39	Substantial
Recreational	0.8	99	162.0	30	Substantial
Medical	0.5	35	161.6	35	Substantial

Table 32 Preliminary impact screening – Construction – Stage 2 – annual average PM significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average TSP					
Residential	2.6	7	45.8	77	Negligible
Educational	6.4	6	46.3	6	Slight
Industrial	11.5	41	60.3	41	Moderate
Recreational	0.2	98	38.1	99	Negligible
Medical	< 0.1	35	37.2	16	Negligible
Annual average PM_{10}					
Residential	5.4	7	76.1	63	Moderate
Educational	11.7	6	82.8	6	Moderate
Industrial	19.7	41	105.9	41	Substantial
Recreational	0.6	98	67.9	99	Negligible
Medical	0.2	35	65.3	16	Negligible
Annual average $PM_{2.5}$					
Residential	2.0	7	76.1	7	Slight
Educational	4.4	6	78.7	6	Slight
Industrial	7.3	41	87.3	41	Moderate
Recreational	0.3	98	72.8	1	Negligible
Medical	< 0.1	35	72.8	1	Negligible
Annual average deposited dust					
Residential	2.2	7	54.2	77	Negligible
Educational	6.4	6	54.4	6	Slight
Industrial	13.1	41	63.7	39	Moderate
Recreational	< 0.1	101	50.3	79	Negligible
Medical	1.8	40	50.1	32	Negligible

Note: The maximum predicted impact at any receptor in each category is presented. Cumulative impact includes other construction sources and regional monitoring data

Table 33 Preliminary impact screening – Construction – Stage 2 – 24-hr average PM significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	13.5	7	126.1	77	Substantial
Educational	21.7	6	124.3	6	Substantial
Industrial	32.2	41	137.3	41	Substantial
Recreational	2.4	98	113.6	30	Substantial
Medical	1.1	32	111.2	35	Substantial
Maximum 24-hour average $PM_{2.5}$					
Residential	3.3	7	164.0	77	Substantial
Educational	5.2	6	164.6	6	Substantial
Industrial	7.7	41	167.6	41	Substantial
Recreational	0.6	98	162.1	30	Substantial
Medical	0.3	32	161.5	35	Substantial

6.2. Operational Phase

6.2.1. Scenarios E1 to E6 – Justified Worst Case Scenarios

The following tables present the impact significance for emergency operation of the diesel generators. As noted earlier, the number of generators operating at any given time would depend on the extent of the power outage and the operational phase of the Proposal.

The results in each table should be interpreted considering the following caveats:

- Impacts are presented for pollutants with associated short-term criteria only. Emergency operations would not be performed over a whole year, and the results would be meaningless.
- Emergency generator use during a power outage would be anticipated for short periods of approximately 15 to 20 minutes. Results are presented assuming operation equivalent to the averaging period assessed (e.g. 1-hour, 8-hour, 24-hour). Impacts presented are therefore likely to overstate the potential impacts by factors of around three (3) to four (4) (for criteria with 1-hour averaging periods), between 24 and 32 (for criteria with 8-hour averaging periods), and between 72 and 96 (for criteria with 24-hour averaging periods). However, given that the duration of any power outage cannot be forecast, results are presented assuming generators would be operational for the entire averaging period, and the results should be viewed with that potential conservatism in mind.
- Predicted impacts associated with the impacts under the potential three (3) feeder outage have been explicitly modelled, with potential impacts associated with one (1) or two (2) feeder outages scaled *pro-rata* from those results. This is appropriate given that the locations of the generators to be used in an emergency under one (1) or two (2) feeder failures cannot be known, with the model outputs for a potential three (3) feeder failure covering the maximum extent of all generators at the Proposal site.

A summary of the maximum assessed impact significance under emergency scenarios for each phase of development, under each of one (1), two (2), or three (3) feeder failures is presented in Table 34.

Results for the most likely feeder outage scenario (one (1) feeder outage) are presented in the main report, with results for potential impacts under the less likely two and three feeder outage scenarios presented in Appendix H.

For each pollutant and averaging period, additional detail on the potential impact significance is presented in Section 6.2.1.1 for NO_2, Section 6.2.1.2 for particulate matter, and Section 6.2.1.3 for all other pollutants assessed.

Table 34 Summary of significance analysis – Emergency – 1, 2 or 3 feeder outage

Pollutant	Averaging period	Emergency scenario					
		E1	E2	E3	E4	E5	E6
NO_2	1-hour	Substantial	Substantial	Substantial	Substantial	Substantial	Substantial
PM_{10}	24-hour	Substantial	Substantial	Substantial	Substantial	Substantial	Substantial
$PM_{2.5}$	24-hour	Substantial	Substantial	Substantial	Substantial	Substantial	Substantial
CO	15-min	Slight	Moderate	Moderate	Moderate	Moderate	Moderate
	1-hour	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
	8-hour	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
SO_2	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	24-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
PAH	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Benzene	1-hour	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Toluene (odour)	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Xylene (odour)	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Formaldehyde	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Note: Maximum significance at any receptor location presented

6.2.1.1. Nitrogen Dioxide

Further detail associated with the assessed impact significance of NO_2 under each modelled emergency scenario is presented in the following tables. These provide the potential maximum impact significance associated with each receptor category. Note that only the short-term criteria are assessed as previously discussed.

Table 35 Preliminary impact screening – Emergency – E1 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	365.8	96	365.8	96	Substantial
Educational	342.3	20	346.0	20	Substantial
Industrial	395.5	128	395.5	128	Substantial
Recreational	350.7	101	356.9	101	Substantial
Medical	251.9	35	253.1	35	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 36 Preliminary impact screening – Emergency – E2 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	699.8	96	706.0	96	Substantial
Educational	648.0	20	651.8	20	Substantial
Industrial	704.9	52	705.0	52	Substantial
Recreational	667.2	99	673.4	99	Substantial
Medical	486.2	32	486.3	32	Substantial

are **Note:** Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H

Table 37 Preliminary impact screening – Emergency – E3 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	641.4	66	648.9	66	Substantial
Educational	563.8	22	570.0	22	Substantial
Industrial	600.3	38	607.8	38	Substantial
Recreational	654.7	99	660.9	99	Substantial
Medical	469.6	36	470.9	36	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 38 Preliminary impact screening – Emergency – E4 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	974.6	110	974.6	110	Substantial
Educational	897.6	22	903.9	22	Substantial
Industrial	848.8	126	856.2	38	Substantial
Recreational	913.9	99	920.2	99	Substantial
Medical	704.7	36	705.9	36	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios presented in Appendix H.

Table 39 Preliminary impact screening – Emergency – E5 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	1 233.0	110	1 233.0	110	Substantial
Educational	1 083.4	22	1 089.6	22	Substantial
Industrial	1 213.6	76	1 213.6	76	Substantial
Recreational	851.4	99	857.6	99	Substantial
Medical	855.3	36	856.5	36	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 40 Preliminary impact screening – Emergency – E6 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	1 414.5	110	1 414.5	110	Substantial
Educational	1 219.6	22	1 225.8	22	Substantial
Industrial	1 386.9	76	1 387.0	76	Substantial
Recreational	951.6	99	957.9	99	Substantial
Medical	981.9	36	983.1	36	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

6.2.1.2. Particulate Matter

Further detail associated with the assessed impact significance of particulate matter (PM_{10} and $PM_{2.5}$) under each modelled emergency scenario is presented in the following tables. These provide the potential maximum impact significance associated with each receptor category. Note that only the short-term criteria are assessed as previously discussed.

Table 41 Preliminary impact screening – Emergency – E1 – PM_{10} and $PM_{2.5}$ impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	108.1	1	161.5	1	Substantial
Educational	157.5	4	213.8	4	Substantial
Industrial	186.4	14	278.8	14	Substantial
Recreational	23.6	98	117.5	102	Substantial
Medical	15.0	33	114.9	35	Substantial
Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average $PM_{2.5}$					
Residential	216.2	1.0	264.7	1.0	Substantial
Educational	56.8	2	122.0	2	Substantial
Industrial	43.2	13	108.3	13	Substantial
Recreational	5.1	98	70.2	98	Substantial
Medical	2.2	32	67.3	32	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 42 Preliminary impact screening – Emergency – E2 – PM_{10} and $PM_{2.5}$ impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	161.0	1	223.8	1	Substantial
Educational	261.0	4	300.1	4	Substantial
Industrial	323.6	14	374.2	14	Substantial
Recreational	47.7	98	134.4	98	Substantial
Medical	28.5	33	111.6	35	Substantial
Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average $PM_{2.5}$					
Residential	321.9	1.0	368.7	1.0	Substantial
Educational	114.9	2	180.0	2	Substantial
Industrial	95.9	14	161.0	14	Substantial
Recreational	10.0	98	75.1	98	Substantial
Medical	4.1	32	69.2	32	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 43 Preliminary impact screening – Emergency – E3 – PM_{10} and $PM_{2.5}$ impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	128.6	7	189.3	1	Substantial
Educational	201.4	2	231.4	2	Substantial
Industrial	180.7	14	273.1	14	Substantial
Recreational	43.0	98	125.8	102	Substantial
Medical	26.1	32	121.4	35	Substantial
Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average $PM_{2.5}$					
Residential	257.1	7	320.3	1	Substantial
Educational	104.8	2	169.9	2	Substantial
Industrial	107.2	14	172.3	14	Substantial
Recreational	9.2	98	74.3	98	Substantial
Medical	4.3	32	69.4	32	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 44 Preliminary impact screening – Emergency – E4 – PM_{10} and $PM_{2.5}$ impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	169.0	7	212.1	7	Substantial
Educational	262.5	6	319.1	6	Substantial
Industrial	234.2	41	294.9	14	Substantial
Recreational	58.4	98	132.9	102	Substantial
Medical	39.1	32	128.1	35	Substantial
Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average $PM_{2.5}$					
Residential	338.1	7	382.6	7	Substantial
Educational	139.6	2	204.7	2	Substantial
Industrial	113.6	14	178.8	14	Substantial
Recreational	13.6	98	78.7	98	Substantial
Medical	6.1	32	71.2	32	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 45 Preliminary impact screening – Emergency – E5 – PM_{10} and $PM_{2.5}$ impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	174.3	1	201.1	7	Substantial
Educational	204.2	6	261.6	6	Substantial
Industrial	298.4	41	331.0	41	Substantial
Recreational	61.4	101	133.8	102	Substantial
Medical	45.5	32	131.8	35	Substantial
Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average $PM_{2.5}$					
Residential	348.7	1	359.9	7	Substantial
Educational	128.4	4	193.5	4	Substantial
Industrial	107.8	41	172.9	41	Substantial
Recreational	15.8	98	80.9	98	Substantial
Medical	6.8	32	71.9	32	Substantial

Note: Results shown indicate the maximum impact within each receptor category. . Results for two and three feeder outage scenarios are presented in Appendix H.

Table 46 Preliminary impact screening – Emergency – E6 – PM_{10} and $PM_{2.5}$ impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average PM_{10}					
Residential	199.0	1	225.4	7	Substantial
Educational	233.1	6	290.2	6	Substantial
Industrial	340.6	41	369.4	41	Substantial
Recreational	70.1	101	137.2	102	Substantial
Medical	52.0	32	135.0	35	Substantial
Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average $PM_{2.5}$					
Residential	398.1	1.0	408.4	7.0	Substantial
Educational	146.6	4	211.7	4	Substantial
Industrial	123.1	41	188.2	41	Substantial
Recreational	18.1	98	83.2	98	Substantial
Medical	7.8	32	72.9	32	Substantial

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

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6.2.1.3. Other Pollutants

Further detail associated with the assessed impact significance of other assessed pollutants under the most likely emergency scenario (one feeder failure) is presented in Table 47 to Table 64.

Table 47 Preliminary impact screening – Emergency – E1 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average SO_2					
Residential	< 0.1	1	20.0	1	Negligible
Educational	< 0.1	3	20.0	3	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	101	20.0	101	Negligible
Medical	< 0.1	32	20.0	32	Negligible
Maximum 24-hour average SO_2					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	4	15.1	4	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	98	15.1	98	Negligible
Medical	< 0.1	33	15.1	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 48 Preliminary impact screening – Emergency – E1 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average CO					
Residential	3.9	1	6.0	1	Negligible
Educational	3.5	3	5.6	3	Negligible
Industrial	6.7	14	8.8	14	Slight
Recreational	0.9	101	3.0	101	Negligible
Medical	0.8	32	2.9	32	Negligible
Maximum 1-hour average CO					
Residential	10.0	1	15.3	1	Slight
Educational	8.8	3	14.1	3	Slight
Industrial	16.9	14	22.2	14	Moderate
Recreational	2.4	101	7.7	101	Negligible
Medical	1.9	32	7.2	32	Negligible
Maximum 8-hour average CO					
Residential	16.4	1	29.4	1	Moderate
Educational	18.9	2	31.9	2	Moderate
Industrial	34.5	14	47.5	14	Moderate
Recreational	5.0	98	18.0	98	Slight
Medical	3.2	32	16.2	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 49 Preliminary impact screening – Emergency – E1 – other pollutants impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	0.2	1	0.2	1	Negligible
Educational	0.2	2	0.2	2	Negligible
Industrial	0.4	14	0.4	14	Negligible
Recreational	< 0.1	79	< 0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	0.2	1	0.2	1	Negligible
Educational	0.3	2	0.3	2	Negligible
Industrial	0.5	14	0.5	14	Negligible
Recreational	< 0.1	79	< 0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	5.7	1	5.7	1	Slight
Educational	6.9	2	6.9	2	Slight
Industrial	12.7	14	12.7	14	Moderate
Recreational	1.7	79	1.7	79	Negligible
Medical	1.2	32	1.2	32	Negligible
Boundary	12.7	194	12.7	194	Moderate
Maximum 1-hour average - formaldehyde					
Residential	0.8	1	0.8	1	Negligible
Educational	1.0	2	1.0	2	Negligible
Industrial	1.9	14	1.9	14	Negligible
Recreational	0.2	79	0.2	79	Negligible
Medical	0.2	32	0.2	32	Negligible
Boundary	1.9	194	1.9	194	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	79	< 0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	< 0.1	194	< 0.1	194	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 50 Preliminary impact screening – Emergency – E2 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average SO_2					
Residential	< 0.1	1	20.0	1	Negligible
Educational	< 0.1	2	20.0	2	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	99	20.0	99	Negligible
Medical	< 0.1	32	20.0	32	Negligible
Maximum 24-hour average SO_2					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	4	15.1	4	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	98	15.1	98	Negligible
Medical	< 0.1	33	15.1	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 51 Preliminary impact screening – Emergency – E2 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average CO					
Residential	5.8	1	7.9	1	Slight
Educational	6.5	2	8.6	2	Slight
Industrial	11.3	14	13.4	14	Moderate
Recreational	1.8	99	3.9	99	Negligible
Medical	1.5	32	3.6	32	Negligible
Maximum 1-hour average CO					
Residential	14.6	1	19.9	1	Moderate
Educational	16.4	2	21.8	2	Moderate
Industrial	28.4	14	33.8	14	Moderate
Recreational	4.7	99	10.0	99	Negligible
Medical	3.8	32	9.1	32	Negligible
Maximum 8-hour average CO					
Residential	23.0	1	36.0	1	Moderate
Educational	32.5	4	45.5	4	Moderate
Industrial	46.1	14	59.1	14	Moderate
Recreational	9.7	98	22.7	98	Slight
Medical	6.3	32	19.3	32	Slight

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 52 Preliminary impact screening – Emergency – E2 – other pollutants impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	0.2	1	0.2	1	Negligible
Educational	0.3	2	0.3	2	Negligible
Industrial	0.5	14	0.5	14	Negligible
Recreational	< 0.1	99	< 0.1	99	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	0.3	1	0.3	1	Negligible
Educational	0.5	2	0.5	2	Negligible
Industrial	0.6	14	0.6	14	Negligible
Recreational	0.1	99	0.1	99	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	8.4	1	8.4	1	Slight
Educational	12.0	2	12.0	2	Moderate
Industrial	15.6	14	15.6	14	Moderate
Recreational	3.1	99	3.1	99	Negligible
Medical	2.2	32	2.2	32	Negligible
Boundary	19.6	192	19.6	192	Moderate
Maximum 1-hour average - formaldehyde					
Residential	1.2	1	1.2	1	Negligible
Educational	1.8	2	1.8	2	Negligible
Industrial	2.3	14	2.3	14	Negligible
Recreational	0.5	99	0.5	99	Negligible
Medical	0.3	32	0.3	32	Negligible
Boundary	2.9	192	2.9	192	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	99	< 0.1	99	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	< 0.1	192	< 0.1	192	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 53 Preliminary impact screening – Emergency – E3 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average SO_2					
Residential	< 0.1	1	20.0	1	Negligible
Educational	< 0.1	2	20.0	2	Negligible
Industrial	< 0.1	15	20.0	15	Negligible
Recreational	< 0.1	99	20.0	99	Negligible
Medical	< 0.1	32	20.0	32	Negligible
Maximum 24-hour average SO_2					
Residential	< 0.1	7	15.1	7	Negligible
Educational	< 0.1	2	15.1	2	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	98	15.1	98	Negligible
Medical	< 0.1	32	15.1	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 54 Preliminary impact screening – Emergency – E3 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average CO					
Residential	4.6	1	6.7	1	Negligible
Educational	5.3	2	7.4	2	Slight
Industrial	7.9	15	10.0	15	Slight
Recreational	1.8	99	3.9	99	Negligible
Medical	1.4	32	3.5	32	Negligible
Maximum 1-hour average CO					
Residential	11.7	1	17.0	1	Moderate
Educational	13.3	2	18.6	2	Moderate
Industrial	20.0	15	25.3	15	Moderate
Recreational	4.6	99	10.0	99	Negligible
Medical	3.6	32	9.0	32	Negligible
Maximum 8-hour average CO					
Residential	17.0	1	30.0	1	Moderate
Educational	25.1	2	38.1	2	Moderate
Industrial	28.9	14	41.9	14	Moderate
Recreational	8.5	99	21.5	99	Slight
Medical	5.8	32	18.8	32	Slight

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 55 Preliminary impact screening – Emergency – E3 – other pollutants impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	0.2	1	0.2	1	Negligible
Educational	0.2	4	0.2	4	Negligible
Industrial	0.4	14	0.4	14	Negligible
Recreational	< 0.1	79	< 0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	0.3	1	0.3	1	Negligible
Educational	0.3	4	0.3	4	Negligible
Industrial	0.5	14	0.5	14	Negligible
Recreational	0.1	79	0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	6.5	1	6.5	1	Slight
Educational	8.5	4	8.5	4	Slight
Industrial	12.5	14	12.5	14	Moderate
Recreational	2.8	79	2.8	79	Negligible
Medical	2.0	32	2.0	32	Negligible
Boundary	13.3	183	13.3	183	Moderate
Maximum 1-hour average - formaldehyde					
Residential	1.0	1	1.0	1	Negligible
Educational	1.3	4	1.3	4	Negligible
Industrial	1.8	14	1.8	14	Negligible
Recreational	0.4	79	0.4	79	Negligible
Medical	0.3	32	0.3	32	Negligible
Boundary	2.0	183	2.0	183	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	4	< 0.1	4	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	79	< 0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	< 0.1	183	< 0.1	183	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 56 Preliminary impact screening – Emergency – E4 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average SO_2					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	4	20.0	4	Negligible
Industrial	< 0.1	15	20.0	15	Negligible
Recreational	< 0.1	99	20.0	99	Negligible
Medical	< 0.1	32	20.0	32	Negligible
Maximum 24-hour average SO_2					
Residential	< 0.1	7	15.1	7	Negligible
Educational	< 0.1	6	15.1	6	Negligible
Industrial	< 0.1	41	15.1	41	Negligible
Recreational	< 0.1	98	15.1	98	Negligible
Medical	< 0.1	32	15.1	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 57 Preliminary impact screening – Emergency – E4 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average CO					
Residential	5.6	7	7.7	7	Slight
Educational	6.9	4	9.0	4	Slight
Industrial	10.1	15	12.2	15	Moderate
Recreational	2.6	99	4.7	99	Negligible
Medical	2.0	32	4.1	32	Negligible
Maximum 1-hour average CO					
Residential	14.2	7	19.5	7	Moderate
Educational	17.3	4	22.7	4	Moderate
Industrial	25.5	15	30.8	15	Moderate
Recreational	6.5	99	11.8	99	Slight
Medical	5.0	32	10.3	32	Negligible
Maximum 8-hour average CO					
Residential	21.4	7	34.4	7	Moderate
Educational	31.5	4	44.5	4	Moderate
Industrial	32.6	14	45.6	14	Moderate
Recreational	11.3	99	24.3	99	Moderate
Medical	7.6	32	20.6	32	Slight

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 58 Preliminary impact screening – Emergency – E4 – other pollutants impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	0.2	7	0.2	7	Negligible
Educational	0.3	6	0.3	6	Negligible
Industrial	0.4	14	0.4	14	Negligible
Recreational	0.1	79	0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	0.3	7	0.3	7	Negligible
Educational	0.4	6	0.4	6	Negligible
Industrial	0.5	14	0.5	14	Negligible
Recreational	0.2	79	0.2	79	Negligible
Medical	0.1	32	0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	8.3	7	8.3	7	Slight
Educational	11.2	6	11.2	6	Moderate
Industrial	13.8	14	13.8	14	Moderate
Recreational	4.0	79	4.0	79	Negligible
Medical	2.7	32	2.7	32	Negligible
Boundary	18.0	178	18.0	178	Moderate
Maximum 1-hour average - formaldehyde					
Residential	1.2	7	1.2	7	Negligible
Educational	1.6	6	1.6	6	Negligible
Industrial	2.0	14	2.0	14	Negligible
Recreational	0.6	79	0.6	79	Negligible
Medical	0.4	32	0.4	32	Negligible
Boundary	2.7	178	2.7	178	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	7	< 0.1	7	Negligible
Educational	< 0.1	6	< 0.1	6	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	79	< 0.1	79	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	< 0.1	178	< 0.1	178	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 59 Preliminary impact screening – Emergency – E5 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average SO_2					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	6	20.0	6	Negligible
Industrial	< 0.1	40	20.0	40	Negligible
Recreational	< 0.1	119	20.0	119	Negligible
Medical	< 0.1	32	20.0	32	Negligible
Maximum 24-hour average SO_2					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	6	15.1	6	Negligible
Industrial	< 0.1	41	15.1	41	Negligible
Recreational	< 0.1	101	15.1	101	Negligible
Medical	< 0.1	32	15.1	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 60 Preliminary impact screening – Emergency – E5 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average CO					
Residential	5.6	7	7.7	7	Slight
Educational	7.0	6	9.1	6	Slight
Industrial	10.1	40	12.2	40	Moderate
Recreational	2.6	119	4.7	119	Negligible
Medical	1.9	32	4.0	32	Negligible
Maximum 1-hour average CO					
Residential	14.1	7	19.5	7	Moderate
Educational	17.6	6	22.9	6	Moderate
Industrial	25.6	40	31.0	40	Moderate
Recreational	6.6	119	11.9	119	Slight
Medical	4.8	32	10.1	32	Negligible
Maximum 8-hour average CO					
Residential	22.6	7	35.6	7	Moderate
Educational	28.8	6	41.8	6	Moderate
Industrial	34.6	41	47.6	41	Moderate
Recreational	12.2	30	25.2	30	Moderate
Medical	8.8	32	21.8	32	Slight

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 61 Preliminary impact screening – Emergency – E5 – other pollutants impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	0.3	7	0.3	7	Negligible
Educational	0.3	6	0.3	6	Negligible
Industrial	0.4	41	0.4	41	Negligible
Recreational	0.1	119	0.1	119	Negligible
Medical	< 0.1	36	< 0.1	36	Negligible
Maximum 1-hour average - xylene					
Residential	0.4	7	0.4	7	Negligible
Educational	0.4	6	0.4	6	Negligible
Industrial	0.5	41	0.5	41	Negligible
Recreational	0.2	119	0.2	119	Negligible
Medical	0.1	36	0.1	36	Negligible
Maximum 1-hour average - benzene					
Residential	9.1	7	9.1	7	Slight
Educational	10.9	6	10.9	6	Moderate
Industrial	13.9	41	13.9	41	Moderate
Recreational	4.7	119	4.7	119	Negligible
Medical	3.1	36	3.1	36	Negligible
Boundary	21.5	294	21.5	294	Moderate
Maximum 1-hour average - formaldehyde					
Residential	1.3	7	1.3	7	Negligible
Educational	1.6	6	1.6	6	Negligible
Industrial	2.0	41	2.0	41	Negligible
Recreational	0.7	119	0.7	119	Negligible
Medical	0.5	36	0.5	36	Negligible
Boundary	3.2	294	3.2	294	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	7	< 0.1	7	Negligible
Educational	< 0.1	6	< 0.1	6	Negligible
Industrial	< 0.1	41	< 0.1	41	Negligible
Recreational	< 0.1	119	< 0.1	119	Negligible
Medical	< 0.1	36	< 0.1	36	Negligible
Boundary	< 0.1	294	< 0.1	294	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 62 Preliminary impact screening – Emergency – E6 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average SO_2					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	6	20.0	6	Negligible
Industrial	< 0.1	40	20.0	40	Negligible
Recreational	< 0.1	119	20.0	119	Negligible
Medical	< 0.1	32	20.0	32	Negligible
Maximum 24-hour average SO_2					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	6	15.1	6	Negligible
Industrial	< 0.1	41	15.1	41	Negligible
Recreational	< 0.1	101	15.1	101	Negligible
Medical	< 0.1	32	15.1	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 63 Preliminary impact screening – Emergency – E6 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average CO					
Residential	6.4	7	8.5	7	Slight
Educational	8.0	6	10.1	6	Slight
Industrial	11.6	40	13.7	40	Moderate
Recreational	3.0	119	5.1	119	Negligible
Medical	2.2	32	4.3	32	Negligible
Maximum 1-hour average CO					
Residential	16.1	7	21.5	7	Moderate
Educational	20.1	6	25.4	6	Moderate
Industrial	29.3	40	34.6	40	Moderate
Recreational	7.5	119	12.9	119	Slight
Medical	5.5	32	10.8	32	Slight
Maximum 8-hour average CO					
Residential	25.8	7	38.8	7	Moderate
Educational	32.9	6	45.9	6	Moderate
Industrial	39.5	41	52.5	41	Moderate
Recreational	13.9	30	26.9	30	Moderate
Medical	10.1	32	23.1	32	Moderate

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

Table 64 Preliminary impact screening – Emergency – E6 – other pollutants impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	0.3	7	0.3	7	Negligible
Educational	0.4	6	0.4	6	Negligible
Industrial	0.5	41	0.5	41	Negligible
Recreational	0.2	119	0.2	119	Negligible
Medical	0.1	36	0.1	36	Negligible
Maximum 1-hour average - xylene					
Residential	0.4	7	0.4	7	Negligible
Educational	0.5	6	0.5	6	Negligible
Industrial	0.6	41	0.6	41	Negligible
Recreational	0.2	119	0.2	119	Negligible
Medical	0.1	36	0.1	36	Negligible
Maximum 1-hour average - benzene					
Residential	10.4	7	10.4	7	Moderate
Educational	12.5	6	12.5	6	Moderate
Industrial	15.9	41	15.9	41	Moderate
Recreational	5.3	119	5.3	119	Slight
Medical	3.6	36	3.6	36	Negligible
Boundary	24.6	294	24.6	294	Moderate
Maximum 1-hour average - formaldehyde					
Residential	1.5	7	1.5	7	Negligible
Educational	1.8	6	1.8	6	Negligible
Industrial	2.3	41	2.3	41	Negligible
Recreational	0.8	119	0.8	119	Negligible
Medical	0.5	36	0.5	36	Negligible
Boundary	3.6	294	3.6	294	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	7	< 0.1	7	Negligible
Educational	< 0.1	6	< 0.1	6	Negligible
Industrial	< 0.1	41	< 0.1	41	Negligible
Recreational	< 0.1	119	< 0.1	119	Negligible
Medical	< 0.1	36	< 0.1	36	Negligible
Boundary	< 0.1	294	< 0.1	294	Negligible

Note: Results shown indicate the maximum impact within each receptor category. Results for two and three feeder outage scenarios are presented in Appendix H.

6.2.2. Scenarios M1 to M6 – Maintenance Testing Scenarios

Results are presented in the following sections for dispersion model predictions under the proposed maintenance testing scenarios for all phases of the Proposal development. Impacts under scenario M6 represent the impacts at the maximum development stage.

The results reflect the combinatorial optimisation approach adopted and represent the generator flue configuration which results in the maximum 1-hour NO_X impact at each receptor. For clarity, the stack combinations assessed vary by receptor and produce the maximum 1-hour NO_X impacts. Those identified stack combinations have then been taken forward in the assessment of all other pollutants for all other averaging periods.

Presented in Table 65 is a summary of the maximum impact significance (refer Section 6) at any receptor associated with all assessed pollutants and averaging periods under each of the six maintenance scenarios assessed. A more detailed breakdown of these significance results for each receptor category is presented in the following sections.

Table 65 Summary of significance analysis - Maintenance Testing

Pollutant	Averaging period	Maintenance scenario					
		M1	M2	M3	M4	M5	M6
TSP	Annual	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
PM_{10} (A)	24-hour	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
	Annual	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
$PM_{2.5}$ (A)	24-hour	Slight	Moderate	Moderate	Moderate	Moderate	Moderate
	Annual	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
NO_2	1-hour	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
	Annual	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
CO	15-min	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	8-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
SO_2	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	24-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
PAH	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Benzene (C_6H_6)	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Toluene (C_7H_8) (B)	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Xylene (C_8H_{10}) (B)	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Formaldehyde (CH_2O)	1-hour	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Note: (A): Maximum 24-hour PM_{10} and $PM_{2.5}$ significance based on maximum cumulative impact, including already exceeding background concentrations. Refer to additional data in the following sections.

6.2.2.1. Nitrogen Dioxide

Presented in Table 66 to Table 71 is a summary of the maximum impact significance (refer Section 6) predicted at any receptor category associated with NO_2 under each maintenance scenario assessed.

Table 66 Preliminary impact screening – Maintenance – M1 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	19.5	110	55.3	96	Moderate
Educational	15.9	5	69.1	29	Moderate
Industrial	24.4	14	51.0	15	Moderate
Recreational	14.0	101	75.0	98	Moderate
Medical	14.5	35	42.6	35	Moderate
Annual average					
Residential	< 0.1	1	29.0	96	Negligible
Educational	< 0.1	2	29.0	19	Negligible
Industrial	< 0.1	13	29.4	124	Negligible
Recreational	< 0.1	99	28.9	98	Negligible
Medical	< 0.1	32	27.9	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category.

Table 67 Preliminary impact screening – Maintenance – M2 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	30.2	110	55.3	96	Moderate
Educational	25.9	20	69.1	29	Moderate
Industrial	33.0	43	62.0	15	Moderate
Recreational	27.1	30	75.0	98	Moderate
Medical	21.9	35	42.6	35	Moderate
Annual average					
Residential	0.1	73	29.0	96	Negligible
Educational	0.1	4	29.0	19	Negligible
Industrial	< 0.1	10	29.5	124	Negligible
Recreational	< 0.1	98	28.9	98	Negligible
Medical	< 0.1	32	27.9	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 68 Preliminary impact screening – Maintenance – M3 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	34.7	61	55.3	96	Moderate
Educational	32.8	21	69.1	29	Moderate
Industrial	36.0	127	58.6	15	Moderate
Recreational	34.4	79	75.0	98	Moderate
Medical	22.1	35	42.6	35	Moderate
Annual average					
Residential	< 0.1	73	29.0	96	Negligible
Educational	0.1	4	29.0	19	Negligible
Industrial	< 0.1	10	29.5	124	Negligible
Recreational	< 0.1	99	28.9	98	Negligible
Medical	< 0.1	32	27.9	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 69 Preliminary impact screening – Maintenance – M4 - NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	34.2	61	55.3	96	Moderate
Educational	37.9	20	69.1	29	Moderate
Industrial	39.0	127	58.6	15	Moderate
Recreational	33.9	79	75.0	98	Moderate
Medical	22.1	35	42.6	35	Moderate
Annual average					
Residential	< 0.1	73	29.0	96	Negligible
Educational	0.1	2	29.0	19	Negligible
Industrial	< 0.1	10	29.5	124	Negligible
Recreational	< 0.1	98	28.9	98	Negligible
Medical	< 0.1	32	27.9	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 70 Preliminary impact screening – Maintenance – M5 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	34.2	61	55.3	96	Moderate
Educational	37.9	20	69.1	29	Moderate
Industrial	39.0	127	58.6	15	Moderate
Recreational	33.9	79	75.0	98	Moderate
Medical	22.1	35	42.6	35	Moderate
Annual average					
Residential	< 0.1	73	29.0	96	Negligible
Educational	0.1	2	29.0	19	Negligible
Industrial	< 0.1	10	29.5	124	Negligible
Recreational	< 0.1	98	28.9	98	Negligible
Medical	< 0.1	32	27.9	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 71 Preliminary impact screening – Maintenance – M6 – NO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	36.6	96	55.3	96	Moderate
Educational	38.9	20	69.1	29	Moderate
Industrial	39.0	127	58.6	15	Moderate
Recreational	37.9	98	75.0	98	Moderate
Medical	22.1	35	42.6	35	Moderate
Annual average					
Residential	< 0.1	73	29.0	96	Negligible
Educational	0.1	2	29.0	19	Negligible
Industrial	< 0.1	41	29.5	124	Negligible
Recreational	< 0.1	98	28.9	98	Negligible
Medical	< 0.1	32	27.9	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

6.2.2.2. Particulate Matter

Presented in Table 72 to Table 101 is a summary of the maximum impact significance (refer Section 6) predicted at any receptor category associated with particulate matter (as TSP, PM_{10} and $PM_{2.5}$) under each maintenance scenario assessed. The impact significance associated with the highest and second highest 24-hour average PM_{10} and $PM_{2.5}$ impacts are presented, given that one exceedance of the relevant criteria is already included in the background data adopted.

Table 72 Preliminary impact screening – Maintenance – M1 – TSP impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average					
Residential	< 0.1	1	37.3	55	Negligible
Educational	< 0.1	2	37.3	19	Negligible
Industrial	< 0.1	13	38.3	127	Negligible
Recreational	< 0.1	79	37.3	98	Negligible
Medical	< 0.1	32	37.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 73 Preliminary impact screening – Maintenance – M1 – PM_{10} impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.3	1	111.4	1	Substantial
Educational	4.2	2	110.9	2	Substantial
Industrial	6.3	14	111.4	10	Substantial
Recreational	0.7	79	110.3	99	Negligible
Medical	0.3	35	110.0	32	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	79	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 74 Preliminary impact screening – Maintenance – M1 – PM_{10} impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.2	1	92.8	73	Negligible
Educational	3.9	4	92.5	37	Negligible
Industrial	6.1	14	98.6	14	Moderate
Recreational	0.4	79	92.6	119	Negligible
Medical	0.2	32	92.5	35	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	79	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 75 Preliminary impact screening – Maintenance – M1 – $PM_{2.5}$ impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	6.7	1	164.3	1	Substantial
Educational	8.3	2	163.3	2	Substantial
Industrial	12.5	14	164.4	10	Substantial
Recreational	1.4	79	162.2	99	Negligible
Medical	0.6	35	161.6	32	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.2	2	72.9	19	Negligible
Industrial	0.2	13	78.1	127	Negligible
Recreational	< 0.1	79	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 76 Preliminary impact screening – Maintenance – M1 – $PM_{2.5}$ impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	6.5	1	89.7	1	Slight
Educational	7.8	4	89.0	2	Slight
Industrial	12.3	14	91.5	13	Slight
Recreational	0.7	79	87.6	99	Negligible
Medical	0.4	32	87.3	35	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.2	2	72.9	19	Negligible
Industrial	0.2	13	78.1	127	Negligible
Recreational	< 0.1	79	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 77 Preliminary impact screening – Maintenance – M2 – TSP impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average					
Residential	< 0.1	1	37.3	55	Negligible
Educational	< 0.1	2	37.3	19	Negligible
Industrial	< 0.1	14	38.3	127	Negligible
Recreational	< 0.1	98	37.3	98	Negligible
Medical	< 0.1	32	37.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 78 Preliminary impact screening – Maintenance – M2 – PM_{10} impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	4.0	1	112.4	1	Substantial
Educational	5.6	4	111.7	2	Substantial
Industrial	7.4	14	111.7	10	Substantial
Recreational	1.1	79	110.3	99	Negligible
Medical	0.4	35	110.1	32	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	14	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 79 Preliminary impact screening – Maintenance – M2 – PM_{10} impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.6	1	92.9	73	Negligible
Educational	5.3	4	92.5	37	Negligible
Industrial	6.9	14	98.8	14	Moderate
Recreational	0.5	79	92.6	119	Negligible
Medical	0.3	32	92.5	35	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	14	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 80 Preliminary impact screening – Maintenance – M2 – $PM_{2.5}$ impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	8.0	1	166.3	1	Substantial
Educational	11.2	4	165.0	2	Substantial
Industrial	14.8	14	164.9	10	Substantial
Recreational	2.1	79	162.3	99	Negligible
Medical	0.8	35	161.7	32	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	14	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 81 Preliminary impact screening – Maintenance – M2 – $PM_{2.5}$ impact significance (2^{nd} highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	7.1	1	90.5	1	Slight
Educational	10.6	4	90.7	2	Slight
Industrial	13.9	14	93.2	13	Moderate
Recreational	1.0	79	87.7	99	Negligible
Medical	0.6	32	87.3	35	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	14	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 82 Preliminary impact screening – Maintenance – M3 – TSP impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average					
Residential	< 0.1	1	37.3	55	Negligible
Educational	< 0.1	4	37.3	19	Negligible
Industrial	< 0.1	13	38.3	127	Negligible
Recreational	< 0.1	98	37.3	98	Negligible
Medical	< 0.1	32	37.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 83 Preliminary impact screening – Maintenance – M3 – PM_{10} impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.9	1	112.3	1	Substantial
Educational	4.9	2	112.2	4	Substantial
Industrial	6.3	14	111.8	10	Substantial
Recreational	1.0	79	110.3	99	Negligible
Medical	0.4	35	110.1	32	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	4	65.4	4	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 84 Preliminary impact screening – Maintenance – M3 – PM_{10} impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.4	1	92.9	63	Negligible
Educational	4.7	2	92.5	37	Negligible
Industrial	6.0	14	97.8	14	Moderate
Recreational	0.7	79	92.6	119	Negligible
Medical	0.4	32	92.5	35	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	4	65.4	4	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 85 Preliminary impact screening – Maintenance – M3 – $PM_{2.5}$ impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	7.8	1	166.2	1	Substantial
Educational	9.8	2	166.0	4	Substantial
Industrial	12.6	14	165.1	10	Substantial
Recreational	2.0	79	162.3	99	Negligible
Medical	0.9	35	161.7	32	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	4	72.9	4	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 86 Preliminary impact screening – Maintenance – M3 – $PM_{2.5}$ impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	6.9	1	90.4	1	Slight
Educational	9.3	2	90.7	4	Slight
Industrial	12.0	14	93.0	13	Moderate
Recreational	1.5	79	87.7	98	Negligible
Medical	0.7	32	87.3	35	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	4	72.9	4	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	32	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 87 Preliminary impact screening – Maintenance – M4 – TSP impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average					
Residential	< 0.1	1	37.3	55	Negligible
Educational	< 0.1	2	37.3	19	Negligible
Industrial	< 0.1	13	38.3	127	Negligible
Recreational	< 0.1	98	37.3	98	Negligible
Medical	< 0.1	32	37.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 88 Preliminary impact screening – Maintenance – M4 – PM_{10} impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.9	1	112.3	1	Substantial
Educational	4.9	2	112.6	4	Substantial
Industrial	6.3	14	111.8	10	Substantial
Recreational	0.9	79	110.3	99	Negligible
Medical	0.4	35	110.1	32	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 89 Preliminary impact screening – Maintenance – M4 – PM_{10} impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.4	1	92.9	63	Negligible
Educational	4.7	2	92.5	37	Negligible
Industrial	6.0	14	97.8	14	Moderate
Recreational	0.7	79	92.7	119	Negligible
Medical	0.3	32	92.5	35	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 90 Preliminary impact screening – Maintenance – M4 – $PM_{2.5}$ impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	7.8	1	166.2	1	Substantial
Educational	9.8	2	166.9	4	Substantial
Industrial	12.6	14	165.1	10	Substantial
Recreational	1.9	79	162.3	99	Negligible
Medical	0.9	35	161.7	32	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 91 Preliminary impact screening – Maintenance – M4 – $PM_{2.5}$ impact significance (2^{nd} highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	6.9	1	90.4	1	Slight
Educational	9.3	2	90.7	2	Slight
Industrial	12.0	14	93.0	13	Moderate
Recreational	1.4	79	87.7	98	Negligible
Medical	0.6	32	87.3	35	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 92 Preliminary impact screening – Maintenance – M5 – TSP impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average					
Residential	< 0.1	1	37.3	55	Negligible
Educational	< 0.1	2	37.3	19	Negligible
Industrial	< 0.1	13	38.3	127	Negligible
Recreational	< 0.1	98	37.3	98	Negligible
Medical	< 0.1	32	37.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 93 Preliminary impact screening – Maintenance – M5 – PM_{10} impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.9	1	112.3	1	Substantial
Educational	4.9	2	112.6	4	Substantial
Industrial	6.3	14	111.8	10	Substantial
Recreational	0.9	79	110.3	99	Negligible
Medical	0.4	35	110.1	32	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 94 Preliminary impact screening – Maintenance – M5 – PM_{10} impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.4	1	92.9	63	Negligible
Educational	4.7	2	92.5	37	Negligible
Industrial	6.0	14	97.8	14	Moderate
Recreational	0.7	79	92.7	119	Negligible
Medical	0.3	32	92.5	35	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 95 Preliminary impact screening – Maintenance – M5 – $PM_{2.5}$ impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	7.8	1	166.2	1	Substantial
Educational	9.8	2	166.9	4	Substantial
Industrial	12.6	14	165.1	10	Substantial
Recreational	1.9	79	162.3	99	Negligible
Medical	0.9	35	161.7	32	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 96 Preliminary impact screening – Maintenance – M5 – $PM_{2.5}$ impact significance (2^{nd} highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	6.9	1	90.4	1	Slight
Educational	9.3	2	90.7	2	Slight
Industrial	12.0	14	93.0	13	Moderate
Recreational	1.4	79	87.7	98	Negligible
Medical	0.6	32	87.3	35	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 97 Preliminary impact screening – Maintenance – M6 – TSP impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Annual average					
Residential	< 0.1	1	37.3	55	Negligible
Educational	< 0.1	2	37.3	19	Negligible
Industrial	< 0.1	13	38.3	127	Negligible
Recreational	< 0.1	98	37.3	98	Negligible
Medical	< 0.1	32	37.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 98 Preliminary impact screening – Maintenance – M6 – PM_{10} impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.9	1	112.3	1	Substantial
Educational	4.9	2	112.6	4	Substantial
Industrial	6.3	14	112.1	41	Substantial
Recreational	1.1	79	110.3	99	Negligible
Medical	0.4	35	110.0	32	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 99 Preliminary impact screening – Maintenance – M6 – PM_{10} impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	3.4	1	92.9	63	Negligible
Educational	4.7	2	92.5	37	Negligible
Industrial	6.0	14	97.8	14	Moderate
Recreational	0.5	79	92.8	119	Negligible
Medical	0.3	32	92.5	35	Negligible
Annual average					
Residential	< 0.1	1	65.4	55	Negligible
Educational	< 0.1	2	65.3	19	Negligible
Industrial	< 0.1	13	67.0	127	Negligible
Recreational	< 0.1	98	65.3	98	Negligible
Medical	< 0.1	32	65.2	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 100 Preliminary impact screening – Maintenance – M6 – $PM_{2.5}$ impact significance (maximum)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	7.8	1	166.2	1	Substantial
Educational	9.8	2	166.9	4	Substantial
Industrial	12.6	14	165.7	41	Substantial
Recreational	2.3	79	162.3	99	Negligible
Medical	0.9	35	161.7	32	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 101 Preliminary impact screening – Maintenance – M6 – $PM_{2.5}$ impact significance (2nd highest)

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 24-hour average					
Residential	6.9	1	90.4	1	Slight
Educational	9.3	2	91.1	6	Slight
Industrial	12.0	14	93.0	13	Moderate
Recreational	1.1	79	87.7	98	Negligible
Medical	0.7	32	87.3	35	Negligible
Annual average					
Residential	0.2	1	73.1	55	Negligible
Educational	0.3	2	72.9	19	Negligible
Industrial	0.3	13	78.1	127	Negligible
Recreational	< 0.1	98	72.7	98	Negligible
Medical	< 0.1	32	72.3	33	Negligible

Note: Results shown indicate the maximum impact within each receptor category

6.2.2.3. Other Pollutants

Presented in Table 102 to Table 119 is a summary of the maximum impact significance (refer Section 6) predicted at any receptor category associated with SO_2, CO, and VOCs (benzene (C_6H_6), toluene (C_7H_8), xylene (C_8H_{10}), PAH, and formaldehyde (CH_2O)) under each maintenance scenario assessed.

Table 102 Preliminary impact screening – Maintenance – M1 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	< 0.1	1	20.0	1	Negligible
Educational	< 0.1	5	20.0	5	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	79	20.0	79	Negligible
Medical	< 0.1	35	20.0	35	Negligible
Maximum 24-hour average					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	2	15.1	2	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	79	15.1	79	Negligible
Medical	< 0.1	35	15.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 103 Preliminary impact screening – Maintenance – M1 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average					
Residential	0.2	1	2.3	1	Negligible
Educational	0.2	5	2.3	5	Negligible
Industrial	0.4	14	2.5	14	Negligible
Recreational	< 0.1	79	2.2	79	Negligible
Medical	< 0.1	35	2.1	35	Negligible
Maximum 1-hour average					
Residential	0.4	1	5.7	1	Negligible
Educational	0.5	5	5.8	5	Negligible
Industrial	0.9	14	6.3	14	Negligible
Recreational	0.1	79	5.5	79	Negligible
Medical	< 0.1	35	5.4	35	Negligible
Maximum 8-hour average					
Residential	0.7	1	13.7	1	Negligible
Educational	0.8	2	13.8	2	Negligible
Industrial	1.6	14	14.6	14	Negligible
Recreational	0.2	79	13.2	79	Negligible
Medical	< 0.1	35	13.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 104 Preliminary impact screening – Maintenance – M1 – VOC impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	0.3	1	0.3	1	Negligible
Educational	0.3	2	0.3	2	Negligible
Industrial	0.7	14	0.7	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	0.7	195	0.7	195	Negligible
Maximum 1-hour average - formaldehyde					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	0.1	14.0	0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	0.1	195.0	0.1	195.0	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	< 0.1	195.0	< 0.1	195.0	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 105 Preliminary impact screening – Maintenance – M2 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	< 0.1	73	20.0	73	Negligible
Educational	< 0.1	2	20.0	2	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	98	20.0	98	Negligible
Medical	< 0.1	35	20.0	35	Negligible
Maximum 24-hour average					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	4	15.1	4	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	79	15.1	79	Negligible
Medical	< 0.1	35	15.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 106 Preliminary impact screening – Maintenance – M2 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average					
Residential	0.2	73	2.3	73	Negligible
Educational	0.3	2	2.4	2	Negligible
Industrial	0.5	14	2.6	14	Negligible
Recreational	< 0.1	98	2.2	98	Negligible
Medical	< 0.1	35	2.2	35	Negligible
Maximum 1-hour average					
Residential	0.6	73	5.9	73	Negligible
Educational	0.8	2	6.2	2	Negligible
Industrial	1.3	14	6.6	14	Negligible
Recreational	0.2	98	5.5	98	Negligible
Medical	0.1	35	5.5	35	Negligible
Maximum 8-hour average					
Residential	1.0	1	14.0	1	Negligible
Educational	1.1	4	14.1	4	Negligible
Industrial	1.7	14	14.7	14	Negligible
Recreational	0.2	79	13.2	79	Negligible
Medical	0.1	35	13.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 107 Preliminary impact screening – Maintenance – M2 – VOC impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	4	< 0.1	4	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	4	< 0.1	4	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	0.4	1	0.4	1	Negligible
Educational	0.5	4	0.5	4	Negligible
Industrial	0.7	14	0.7	14	Negligible
Recreational	0.1	98	0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	0.9	188	0.9	188	Negligible
Maximum 1-hour average - formaldehyde					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	4.0	< 0.1	4.0	Negligible
Industrial	0.1	14.0	0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	0.1	188.0	0.1	188.0	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	4.0	< 0.1	4.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	< 0.1	188.0	< 0.1	188.0	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 108 Preliminary impact screening – Maintenance – M3 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	2	20.0	2	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	79	20.0	79	Negligible
Medical	< 0.1	35	20.0	35	Negligible
Maximum 24-hour average					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	2	15.1	2	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	79	15.1	79	Negligible
Medical	< 0.1	35	15.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 109 Preliminary impact screening – Maintenance – M3 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average					
Residential	0.2	7	2.3	7	Negligible
Educational	0.3	2	2.4	2	Negligible
Industrial	0.5	14	2.6	14	Negligible
Recreational	0.1	79	2.2	79	Negligible
Medical	< 0.1	35	2.2	35	Negligible
Maximum 1-hour average					
Residential	0.6	7	5.9	7	Negligible
Educational	0.8	2	6.2	2	Negligible
Industrial	1.3	14	6.6	14	Negligible
Recreational	0.3	79	5.7	79	Negligible
Medical	0.1	35	5.5	35	Negligible
Maximum 8-hour average					
Residential	1.0	1	14.0	1	Negligible
Educational	1.0	2	14.0	2	Negligible
Industrial	1.5	14	14.5	14	Negligible
Recreational	0.2	79	13.2	79	Negligible
Medical	0.1	35	13.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 110 Preliminary impact screening – Maintenance – M3 – VOC impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	0.4	1	0.4	1	Negligible
Educational	0.5	2	0.5	2	Negligible
Industrial	0.6	14	0.6	14	Negligible
Recreational	0.1	98	0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	0.8	195	0.8	195	Negligible
Maximum 1-hour average - formaldehyde					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	0.1	195.0	0.1	195.0	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	< 0.1	195.0	< 0.1	195.0	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 111 Preliminary impact screening – Maintenance – M4 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	2	20.0	2	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	79	20.0	79	Negligible
Medical	< 0.1	35	20.0	35	Negligible
Maximum 24-hour average					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	2	15.1	2	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	98	15.1	98	Negligible
Medical	< 0.1	35	15.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 112 Preliminary impact screening – Maintenance – M4 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average					
Residential	0.2	7	2.3	7	Negligible
Educational	0.3	2	2.4	2	Negligible
Industrial	0.5	14	2.6	14	Negligible
Recreational	0.1	79	2.2	79	Negligible
Medical	< 0.1	35	2.2	35	Negligible
Maximum 1-hour average					
Residential	0.6	7	5.9	7	Negligible
Educational	0.8	2	6.2	2	Negligible
Industrial	1.3	14	6.6	14	Negligible
Recreational	0.3	79	5.6	79	Negligible
Medical	0.1	35	5.5	35	Negligible
Maximum 8-hour average					
Residential	1.0	1	14.0	1	Negligible
Educational	1.1	4	14.1	4	Negligible
Industrial	1.5	14	14.5	14	Negligible
Recreational	0.2	79	13.2	79	Negligible
Medical	0.1	35	13.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 113 Preliminary impact screening – Maintenance – M4 – VOC impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	0.4	1	0.4	1	Negligible
Educational	0.5	2	0.5	2	Negligible
Industrial	0.6	14	0.6	14	Negligible
Recreational	0.1	98	0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	0.9	181	0.9	181	Negligible
Maximum 1-hour average - formaldehyde					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	0.1	181.0	0.1	181.0	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	< 0.1	181.0	< 0.1	181.0	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 114 Preliminary impact screening – Maintenance – M5 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	2	20.0	2	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	79	20.0	79	Negligible
Medical	< 0.1	35	20.0	35	Negligible
Maximum 24-hour average					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	2	15.1	2	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	98	15.1	98	Negligible
Medical	< 0.1	35	15.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 115 Preliminary impact screening – Maintenance – M5 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average					
Residential	0.2	7	2.3	7	Negligible
Educational	0.3	2	2.4	2	Negligible
Industrial	0.5	14	2.6	14	Negligible
Recreational	0.1	79	2.2	79	Negligible
Medical	< 0.1	35	2.2	35	Negligible
Maximum 1-hour average					
Residential	0.6	7	5.9	7	Negligible
Educational	0.8	2	6.2	2	Negligible
Industrial	1.3	14	6.6	14	Negligible
Recreational	0.3	79	5.6	79	Negligible
Medical	0.1	35	5.5	35	Negligible
Maximum 8-hour average					
Residential	1.0	1	14.0	1	Negligible
Educational	1.1	4	14.1	4	Negligible
Industrial	1.5	14	14.5	14	Negligible
Recreational	0.2	79	13.2	79	Negligible
Medical	0.1	35	13.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 116 Preliminary impact screening – Maintenance – M5 – VOC impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	98	< 0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	0.4	1	0.4	1	Negligible
Educational	0.5	2	0.5	2	Negligible
Industrial	0.6	14	0.6	14	Negligible
Recreational	0.1	98	0.1	98	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	0.9	181	0.9	181	Negligible
Maximum 1-hour average - formaldehyde					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	0.1	181.0	0.1	181.0	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	98.0	< 0.1	98.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	< 0.1	181.0	< 0.1	181.0	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 117 Preliminary impact screening – Maintenance – M6 – SO_2 impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average					
Residential	< 0.1	7	20.0	7	Negligible
Educational	< 0.1	6	20.0	6	Negligible
Industrial	< 0.1	14	20.0	14	Negligible
Recreational	< 0.1	98	20.0	98	Negligible
Medical	< 0.1	35	20.0	35	Negligible
Maximum 24-hour average					
Residential	< 0.1	1	15.1	1	Negligible
Educational	< 0.1	2	15.1	2	Negligible
Industrial	< 0.1	14	15.1	14	Negligible
Recreational	< 0.1	79	15.1	79	Negligible
Medical	< 0.1	35	15.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 118 Preliminary impact screening – Maintenance – M6 – CO impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 15-minute average					
Residential	0.2	7	2.3	7	Negligible
Educational	0.4	6	2.5	6	Negligible
Industrial	0.5	14	2.6	14	Negligible
Recreational	< 0.1	98	2.2	98	Negligible
Medical	< 0.1	35	2.2	35	Negligible
Maximum 1-hour average					
Residential	0.6	7	5.9	7	Negligible
Educational	0.9	6	6.2	6	Negligible
Industrial	1.3	14	6.6	14	Negligible
Recreational	0.2	98	5.6	98	Negligible
Medical	0.1	35	5.5	35	Negligible
Maximum 8-hour average					
Residential	1.0	1	14.0	1	Negligible
Educational	1.1	4	14.1	4	Negligible
Industrial	1.5	14	14.5	14	Negligible
Recreational	0.3	79	13.3	79	Negligible
Medical	0.1	35	13.1	35	Negligible

Note: Results shown indicate the maximum impact within each receptor category

Table 119 Preliminary impact screening – Maintenance – M6 – VOC impact significance

Receptor category	% change relative to IAC	Receptor	Cumulative impact (%)	Receptor	Significance
Maximum 1-hour average - toluene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	101	< 0.1	101	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - xylene					
Residential	< 0.1	1	< 0.1	1	Negligible
Educational	< 0.1	2	< 0.1	2	Negligible
Industrial	< 0.1	14	< 0.1	14	Negligible
Recreational	< 0.1	101	< 0.1	101	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Maximum 1-hour average - benzene					
Residential	0.4	1	0.4	1	Negligible
Educational	0.5	2	0.5	2	Negligible
Industrial	0.6	14	0.6	14	Negligible
Recreational	< 0.1	101	< 0.1	101	Negligible
Medical	< 0.1	32	< 0.1	32	Negligible
Boundary	1.1	295	1.1	295	Negligible
Maximum 1-hour average - formaldehyde					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	101.0	< 0.1	101.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	0.2	295.0	0.2	295.0	Negligible
Maximum 1-hour average - PAH					
Residential	< 0.1	1.0	< 0.1	1.0	Negligible
Educational	< 0.1	2.0	< 0.1	2.0	Negligible
Industrial	< 0.1	14.0	< 0.1	14.0	Negligible
Recreational	< 0.1	101.0	< 0.1	101.0	Negligible
Medical	< 0.1	32.0	< 0.1	32.0	Negligible
Boundary	< 0.1	295.0	< 0.1	295.0	Negligible

Note: Results shown indicate the maximum impact within each receptor category

7. CONSTRUCTION STAGE IMPACT ASSESSMENT

7.1. Scenarios C1 and C2 – Construction Scenarios

The following presents the modelling results for Scenarios C1 and C2 (refer Section 5.2), which represent construction activities under two development stages. Discussion of these results is provided in Section 9.1.

7.1.1. Scenario C1

Results for the Proposal construction under scenario C1 are presented below. The significance screening assessment (Section 6.1) indicated that all pollutants were assessed as having a moderate or substantial impact and all results are presented within this section.

Table 120 Maximum 24-hour average incremental PM_{10} concentrations – Scenario C1

Receptor 2	24-hour average PM_{10} concentration (µg·m^{-3})				Receptor 2	24-hour average PM_{10} concentration (µg·m^{-3})			
Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact	Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact
20/04/2021	20.7	46.2	< 0.1	66.9	13/06/2021	20.9	11.5	1.6	34.0
4/05/2021	6.9	54.9	1.0	62.8	19/07/2021	20.9	9.9	0.6	31.3
21/08/2021	18.8	34.6	< 0.1	53.4	19/09/2021	20.7	9.7	< 0.1	30.4
23/04/2021	16.6	29.9	3.5	50.0	20/04/2021	20.7	46.2	< 0.1	66.9
28/10/2021	12.1	36.6	1.0	49.7	27/03/2021	20.6	10.9	1.4	32.9
20/08/2021	13.7	34.1	1.4	49.3	18/09/2021	19.9	18.4	< 0.1	38.3
18/01/2021	10.9	35.8	1.7	48.4	21/08/2021	18.8	34.6	< 0.1	53.4
25/01/2021	13.0	33.5	< 0.1	46.5	23/08/2021	18.1	25.4	< 0.1	43.5
27/04/2021	8.7	35.4	2.0	46.1	19/12/2021	17.6	17.6	0.2	35.4
19/04/2021	12.7	32.9	0.2	45.8	25/06/2021	17.5	7.9	< 0.1	25.4

Note: Results shown indicate the maximum impact within each receptor category.

Table 121 Maximum 24-hour average incremental $PM_{2.5}$ concentrations – Scenario C1

Receptor 2	24-hour average $PM_{2.5}$ concentration (µg·m^{-3})				Receptor 4	24-hour average $PM_{2.5}$ concentration (µg·m^{-3})			
Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact	Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact
4/05/2021	0.8	40.3	0.1	41.1	27/03/2021	2.6	5.0	0.1	7.6
29/04/2021	0.7	21.8	0.3	22.5	19/09/2021	2.5	2.8	< 0.1	5.3
23/04/2021	2.0	19.5	0.3	21.5	18/09/2021	2.5	9.2	< 0.1	11.7
20/08/2021	1.7	19.2	0.2	20.9	20/04/2021	2.4	10.5	< 0.1	12.9
15/08/2021	1.6	16.1	0.2	17.7	19/07/2021	2.4	5.8	< 0.1	8.2
10/10/2021	0.8	16.9	0.2	17.7	13/06/2021	2.4	10.2	0.1	12.6
23/08/2021	2.4	14.7	< 0.1	17.1	23/08/2021	2.3	14.7	< 0.1	17.0
3/05/2021	1.8	14.9	< 0.1	16.7	19/12/2021	2.3	2.2	< 0.1	4.5
21/08/2021	2.2	13.8	< 0.1	16.0	21/08/2021	2.2	13.8	< 0.1	16.0
14/08/2021	1.3	14.3	< 0.1	15.6	25/06/2021	2.2	4.6	< 0.1	6.8

Note: Results shown indicate the maximum impact within each receptor category.

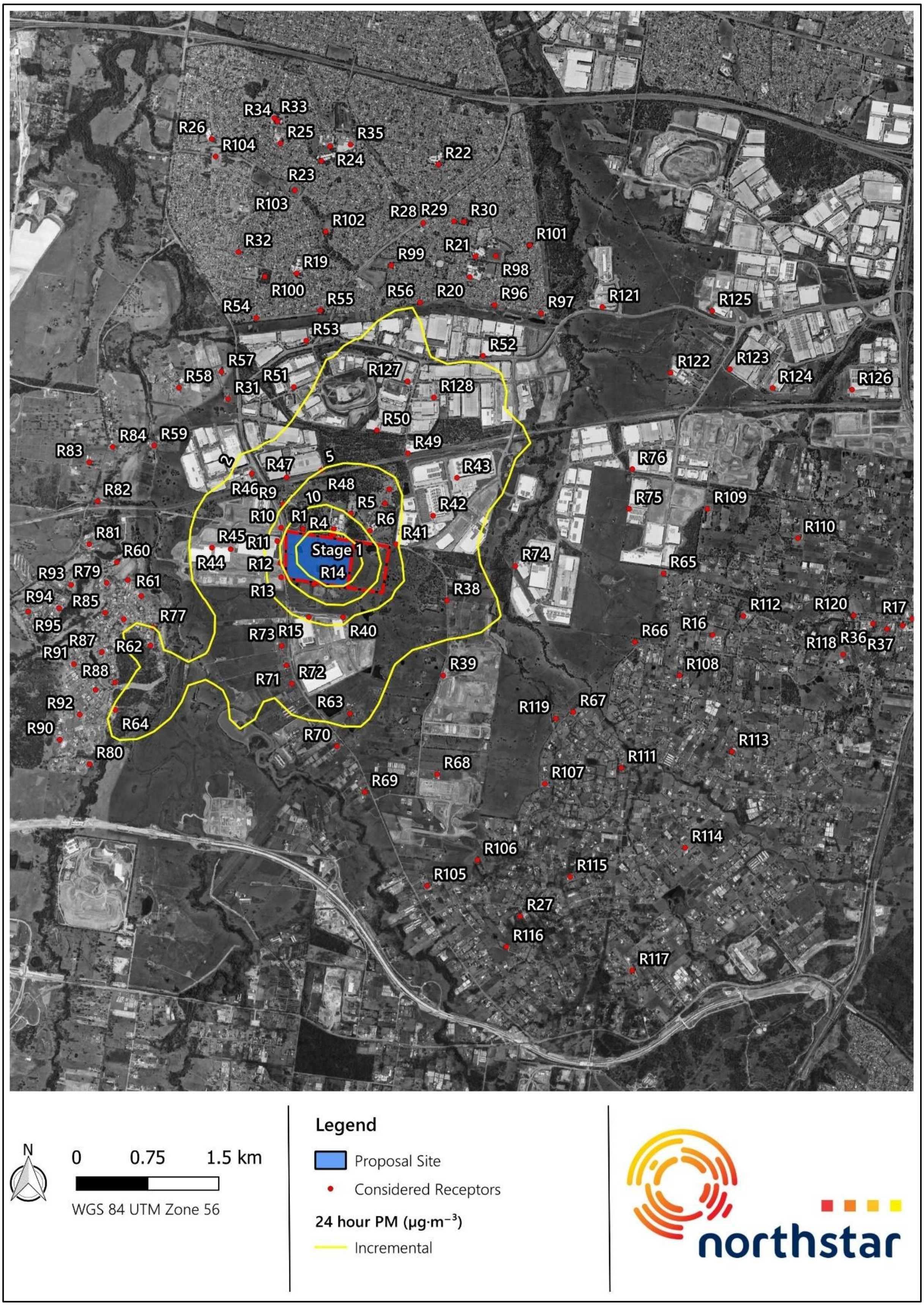
Table 122 Maximum annual average particulate concentrations – Scenario C1

Receptor category	Incremental impact	Background (regional)	Background (other construction)	Cumulative impact
Annual average TSP (µg·m^{-3})				
Criterion	90			
Max % of criterion	22.4%	37.2%	21.9%	62.0%
Residential	12.2	33.5	7.7	47.9
Educational	20.2	33.5	2.5	55.8
Industrial	5.8	33.5	19.7	53.3
Recreational	0.3	33.5	1.0	34.6
Medical	0.1	33.5	0.4	34.0
Annual average PM_{10} (µg·m^{-3})				
Criterion	25			
Max % of criterion	37.2%	65.1%	37.8%	107.8%
Residential	5.7	16.3	4.4	23.4
Educational	9.3	16.3	1.5	27.0
Industrial	3.0	16.3	9.4	22.9
Recreational	0.2	16.3	0.7	17.1
Medical	0.1	16.3	0.3	16.7
Annual average $PM_{2.5}$ (µg·m^{-3})				
Criterion	8			
Max % of criterion	14.4%	72.2%	15.0%	88.5%
Residential	0.7	5.8	0.4	6.6
Educational	1.2	5.8	0.2	7.1
Industrial	0.4	5.8	1.2	6.4
Recreational	< 0.1	5.8	< 0.1	5.8
Medical	< 0.1	5.8	< 0.1	5.8
Annual average deposited dust (g·m^{-2}·month^{-1})				
Criterion	2	-	-	4
Max % of criterion	27.9%	-	-	64.9%
Residential	0.3	2.0	0.2	2.4
Educational	0.6	2.0	< 0.1	2.6
Industrial	0.1	2.0	0.5	2.5
Recreational	< 0.1	2.0	< 0.1	2.0
Medical	< 0.1	2.0	< 0.1	2.0

Note: Results shown indicate the maximum impact within each receptor category.

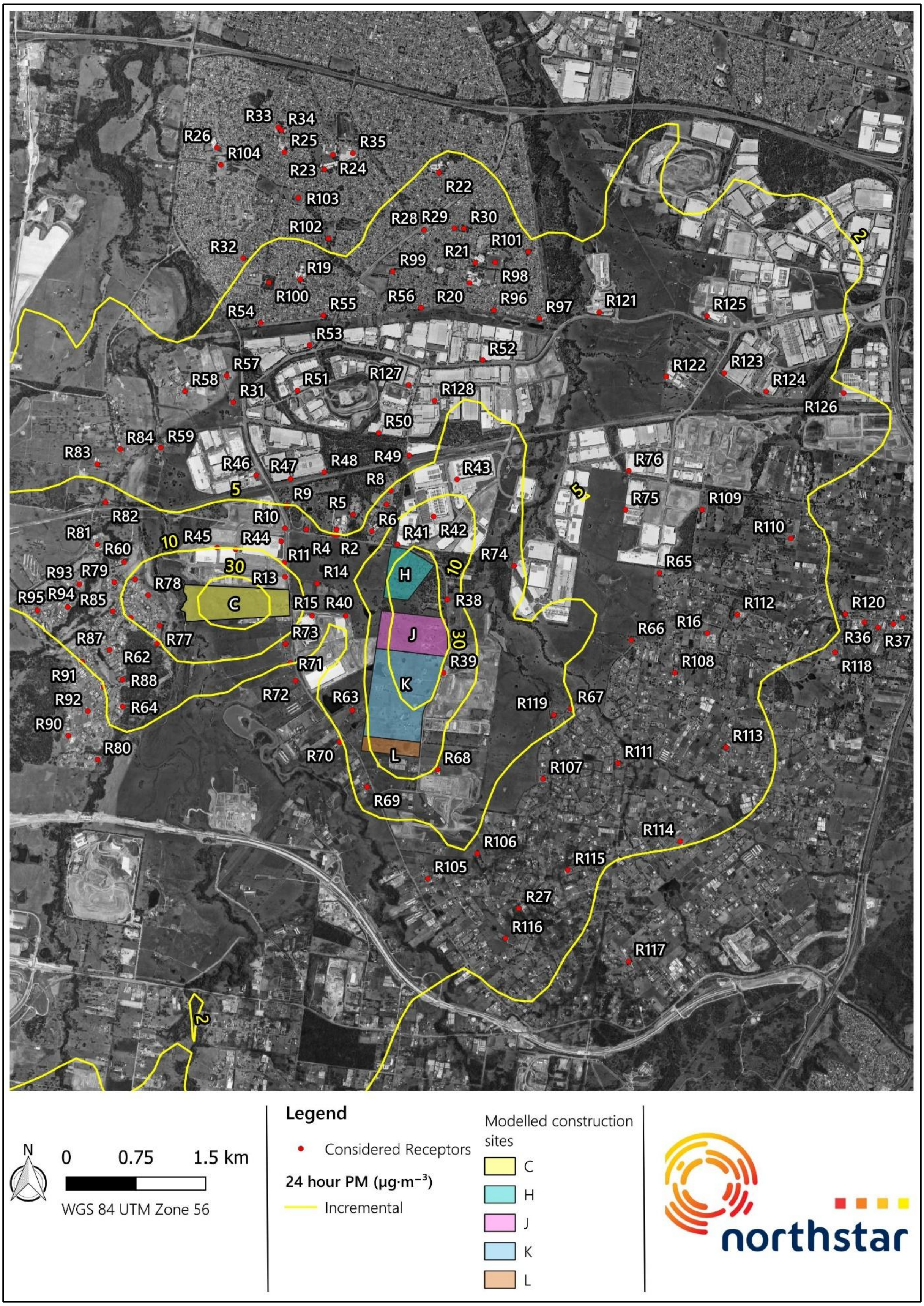
Given that Scenario C1 is predicted to result in the greatest impacts during wither of the two construction stages, contour plots showing the incremental 24-hour PM_{10} impacts associated with Scenario C1, incremental impacts associated with all other assessed construction works, and a cumulative impact (Scenario C1 plus all other construction works) are presented in

Figure 17 Predicted incremental 24-hour PM_{10} concentrations – Scenario C1



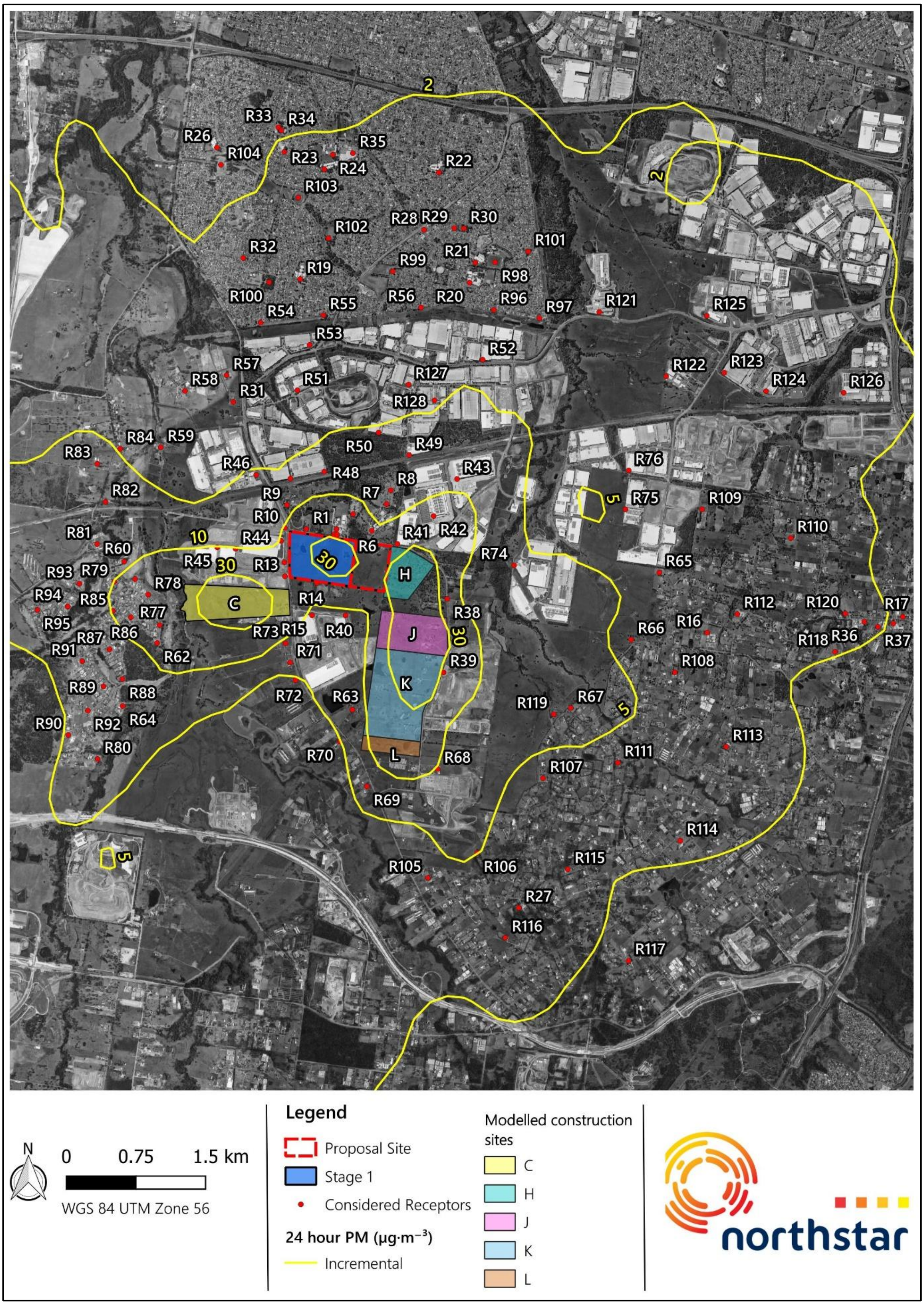
Source: Northstar

Figure 18 Predicted incremental 24-hour PM_{10} concentrations – other construction works



Source: Northstar

Figure 19 Predicted incremental 24-hour PM_{10} concentrations – Scenario C1 plus other construction works



Source: Northstar

7.1.2. Scenario C2

Results for the Proposal construction under scenario C2 are presented below. The significance screening assessment indicated that all pollutants were assessed as having a moderate or substantial impact and all results are presented within this section.

Table 123 Maximum 24-hour average incremental PM_{10} concentrations – Scenario C2

Receptor 6	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$)				Receptor 41	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$)			
Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact	Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact
4/05/2021	4.9	54.9	2.3	62.1	20/05/2021	16.1	14.7	1.3	44.3
20/04/2021	<0.1	46.2	< 0.1	46.2	27/03/2021	15.3	10.9	1.3	30.2
27/04/2021	6.5	35.4	2.6	44.5	8/05/2021	15.1	9.9	0.7	31.5
29/04/2021	5.3	36.0	2.7	43.9	27/06/2021	14.9	10.2	1.4	30.2
18/01/2021	5.6	35.8	1.7	43.0	23/04/2021	14.0	29.9	1.8	47.7
28/10/2021	2.3	36.6	1.4	40.4	22/04/2021	12.7	21.1	1.2	38.1
2/03/2021	4.8	33.8	1.6	40.1	5/07/2021	12.6	10.9	2.2	27.8
20/08/2021	3.7	34.1	2.1	39.9	6/06/2021	12.4	12.5	1.9	32.2
5/03/2021	4.2	32.7	2.0	38.9	15/04/2021	12.3	25.3	1.0	43.6
16/04/2021	5.6	29.9	3.0	38.5	6/08/2021	12.0	15.4	1.1	30.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 124 Maximum 24-hour average incremental $PM_{2.5}$ concentrations – Scenario C2

Receptor 6	24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$)				Receptor 41	24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$)			
Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact	Date	Incremental Impact	Background	Surrounding sources	Cumulative Impact
4/05/2021	0.6	40.3	0.3	40.9	20/05/2021	1.9	8.2	0.2	10.1
29/04/2021	0.6	21.8	0.3	22.4	27/03/2021	1.8	5.0	0.1	6.8
23/04/2021	0.2	19.5	0.2	19.7	8/05/2021	1.8	4.5	< 0.1	6.3
20/08/2021	0.5	19.2	0.3	19.7	27/06/2021	1.7	9.6	0.1	11.3
10/10/2021	0.3	16.9	0.3	17.2	23/04/2021	1.6	19.5	0.2	21.1
15/08/2021	0.8	16.1	0.3	16.9	22/04/2021	1.5	13.4	0.1	14.9
14/08/2021	0.7	14.3	< 0.1	15.0	6/06/2021	1.5	9.5	0.2	11.0
3/05/2021	<0.1	14.9	< 0.1	14.9	5/07/2021	1.5	6.2	0.2	7.7
23/08/2021	<0.1	14.7	< 0.1	14.7	15/04/2021	1.4	5.2	0.1	6.6
19/01/2021	0.7	13.8	0.4	14.5	7/05/2021	1.4	4.5	< 0.1	5.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 125 Maximum annual average particulate concentrations – Scenario C2

Receptor category	Incremental impact	Background (regional)	Background (other construction)	Cumulative impact
Annual average TSP (µg·m^{-3})				
Criterion	90			
Max % of criterion	11.5%	37.2%	21.9%	60.3%
Residential	2.3	33.5	7.7	41.3
Educational	5.7	33.5	2.5	41.6
Industrial	10.4	33.5	19.7	54.3
Recreational	0.2	33.5	1.0	34.3
Medical	< 0.1	33.5	0.4	33.5
Annual average PM_{10} (µg·m^{-3})				
Criterion	25			
Max % of criterion	19.7%	65.1%	37.8%	105.9%
Residential	1.4	16.3	4.4	19.0
Educational	2.9	16.3	1.5	20.7
Industrial	4.9	16.3	9.4	26.5
Recreational	0.2	16.3	0.7	17.0
Medical	< 0.1	16.3	0.3	16.3
Annual average $PM_{2.5}$ (µg·m^{-3})				
Criterion	8			
Max % of criterion	7.3%	72.2%	15.0%	87.3%
Residential	0.2	5.8	0.4	6.1
Educational	0.3	5.8	0.2	6.3
Industrial	0.6	5.8	1.2	7.0
Recreational	< 0.1	5.8	< 0.1	5.8
Medical	< 0.1	5.8	< 0.1	5.8
Annual average deposited dust (g·m^{-2}·month^{-1})				
Criterion	2	-	-	4
Max % of criterion	13.1%	-	-	63.7%
Residential	< 0.1	2.0	0.2	2.2
Educational	0.1	2.0	< 0.1	2.2
Industrial	0.3	2.0	0.5	2.5
Recreational	< 0.1	2.0	< 0.1	2.0
Medical	< 0.1	2.0	< 0.1	2.0

Note: Results shown indicate the maximum impact within each receptor category.

8. OPERATION PHASE IMPACT ASSESSMENT

8.1. Scenarios E1 to E6 – Justified Worst Case Scenarios

The following presents the modelling results for Scenarios E1 to E6 (refer Section 5.2), which reflect varying numbers of stand-by generators operating under each development phase. Results are also provided for predicted exceedances of relevant criteria under one (1), two (2), and three (3) feeder outage scenarios.

Results are presented in this section for short term criteria only (i.e. ≤ 24 hours).

Note: Care should be taken when assessing 24-hour average impacts, as power outages are typically much shorter than 24 hours. Consequently, the assessment assumes a highly conservative scenario where backup generators operate for an entire day. Similarly, comparing impacts against annual average criteria is not meaningful, as generator operation would be limited to occasional, short-term use during worst-case scenarios rather than continuous operation over a year.

Assessment of potential impacts against annual average criteria is presented under Scenarios M1 to M6 (realistic operations). Discussion of the results is presented in Section 9.2.

Results are presented in this section as the number of exceedances of the relevant criterion, and the probability that an exceedance would occur in any year. These probabilities are then used along with the probability of an electricity outage occurring to provide an overall likelihood of an exceedance occurring, presented in Section 9.2.

Table 126 Number of exceedances and probability of occurrence – Scenario E1

Receptor ID	Number of additional exceedances of the criterion			Probability that an exceedance is predicted in one year		
	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2
Scenario E1 - 1 feeder outage - 67 generators of 132 operational						
Residential	20	82	312	0.055	0.225	0.036
Educational	64	111	381	0.175	0.304	0.043
Industrial	48	97	347	0.132	0.266	0.040
Recreational	0	0	298	0.000	0.000	0.034
Medical	0	0	126	0.000	0.000	0.014
Scenario E1 - 2 feeder outage - 132 generators of 132 operational						
Residential	94	136	729	0.258	0.373	0.083
Educational	121	153	1103	0.332	0.419	0.126
Industrial	106	134	665	0.290	0.367	0.076
Recreational	1	5	507	0.003	0.014	0.058
Medical	0	0	237	0.000	0.000	0.027
Scenario E1 - 3 feeder outage - 132 generators of 132 operational						
Residential	94	136	729	0.258	0.373	0.083
Educational	121	153	1103	0.332	0.419	0.126
Industrial	106	134	665	0.290	0.367	0.076
Recreational	1	5	507	0.003	0.014	0.058
Medical	0	0	237	0.000	0.000	0.027

Note: Results shown indicate the maximum impact within each receptor category.

Table 127 Number of exceedances and probability of occurrence – Scenario E2

Receptor ID	Number of additional exceedances of the criterion			Probability that an exceedance is predicted in one year		
	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2
Scenario E2 - 1 feeder outage - 133 generators of 262 operational						
Residential	69	119	726	0.189	0.326	0.083
Educational	132	161	1149	0.362	0.441	0.131
Industrial	99	138	677	0.271	0.378	0.077
Recreational	1	5	517	0.003	0.014	0.059
Medical	0	1	238	0.000	0.003	0.027
Scenario E2 - 2 feeder outage - 262 generators of 262 operational						
Residential	130	159	1353	0.356	0.436	0.154
Educational	166	179	1952	0.455	0.490	0.223
Industrial	143	164	1080	0.392	0.449	0.123
Recreational	7	38	737	0.019	0.104	0.084
Medical	1	7	406	0.003	0.019	0.046
Scenario E2 - 3 feeder outage - 262 generators of 262 operational						
Residential	130	159	1353	0.356	0.436	0.154
Educational	166	179	1952	0.455	0.490	0.223
Industrial	143	164	1080	0.392	0.449	0.123
Recreational	7	38	737	0.019	0.104	0.084
Medical	1	7	406	0.003	0.019	0.046

Note: Results shown indicate the maximum impact within each receptor category.

Table 128 Number of exceedances and probability of occurrence – Scenario E3

Receptor ID	Number of additional exceedances of the criterion			Probability that an exceedance is predicted in one year		
	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2
Scenario E3 - 1 feeder outage - 133 generators of 392 operational						
Residential	67	132	718	0.184	0.362	0.082
Educational	148	182	993	0.405	0.499	0.113
Industrial	148	173	654	0.405	0.474	0.075
Recreational	1	4	497	0.003	0.011	0.057
Medical	0	0	241	0.000	0.000	0.028
Scenario E3 - 2 feeder outage - 326 generators of 392 operational						
Residential	151	177	1777	0.414	0.485	0.203
Educational	197	213	2416	0.540	0.584	0.276
Industrial	189	209	1468	0.518	0.573	0.168
Recreational	14	42	834	0.038	0.115	0.095
Medical	1	10	489	0.003	0.027	0.056
Scenario E3 - 3 feeder outage - 392 generators of 392 operational						
Residential	162	184	1927	0.444	0.504	0.220
Educational	202	216	2685	0.553	0.592	0.307
Industrial	196	211	1662	0.537	0.578	0.190
Recreational	21	51	914	0.058	0.140	0.104
Medical	1	16	566	0.003	0.044	0.065

Note: Results shown indicate the maximum impact within each receptor category.

Table 129 Number of exceedances and probability of occurrence – Scenario E4

Receptor ID	Number of additional exceedances of the criterion			Probability that an exceedance is predicted in one year		
	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2
Scenario E4 - 1 feeder outage - 199 generators of 522 operational						
Residential	102	144	1268	0.279	0.395	0.145
Educational	176	205	1478	0.482	0.562	0.169
Industrial	155	185	1084	0.425	0.507	0.124
Recreational	1	10	639	0.003	0.027	0.073
Medical	1	1	327	0.003	0.003	0.037
Scenario E4 - 2 feeder outage - 392 generators of 522 operational						
Residential	148	177	1907	0.405	0.485	0.218
Educational	212	227	2698	0.581	0.622	0.308
Industrial	189	216	1825	0.518	0.592	0.208
Recreational	21	49	932	0.058	0.134	0.106
Medical	1	14	555	0.003	0.038	0.063
Scenario E4 - 3 feeder outage - 522 generators of 522 operational						
Residential	166	186	2097	0.455	0.510	0.239
Educational	217	235	3109	0.595	0.644	0.355
Industrial	204	223	2126	0.559	0.611	0.243
Recreational	39	69	1047	0.107	0.189	0.120
Medical	4	26	653	0.011	0.071	0.075

Note: Results shown indicate the maximum impact within each receptor category.

Table 130 Number of exceedances and probability of occurrence – Scenario E5

Receptor ID	Number of additional exceedances of the criterion			Probability that an exceedance is predicted in one year		
	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2
Scenario E5 - 1 feeder outage - 199 generators of 684 operational						
Residential	116	157	1639	0.318	0.430	0.187
Educational	181	210	1679	0.496	0.575	0.192
Industrial	136	181	1591	0.373	0.496	0.182
Recreational	1	18	748	0.003	0.049	0.085
Medical	1	1	377	0.003	0.003	0.043
Scenario E5 - 2 feeder outage - 472 generators of 684 operational						
Residential	173	192	2537	0.474	0.526	0.290
Educational	219	233	3184	0.600	0.638	0.363
Industrial	194	221	2401	0.532	0.605	0.274
Recreational	44	77	1124	0.121	0.211	0.128
Medical	4	27	694	0.011	0.074	0.079
Scenario E5 - 3 feeder outage - 684 generators of 684 operational						
Residential	185	204	2737	0.507	0.559	0.312
Educational	228	240	3675	0.625	0.658	0.420
Industrial	211	224	2633	0.578	0.614	0.301
Recreational	64	94	1267	0.175	0.258	0.145
Medical	18	39	823	0.049	0.107	0.094

Note: Results shown indicate the maximum impact within each receptor category.

Table 131 Number of exceedances and probability of occurrence – Scenario E6

Receptor ID	Number of additional exceedances of the criterion			Probability that an exceedance is predicted in one year		
	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2	24-hour PM_{10}	24-hour $PM_{2.5}$	1-hour NO_2
Scenario E6 - 1 feeder outage - 281 generators of 846 operational						
Residential	131	164	1728	0.359	0.449	0.197
Educational	192	216	1803	0.526	0.592	0.206
Industrial	154	184	1757	0.422	0.504	0.201
Recreational	5	25	790	0.014	0.068	0.090
Medical	1	2	424	0.003	0.005	0.048
Scenario E6 - 2 feeder outage - 554 generators of 846 operational						
Residential	169	190	2465	0.463	0.521	0.281
Educational	218	232	2992	0.597	0.636	0.342
Industrial	189	216	2356	0.518	0.592	0.269
Recreational	41	72	1094	0.112	0.197	0.125
Medical	3	23	670	0.008	0.063	0.076
Scenario E6 - 3 feeder outage - 846 generators of 846 operational						
Residential	185	204	2692	0.507	0.559	0.307
Educational	228	240	3313	0.625	0.658	0.378
Industrial	211	224	2656	0.578	0.614	0.303
Recreational	64	94	1261	0.175	0.258	0.144
Medical	18	39	813	0.049	0.107	0.093

Note: Results shown indicate the maximum impact within each receptor category.

8.2. Scenarios M1 to M6 – Maintenance Testing

Presented below are the results of the modelling assessment under the assumptions of Scenarios M1 to M6 (refer Section 5.2) with either 4 (Phase 1) or 6 (Phases 2 to 6) generators operating at a conservative 100 % load for each specified testing hour. It is noted that the likely maintenance scenario involves generators operating simultaneously during daytime hours (7:00 am to 6:00 pm).

As discussed in Section 5.2.2, annual average incremental predictions may be weighted by actual operating hours over those modelled to account for annual average emission loads. In this instance, that scaling has been performed assuming a testing schedule of 200 hours per year, and the results associated with annual average impacts are therefore conservative as the actual hours of maintenance testing would be anticipated to be <200 hours.

A contemporaneous analysis of the 24-hour PM_{10} and $PM_{2.5}$ data has been performed where each predicted incremental concentration is added to the corresponding monitored background concentration, in accordance with Section 11.2.3(b) of the Approved Methods. In addition, the contribution of other data centres in the area has been considered (refer Section 5.5.2.2). PM_{10} and $PM_{2.5}$ results are presented for those receptors at which the greatest impacts have been predicted.

The right side of the contemporaneous PM_{10} and $PM_{2.5}$ tables show the predicted maximum cumulative impacts (typically the days with the highest regional background), and the left side shows the total predicted concentration on days with the highest predicted incremental concentrations respectively. Discussion of the results is presented in Section 9.2.2.

8.2.1. Scenario M1

Results for the proposed generator testing under Scenario M1 are presented below. Only results for those pollutants with impacts predicted to result in impact significance of either moderate or substantial are presented below. The remainder of the results are presented in Appendix H.

Results indicate that the Proposal can be operated under Scenario M1 without resulting in any exceedances of the relevant air quality criteria. One exceedance of the PM_{10} and $PM_{2.5}$ criteria are already identified in the regional particulate dataset adopted, which reflects an exceedance which would occur without the Proposal being operational. The assessment confirm that the Proposal would not contribute additional exceedances under Scenario M1.

Table 132 Maximum 1-hour average NO_2 concentrations – Scenario M1

Receptor category	Maximum 1-hour average NO2 concentration (µg·m^{-3})			
	Maximum incremental impact	Background (regional)	Background (other DC)	Cumulative
Criterion	164			
Max % of criterion	24.4 %	6.3 %	3.8 %	28.7 %
Residential	32.0	< 0.1	0.5	32.5
Educational	26.0	10.3	< 0.1	36.2
Industrial	40.0	4.1	3.0	47.1
Recreational	23.0	2.1	6.3	31.3
Medical	23.7	2.1	< 0.1	25.8
Receptor category	**Incremental impact**	**Background (regional)**	**Background (other DC)**	**Maximum cumulative impact**
Criterion	164			
Max % of criterion	9.8 %	41.3 %	67.5 %	75.0 %
Residential	< 0.1	10.3	80.5	90.7
Educational	< 0.1	12.3	101.1	113.4
Industrial	16.0	12.3	55.3	83.6
Recreational	< 0.1	12.3	110.7	123.0
Medical	< 0.1	67.7	2.2	69.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 133 Maximum 24-hour average incremental particulate matter concentrations – Scenario M1

Receptor category	Maximum 24-hour average concentration (µg·m^{-3})	
	PM_{10}	$PM_{2.5}$
Criterion	50	
Max % of criterion	6.3 %	12.5 %
Residential	1.7	1.7
Educational	2.1	2.1
Industrial	3.1	3.1
Recreational	< 0.1	0.4
Medical	< 0.1	0.1

Note: Results shown indicate the maximum impact within each receptor category.

The results presented in Table 134 and Table 135 reflect the maximum impacted receptors across all categories.

Table 134 Maximum 24-hour average PM_{10} concentrations – Scenario M1

Receptor 14	24-hour average PM_{10} concentration (ug·m^{-3})				Receptor 10	24-hour average PM_{10} concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
15/07/21	3.1	9.9	< 0.1	13.0	04/05/21	0.8	54.9	< 0.1	55.7
20/04/21	3.1	46.2	< 0.1	49.3	20/04/21	< 0.1	46.2	< 0.1	46.2
26/01/21	2.5	23.9	< 0.1	26.4	28/10/21	< 0.1	36.6	< 0.1	36.6
22/01/21	2.4	31.4	< 0.1	33.8	29/04/21	0.2	36.0	< 0.1	36.3
25/06/21	2.2	7.9	< 0.1	10.1	02/09/21	< 0.1	36.0	0.1	36.1
18/10/21	2.0	16.5	< 0.1	18.5	18/01/21	< 0.1	35.8	< 0.1	35.8
11/09/21	2.0	22.1	< 0.1	24.1	27/04/21	0.3	35.4	< 0.1	35.7
09/10/21	2.0	23.8	< 0.1	25.8	10/09/21	< 0.1	35.5	< 0.1	35.6
19/09/21	1.8	9.7	< 0.1	11.5	21/08/21	< 0.1	34.6	< 0.1	34.6
20/08/21	1.8	34.1	< 0.1	35.9	02/03/21	0.4	33.8	< 0.1	34.2

Table 135 Maximum 24-hour average $PM_{2.5}$ concentrations – Scenario M1

Receptor 14	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})				Receptor 10	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
15/07/21	3.1	3.5	< 0.1	6.6	04/05/21	0.8	40.3	< 0.1	41.1
20/04/21	3.1	10.5	< 0.1	13.6	29/04/21	0.2	21.8	< 0.1	22.1
26/01/21	2.5	9.3	< 0.1	11.8	23/04/21	< 0.1	19.5	< 0.1	19.5
22/01/21	2.4	11.7	< 0.1	14.1	20/08/21	< 0.1	19.2	< 0.1	19.2
25/06/21	2.2	4.6	< 0.1	6.8	10/10/21	0.1	16.9	< 0.1	17.0
18/10/21	2.0	5.0	< 0.1	7.0	15/08/21	< 0.1	16.1	< 0.1	16.1
11/09/21	2.0	5.3	< 0.1	7.3	03/05/21	< 0.1	14.9	< 0.1	15.0
09/10/21	2.0	8.0	< 0.1	10.0	23/08/21	< 0.1	14.7	< 0.1	14.7
19/09/21	1.8	2.8	< 0.1	4.6	14/08/21	0.3	14.3	< 0.1	14.6
20/08/21	1.8	19.2	< 0.1	21.0	19/01/21	0.8	13.8	< 0.1	14.6

8.2.2. Scenario M2

Results for the proposed generator testing under Scenario M2 are presented below. Only results for those pollutants with a predicted moderate or substantial impact significance are presented below. The remainder of the results are presented in Appendix H.

Results indicate that the operation of the Proposal under Scenario M2 would not cause exceedances of the relevant air quality criteria. One exceedance of the PM_{10} and $PM_{2.5}$ criteria are already identified in the regional particulate dataset adopted, which reflects an exceedance which would occur without the Proposal being operational. The assessment confirm that the Proposal would not contribute additional exceedances for Scenario M2.

Table 136 Maximum 1-hour average NO_2 concentrations – Scenario M2

Receptor category	Annual average NO2 concentration (µg·m^{-3})			
	Incremental impact	Background (regional)	Background (other DC)	Cumulative impact
Criterion	31			
Max % of criterion	2.6 %	26.7 %	2.1 %	30.9 %
Residential	0.7	8.3	0.5	9.5
Educational	0.8	8.3	0.5	9.6
Industrial	0.6	8.3	0.4	9.2
Recreational	0.2	8.3	0.7	9.2
Medical	0.2	8.3	0.4	8.8

Note: Results shown indicate the maximum impact within each receptor category.

Table 137 Maximum 24-hour average incremental particulate matter concentrations – Scenario M2

Receptor category	Maximum 24-hour average concentration (µg·m^{-3})	
	PM_{10}	$PM_{2.5}$
Criterion	50	
Max % of criterion	7.4 %	14.8 %
Residential	2.0	2.0
Educational	2.8	2.8
Industrial	3.7	3.7
Recreational	< 0.1	0.5
Medical	< 0.1	0.2

Note: Results shown indicate the maximum impact within each receptor category.

The results presented in Table 138 and Table 139 reflect the maximum impacted receptors across all categories.

Table 138 Maximum 24-hour average PM_{10} concentrations – Scenario M2

Receptor 14	24-hour average PM_{10} concentration ($ug \cdot m^{-3}$)				Receptor 1	24-hour average PM_{10} concentration ($ug \cdot m^{-3}$)			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.7	23.9	< 0.1	27.6	04/05/21	1.3	54.9	< 0.1	56.2
15/07/21	3.5	9.9	< 0.1	13.4	20/04/21	< 0.1	46.2	< 0.1	46.2
24/01/21	3.3	25.4	< 0.1	28.8	29/04/21	0.8	36.0	< 0.1	36.8
22/01/21	3.2	31.4	< 0.1	34.6	28/10/21	< 0.1	36.6	< 0.1	36.7
20/04/21	3.2	46.2	< 0.1	49.4	02/09/21	< 0.1	36.0	0.1	36.1
18/10/21	3.0	16.5	< 0.1	19.5	27/04/21	0.7	35.4	< 0.1	36.1
25/06/21	2.8	7.9	< 0.1	10.7	18/01/21	0.2	35.8	< 0.1	36.0
11/09/21	2.5	22.1	< 0.1	24.7	10/09/21	0.4	35.5	< 0.1	35.9
25/02/21	2.5	16.4	< 0.1	19.0	02/03/21	0.8	33.8	< 0.1	34.6
14/01/21	2.5	29.5	< 0.1	32.0	21/08/21	< 0.1	34.6	< 0.1	34.6

Table 139 Maximum 24-hour average $PM_{2.5}$ concentrations – Scenario M2

Receptor 14	24-hour average $PM_{2.5}$ concentration ($ug \cdot m^{-3}$)				Receptor 1	24-hour average $PM_{2.5}$ concentration ($ug \cdot m^{-3}$)			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.7	9.3	< 0.1	13.0	04/05/21	1.3	40.3	< 0.1	41.6
15/07/21	3.5	3.5	< 0.1	7.0	29/04/21	0.8	21.8	< 0.1	22.6
24/01/21	3.3	10.2	< 0.1	13.6	23/04/21	< 0.1	19.5	< 0.1	19.6
22/01/21	3.2	11.7	< 0.1	14.9	20/08/21	< 0.1	19.2	< 0.1	19.2
20/04/21	3.2	10.5	< 0.1	13.7	10/10/21	0.2	16.9	< 0.1	17.1
18/10/21	3.0	5.0	< 0.1	8.0	15/08/21	0.2	16.1	< 0.1	16.3
25/06/21	2.8	4.6	< 0.1	7.4	14/08/21	0.7	14.3	< 0.1	15.1
11/09/21	2.5	5.3	< 0.1	7.9	03/05/21	< 0.1	14.9	< 0.1	15.0
25/02/21	2.5	6.1	< 0.1	8.7	19/01/21	1.1	13.8	< 0.1	14.9
14/01/21	2.5	9.5	< 0.1	12.0	23/08/21	< 0.1	14.7	< 0.1	14.7

8.2.3. Scenario M3

Results for the proposed generator testing under Scenario M3 are presented below. Only results for those pollutants with predicted impacts corresponding to either a moderate or substantial impact significance are presented below. The remainder of the results are presented in Appendix H.

Results indicate that operation of the Proposal under Scenario M3 would not cause exceedances of relevant air quality criteria. One PM_{10} and $PM_{2.5}$ exceedance is present in the regional dataset, reflecting background conditions without the Proposal. The assessment confirms that the Proposal would not contribute additional exceedances for Scenario M3.

Table 140 Maximum 1-hour average NO_2 concentrations – Scenario M3

Receptor category	Maximum 1-hour average NO2 concentration (µg·m^{-3})			
	Maximum incremental impact	Background (regional)	Background (other DC)	Cumulative
Criterion	164			
Max % of criterion	36.0 %	17.5 %	0.2 %	52.2 %
Residential	56.9	28.7	< 0.1	85.7
Educational	53.7	4.1	< 0.1	57.9
Industrial	59.1	4.1	0.3	63.5
Recreational	56.5	28.7	< 0.1	85.2
Medical	36.2	2.1	< 0.1	38.2
Receptor category	**Incremental impact**	**Background (regional)**	**Background (other DC)**	**Maximum cumulative impact**
Criterion	164			
Max % of criterion	17.4 %	41.3 %	67.5 %	75.0 %
Residential	< 0.1	10.3	80.5	90.7
Educational	< 0.1	12.3	101.1	113.4
Industrial	28.5	12.3	55.3	96.1
Recreational	< 0.1	12.3	110.7	123.0
Medical	< 0.1	67.7	2.2	69.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 141 Maximum 24-hour average incremental particulate matter concentrations – Scenario M3

Receptor category	Maximum 24-hour average concentration (µg·m^{-3})	
	PM_{10}	$PM_{2.5}$
Criterion	50	
Max % of criterion	6.3 %	12.6 %
Residential	1.9	1.9
Educational	2.5	2.5
Industrial	3.2	3.2
Recreational	< 0.1	0.5
Medical	< 0.1	0.2

Note: Results shown indicate the maximum impact within each receptor category.

The results presented in Table 142 and Table 143 reflect the maximum impacted receptors across all categories.

Table 142 Maximum 24-hour average PM_{10} concentrations – Scenario M3

Receptor 14	24-hour average PM_{10} concentration ($ug \cdot m^{-3}$)				Receptor 1	24-hour average PM_{10} concentration ($ug \cdot m^{-3}$)			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	23.9	< 0.1	27.1	04/05/21	1.2	54.9	< 0.1	56.2
15/07/21	3.0	9.9	< 0.1	12.9	20/04/21	< 0.1	46.2	< 0.1	46.2
20/04/21	2.7	46.2	< 0.1	48.9	29/04/21	0.7	36.0	< 0.1	36.8
24/01/21	2.5	25.4	< 0.1	27.9	28/10/21	< 0.1	36.6	< 0.1	36.7
22/01/21	2.5	31.4	< 0.1	33.9	02/09/21	< 0.1	36.0	0.1	36.1
25/06/21	2.5	7.9	< 0.1	10.4	27/04/21	0.6	35.4	< 0.1	36.0
18/10/21	2.3	16.5	< 0.1	18.8	18/01/21	0.2	35.8	< 0.1	36.0
11/09/21	2.1	22.1	< 0.1	24.2	10/09/21	0.4	35.5	< 0.1	35.9
19/09/21	2.0	9.7	< 0.1	11.7	02/03/21	0.8	33.8	< 0.1	34.6
20/08/21	1.9	34.1	< 0.1	36.0	21/08/21	< 0.1	34.6	< 0.1	34.6

Table 143 Maximum 24-hour average $PM_{2.5}$ concentrations – Scenario M3

Receptor 14	24-hour average $PM_{2.5}$ concentration ($ug \cdot m^{-3}$)				Receptor 1	24-hour average $PM_{2.5}$ concentration ($ug \cdot m^{-3}$)			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	9.3	< 0.1	12.5	04/05/21	1.2	40.3	< 0.1	41.6
15/07/21	3.0	3.5	< 0.1	6.5	29/04/21	0.7	21.8	< 0.1	22.6
20/04/21	2.7	10.5	< 0.1	13.2	23/04/21	< 0.1	19.5	< 0.1	19.6
24/01/21	2.5	10.2	< 0.1	12.7	20/08/21	< 0.1	19.2	< 0.1	19.2
22/01/21	2.5	11.7	< 0.1	14.2	10/10/21	0.2	16.9	< 0.1	17.1
25/06/21	2.5	4.6	< 0.1	7.1	15/08/21	0.1	16.1	< 0.1	16.2
18/10/21	2.3	5.0	< 0.1	7.3	14/08/21	0.7	14.3	< 0.1	15.1
11/09/21	2.1	5.3	< 0.1	7.4	03/05/21	< 0.1	14.9	< 0.1	15.0
19/09/21	2.0	2.8	< 0.1	4.8	19/01/21	1.1	13.8	< 0.1	14.9
20/08/21	1.9	19.2	< 0.1	21.1	23/08/21	< 0.1	14.7	< 0.1	14.7

8.2.4. Scenario M4

Results for the proposed generator testing under Scenario M4 are presented below. Only results for those pollutants with impacts predicted to result in a moderate or substantial impact significance are presented below. The remainder of the results are presented in Appendix H.

Results indicate that the Proposal can be operated under this scenario without resulting in any exceedances of the relevant air quality criteria. One exceedance of the PM_{10} and $PM_{2.5}$ criteria are already identified in the regional particulate dataset adopted, which reflects an exceedance which would occur without the Proposal being operational. The assessment confirm that the Proposal can be operated to result in no additional exceedances of the relevant air quality criteria under this scenario.

Table 144 Maximum 1-hour average NO_2 concentrations – Scenario M4

Receptor category	Maximum 1-hour average NO2 concentration (µg·m^{-3})			
	Maximum incremental impact	Background (regional)	Background (other DC)	Cumulative
Criterion	164			
Max % of criterion	39.0 %	17.5 %	3.6 %	51.7 %
Residential	56.1	28.7	< 0.1	84.8
Educational	62.1	4.1	5.9	72.1
Industrial	64.0	4.1	0.3	68.4
Recreational	55.6	28.7	< 0.1	84.3
Medical	36.2	2.1	< 0.1	38.2
Receptor category	**Incremental impact**	**Background (regional)**	**Background (other DC)**	**Maximum cumulative impact**
Criterion	164			
Max % of criterion	17.4 %	41.3 %	67.5 %	75.0 %
Residential	< 0.1	10.3	80.5	90.7
Educational	< 0.1	12.3	101.1	113.4
Industrial	28.5	12.3	55.3	96.1
Recreational	< 0.1	12.3	110.7	123.0
Medical	< 0.1	67.7	2.2	69.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 145 Maximum 24-hour average incremental particulate matter concentrations – Scenario M4

Receptor category	Maximum 24-hour average concentration (µg·m^{-3})	
	PM_{10}	$PM_{2.5}$
Criterion	50	
Max % of criterion	6.3 %	12.6 %
Residential	1.9	1.9
Educational	2.5	2.5
Industrial	3.2	3.2
Recreational	< 0.1	0.5
Medical	< 0.1	0.2

Note: Results shown indicate the maximum impact within each receptor category.

The results presented in Table 146 and Table 147 reflect the maximum impacted receptors across all categories.

Table 146 Maximum 24-hour average PM_{10} concentrations – Scenario M4

Receptor 14	24-hour average PM_{10} concentration (ug·m^{-3})				Receptor 4	24-hour average PM_{10} concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	23.9	< 0.1	27.1	04/05/21	1.4	54.9	< 0.1	56.3
15/07/21	3.0	9.9	< 0.1	12.9	20/04/21	< 0.1	46.2	< 0.1	46.2
20/04/21	2.7	46.2	< 0.1	48.9	29/04/21	0.8	36.0	< 0.1	36.9
24/01/21	2.5	25.4	< 0.1	27.9	28/10/21	< 0.1	36.6	0.1	36.8
22/01/21	2.5	31.4	< 0.1	33.9	27/04/21	0.8	35.4	< 0.1	36.2
25/06/21	2.5	7.9	< 0.1	10.4	02/09/21	< 0.1	36.0	0.1	36.1
18/10/21	2.3	16.5	< 0.1	18.8	18/01/21	0.2	35.8	< 0.1	36.0
11/09/21	2.1	22.1	< 0.1	24.2	10/09/21	0.4	35.5	< 0.1	35.9
19/09/21	2.0	9.7	< 0.1	11.7	02/03/21	1.0	33.8	< 0.1	34.8
20/08/21	1.9	34.1	< 0.1	36.0	21/08/21	< 0.1	34.6	< 0.1	34.6

Table 147 Maximum 24-hour average $PM_{2.5}$ concentrations – Scenario M4

Receptor 14	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})				Receptor 4	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	9.3	< 0.1	12.5	04/05/21	1.4	40.3	< 0.1	41.7
15/07/21	3.0	3.5	< 0.1	6.5	29/04/21	0.8	21.8	< 0.1	22.7
20/04/21	2.7	10.5	< 0.1	13.2	23/04/21	< 0.1	19.5	< 0.1	19.6
24/01/21	2.5	10.2	< 0.1	12.7	20/08/21	< 0.1	19.2	< 0.1	19.3
22/01/21	2.5	11.7	< 0.1	14.2	10/10/21	0.2	16.9	< 0.1	17.2
25/06/21	2.5	4.6	< 0.1	7.1	15/08/21	0.2	16.1	< 0.1	16.3
18/10/21	2.3	5.0	< 0.1	7.3	14/08/21	0.9	14.3	0.1	15.3
11/09/21	2.1	5.3	< 0.1	7.4	19/01/21	1.4	13.8	< 0.1	15.2
19/09/21	2.0	2.8	< 0.1	4.8	03/05/21	< 0.1	14.9	0.2	15.1
20/08/21	1.9	19.2	< 0.1	21.1	23/08/21	< 0.1	14.7	< 0.1	14.8

8.2.5. Scenario M5

Results for the proposed generator testing under Scenario M5 are presented below. Only results for those pollutants with predicted impacts corresponding to either a moderate or substantial impact significance are presented below. The remainder of the results are presented in Appendix H.

Results indicate that operation of the Proposal under Scenario M5 would not cause any exceedances of the relevant air quality criteria. One exceedance of the PM_{10} and $PM_{2.5}$ criteria are already identified in the regional particulate dataset adopted, which reflects an exceedance which would occur without the Proposal being operational. The assessment under Scenario M5 confirms that the Proposal would not contribute additional exceedances.

Table 148 Maximum 1-hour average NO_2 concentrations – Scenario M5

Receptor category	Maximum 1-hour average NO2 concentration ($\mu g \cdot m^{-3}$)			
	Maximum incremental impact	Background (regional)	Background (other DC)	Cumulative
Criterion	164			
Max % of criterion	39.0 %	17.5 %	3.6 %	51.7 %
Residential	56.1	28.7	< 0.1	84.8
Educational	62.1	4.1	5.9	72.1
Industrial	64.0	4.1	0.3	68.4
Recreational	55.6	28.7	< 0.1	84.3
Medical	36.2	2.1	< 0.1	38.2
Receptor category	**Incremental impact**	**Background (regional)**	**Background (other DC)**	**Maximum cumulative impact**
Criterion	164			
Max % of criterion	17.4 %	41.3 %	67.5 %	75.0 %
Residential	< 0.1	10.3	80.5	90.7
Educational	< 0.1	12.3	101.1	113.4
Industrial	28.5	12.3	55.3	96.1
Recreational	< 0.1	12.3	110.7	123.0
Medical	< 0.1	67.7	2.2	69.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 149 Maximum 24-hour average incremental particulate matter concentrations – Scenario M5

Receptor category	Maximum 24-hour average concentration ($\mu g \cdot m^{-3}$)	
	PM_{10}	$PM_{2.5}$
Criterion	50	
Max % of criterion	6.3 %	12.6 %
Residential	1.9	1.9
Educational	2.5	2.5
Industrial	3.2	3.2
Recreational	< 0.1	0.5
Medical	< 0.1	0.2

Note: Results shown indicate the maximum impact within each receptor category.

Table 150 Maximum 24-hour average PM_{10} concentrations – Scenario M5

Receptor 14	24-hour average PM_{10} concentration (ug·m^{-3})				Receptor 4	24-hour average PM_{10} concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	23.9	< 0.1	27.1	04/05/21	1.4	54.9	< 0.1	56.3
15/07/21	3.0	9.9	< 0.1	12.9	20/04/21	< 0.1	46.2	< 0.1	46.2
20/04/21	2.7	46.2	< 0.1	48.9	29/04/21	0.8	36.0	< 0.1	36.9
24/01/21	2.5	25.4	< 0.1	27.9	28/10/21	< 0.1	36.6	0.1	36.8
22/01/21	2.5	31.4	< 0.1	33.9	27/04/21	0.8	35.4	< 0.1	36.2
25/06/21	2.5	7.9	< 0.1	10.4	02/09/21	< 0.1	36.0	0.1	36.1
18/10/21	2.3	16.5	< 0.1	18.8	18/01/21	0.2	35.8	< 0.1	36.0
11/09/21	2.1	22.1	< 0.1	24.2	10/09/21	0.4	35.5	< 0.1	35.9
19/09/21	2.0	9.7	< 0.1	11.7	02/03/21	1.0	33.8	< 0.1	34.8
20/08/21	1.9	34.1	< 0.1	36.0	21/08/21	< 0.1	34.6	< 0.1	34.6

Table 151 Maximum 24-hour average $PM_{2.5}$ concentrations – Scenario M5

Receptor 14	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})				Receptor 4	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	9.3	< 0.1	12.5	04/05/21	1.4	40.3	< 0.1	41.7
15/07/21	3.0	3.5	< 0.1	6.5	29/04/21	0.8	21.8	< 0.1	22.7
20/04/21	2.7	10.5	< 0.1	13.2	23/04/21	< 0.1	19.5	< 0.1	19.6
24/01/21	2.5	10.2	< 0.1	12.7	20/08/21	< 0.1	19.2	< 0.1	19.3
22/01/21	2.5	11.7	< 0.1	14.2	10/10/21	0.2	16.9	< 0.1	17.2
25/06/21	2.5	4.6	< 0.1	7.1	15/08/21	0.2	16.1	< 0.1	16.3
18/10/21	2.3	5.0	< 0.1	7.3	14/08/21	0.9	14.3	0.1	15.3
11/09/21	2.1	5.3	< 0.1	7.4	19/01/21	1.4	13.8	< 0.1	15.2
19/09/21	2.0	2.8	< 0.1	4.8	03/05/21	< 0.1	14.9	0.2	15.1
20/08/21	1.9	19.2	< 0.1	21.1	23/08/21	< 0.1	14.7	< 0.1	14.8

8.2.6. Scenario M6

Results for the proposed generator testing under Scenario M6 are presented below. Only results for those pollutants with an impact significance of either moderate or substantial are presented below. The remainder of the results are presented in Appendix H.

Results indicate the Proposal can operate under this scenario without exceeding relevant air quality criteria. One PM_{10} and $PM_{2.5}$ exceedance exists in the regional dataset, reflecting background conditions, and the Proposal would not contribute additional exceedances for this scenario.

Table 152 Maximum 1-hour average NO_2 concentrations – Scenario M6

Receptor category	Maximum 1-hour average NO2 concentration ($\mu g \cdot m^{-3}$)			
	Maximum incremental impact	Background (regional)	Background (other DC)	Cumulative
Criterion	164			
Max % of criterion	39.0 %	2.5 %	5.6 %	46.0 %
Residential	60.0	4.1	1.4	65.5
Educational	63.8	4.1	5.9	73.9
Industrial	64.0	4.1	0.3	68.4
Recreational	62.1	4.1	9.2	75.4
Medical	36.2	2.1	< 0.1	38.2
Receptor category	Incremental impact	Background (regional)	Background (other DC)	Maximum cumulative impact
Criterion	164			
Max % of criterion	17.4 %	41.3 %	67.5 %	75.0 %
Residential	< 0.1	10.3	80.5	90.7
Educational	< 0.1	12.3	101.1	113.4
Industrial	28.5	12.3	55.3	96.1
Recreational	< 0.1	12.3	110.7	123.0
Medical	< 0.1	67.7	2.2	69.9

Note: Results shown indicate the maximum impact within each receptor category.

Table 153 Maximum 24-hour average incremental particulate matter concentrations – Scenario M6

Receptor category	Maximum 24-hour average concentration ($\mu g \cdot m^{-3}$)	
	PM_{10}	$PM_{2.5}$
Criterion	50	
Max % of criterion	6.3 %	12.6 %
Residential	1.9	1.9
Educational	2.5	2.5
Industrial	3.2	3.2
Recreational	< 0.1	0.6
Medical	< 0.1	0.2

Note: Results shown indicate the maximum impact within each receptor category.

Table 154 Maximum 24-hour average PM_{10} concentrations – Scenario M6

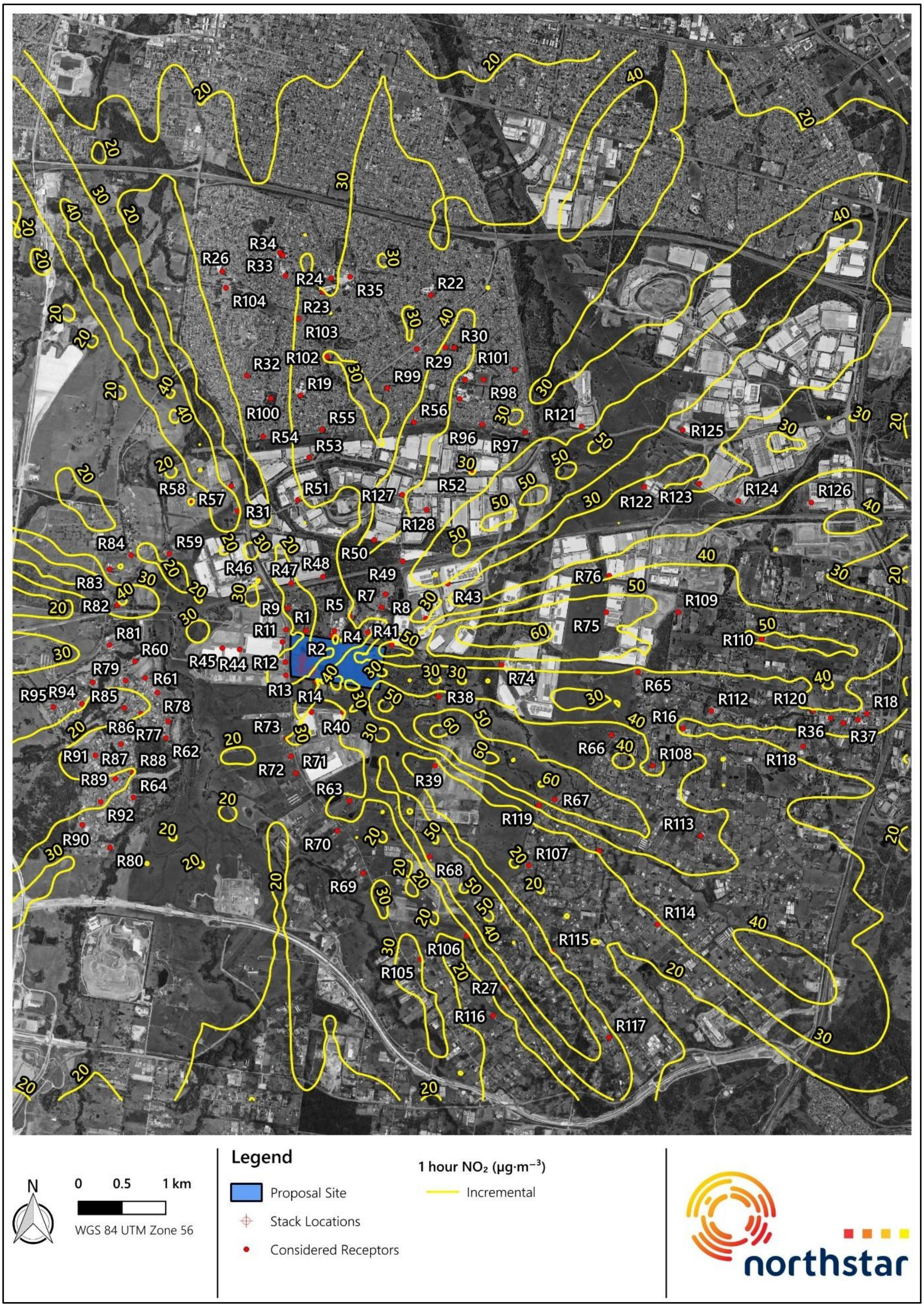
Receptor 14	24-hour average PM_{10} concentration (ug·m^{-3})				Receptor 4	24-hour average PM_{10} concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	23.9	< 0.1	27.1	04/05/21	1.4	54.9	< 0.1	56.3
15/07/21	3.0	9.9	< 0.1	12.9	20/04/21	< 0.1	46.2	< 0.1	46.2
20/04/21	2.7	46.2	< 0.1	48.9	29/04/21	0.8	36.0	< 0.1	36.9
24/01/21	2.5	25.4	< 0.1	27.9	28/10/21	< 0.1	36.6	0.1	36.8
22/01/21	2.5	31.4	< 0.1	33.9	27/04/21	0.8	35.4	< 0.1	36.2
25/06/21	2.5	7.9	< 0.1	10.4	02/09/21	< 0.1	36.0	0.1	36.1
18/10/21	2.3	16.5	< 0.1	18.8	18/01/21	0.2	35.8	< 0.1	36.0
11/09/21	2.1	22.1	< 0.1	24.2	10/09/21	0.4	35.5	< 0.1	35.9
19/09/21	2.0	9.7	< 0.1	11.7	02/03/21	1.0	33.8	< 0.1	34.8
20/08/21	1.9	34.1	< 0.1	36.0	21/08/21	< 0.1	34.6	< 0.1	34.6

Table 155 Maximum 24-hour average $PM_{2.5}$ concentrations – Scenario M6

Receptor 14	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})				Receptor 4	24-hour average $PM_{2.5}$ concentration (ug·m^{-3})			
Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.	Date	Incr.	Bkg. (regional)	Bkg. (other DC)	Cumul.
26/01/21	3.2	9.3	< 0.1	12.5	04/05/21	1.4	40.3	< 0.1	41.7
15/07/21	3.0	3.5	< 0.1	6.5	29/04/21	0.8	21.8	< 0.1	22.7
20/04/21	2.7	10.5	< 0.1	13.2	23/04/21	< 0.1	19.5	< 0.1	19.6
24/01/21	2.5	10.2	< 0.1	12.7	20/08/21	< 0.1	19.2	< 0.1	19.3
22/01/21	2.5	11.7	< 0.1	14.2	10/10/21	0.2	16.9	< 0.1	17.1
25/06/21	2.5	4.6	< 0.1	7.1	15/08/21	0.2	16.1	< 0.1	16.3
18/10/21	2.3	5.0	< 0.1	7.3	14/08/21	0.9	14.3	0.1	15.3
11/09/21	2.1	5.3	< 0.1	7.4	19/01/21	1.3	13.8	< 0.1	15.1
19/09/21	2.0	2.8	< 0.1	4.8	03/05/21	< 0.1	14.9	0.2	15.1
20/08/21	1.9	19.2	< 0.1	21.1	23/08/21	< 0.1	14.7	< 0.1	14.8

Contour plots of predicted impacts under Scenario M6 are presented in Figure 20 (1-hour NO_2) and Figure 21 (24-hour PM_{10} and $PM_{2.5}$).

Figure 20 Predcicted maximum incremental 1-hour NO_2 impacts



Source: Northstar

Figure 21 Predicted maximum incremental 24-hour $PM_{2.5}$ impacts

northstar

Source: Northstar

8.3. Comparison with POEO (Clean Air) Regulation Standards of Concentrations

Section 3.2 outlines the POEO CAR context and the emission standards for scheduled and non-scheduled activities. At ultimate development, the Proposal is envisaged to include:

- 846 standby generators with each rated at (approximately) 2 MW;
- Maintenance testing of up to six (6) generators simultaneously for less than 200 hrs per year; and
- Diesel fuel storage of up to 18 056 kL or circa 15 361 t.

Clause 73, Part 5, Division 6 of the POEO CAR exempts emergency stationary reciprocal internal combustion engines from the respective NO_2 and NO in-stack concentration standards if operated for no more than 200 hours per year.

Based on the maintenance schedule (refer Section 2.3.2.1) and fuel storage capacities (refer Section 2.3.2.2) the Proposal site qualifies as a scheduled chemical storage activity and must comply with the concentration standards in Schedule 2, Part 2 of the POEO CAR (refer Section 3.2), except for NO_2 / NO which are exempt as previously explained.

Table 156 below presents a comparison of the in stack emissions for each individual standby generator to be sited at the Proposal site against the respective POEO CAR schedule 2 concentration standards.

Table 156 POEO CAR – Standards of concentrations comparison

Air impurity	Standard of concentration ($mg \cdot Nm^{-3}$) (A)	Standby generator emissions (per generator) ($mg \cdot Nm^{-3}$)
Solid particles (total)	50	17.7
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	450	Not applicable
Volatile organic compounds (VOCs), as *n*-propane	1 140 $mg \cdot Nm^{-3}$ (A) VOCs *or*	11
	5 880 $mg \cdot Nm^{-3}$ (A) CO	58

Note: (A): Standard of emissions concentration under dry, 273 K, 101.3 kPa, 7 % O_2 conditions

Table 156 shows that the respective concentration standards can be met with the use of the standby diesel generators at the Proposal site.

9. DISCUSSION

This section provides a discussion of the potential air quality impacts associated with the construction and operation of the Proposal. Potential air quality impacts have been assessed with regard to the requirements of relevant legislation, including the POEO Act and POEO CAR, and associated guidance including that published by the NSW EPA.

This discussion summarises the assessment findings, highlighting identified risks and the potential impacts on surrounding receptors and the broader environment.

9.1. Construction Stage Impact Assessment

The construction stage impact assessment for the Proposal, presented in Section 7, indicates that predicted incremental PM impacts at surrounding receptor locations associated with the construction of the Proposal are anticipated to be greater during the Stage 1 construction works than during Stage 2.

The predicted results include the potential impacts associated with earthworks and other construction activities at surrounding land uses, including the relevant contributions from regional background sources.

Additional exceedances of the 24-hour PM_{10} criterion are predicted during Stage 1 construction works at several receptors close to the Proposal site. Whilst these generally occur on days with elevated regional background concentrations, they are not shown to be heavily influenced by surrounding construction activity. No additional exceedances of the 24-hour PM_{10} criterion are predicted at any receptor during Stage 2 construction works.

No additional exceedances of the 24-hour $PM_{2.5}$ criterion are predicted at any receptor during Stage 1 or Stage 2 construction works.

The annual average TSP, $PM_{2.5}$ and dust deposition criteria are all predicted to be achieved at all receptors during both stages of construction works, even accounting for surrounding construction activities in the MRP.

An exceedance of the annual average PM_{10} criterion is predicted at receptors R2 and R4 (educational) during Stage 1 construction works, and at receptors R39 and R41 (industrial) during Stage 2 construction works, reflecting the change in location of those earthworks activities.

Whilst a range of mitigation measures representing best management practice have been applied within the assessment, further management would be required to ensure that exceedances of the relevant air quality criteria do not occur at surrounding receptors. A detailed Construction Air Quality Management Plan (CAQMP), including a Trigger Action Response Plan (TARP) would be implemented as part of the construction works. The CAQMP includes real-time short-term (i.e. 1-hour average) PM_{10} monitoring as part of the TARP and applies a hierarchy of responses to ensure that impacts associated with the construction works are effectively managed. Further detail is provided in the CAQMP provided under separate cover (Northstar, 2025c).

9.2. Operational Phase Impact Assessment

The predicted impacts of operational phase activities under worst-case emergency scenarios (Scenarios E1 to E6) and realistic operational maintenance scenarios (Scenarios M1 to M6) are presented in Section 8.

9.2.1. Scenarios E1 to E6 – Justified Worst-Case

Under the justified worst-case standby generator operational scenario (Scenarios E1 to E6), a number of additional exceedances of the short-term air quality criteria for NO_2, PM_{10} and $PM_{2.5}$ are predicted, as presented in Section 8.1.

Note: care must be applied when assessing 24-hour average impacts as the likely duration of a power outage event is likely to be significantly less than 24-hours, and as such the assessment should be considered to be highly conservative (i.e. relevant to the operation of all back-up generators for an entire 24-hour period).

Six scenarios have been assessed which assume that up to 846 generators would be operational at one time to provide critical IT load and house operations (at ultimate development). The predicted incremental concentrations under Scenarios E1 to E6 show exceedances of particulate matter (as PM_{10} and $PM_{2.5}$) and NO_2 at sensitive receptor locations if a power outage occurred, and the generators operating at a continuous 100 % load (refer Section 8.1).

The Proposal has been designed to incorporate a high level of redundancy, such that a power outage affecting one or two feeders at the site would not result in all generators being required. This assessment has considered the potential impacts under all of these potential feeder outage scenarios.

An assessment of the probability (p) of an exceedance of the relevant short-term criteria has been performed. As a maximum across all receptors and modelled scenarios, the probability of an exceedance of the NO_2, PM_{10} or $PM_{2.5}$ criterion (where p=0 is an impossible event, and p=1 is a certain event) in any year of operation is:

- PM_{10} $p = 0.625$;
- $PM_{2.5}$ $p = 0.658$; and
- NO_2: $p = 0.420$.

To predict the likelihood of exceedances under each emergency scenario (i.e. all generators operating continuously at 100 % load), the reliability of the power network has been considered against the latest information contained in the Endeavour Energy 2024 Distribution Annual Planning Report (DAPR) (Endeavour Energy, 2024).

Based on the DAPR and associated network reliability statistics, the average unplanned outage duration per year per customer over a 10-year period from financial-year 2013 (2013/14) to financial-year 2023 (2023/24) equated to approximately 82.0 minutes, although exact duration of power outages requiring standby generators cannot be determined. Correspondingly, the likelihood of power interruptions occurring is approximately 0.016 % of the time per year (82.0 / (8 760 × 60)) or have a probability of p=0.00016 (expressed as 1.6×10^{-4}).

The corresponding probability of 1, 2 and 3 feeder failure (of any duration) is:

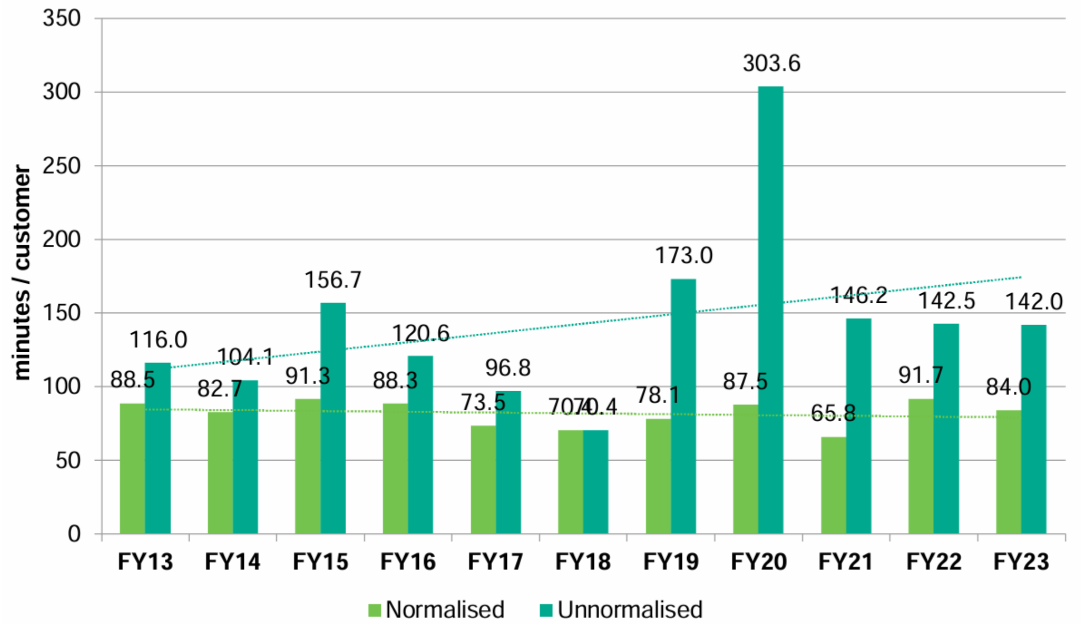
- 1 feeder failure $p=1.6\times10^{-4}$
- 2 feeder failure $p=1.8\times10^{-8}$
- 3 feeder failure $p=1.3\times10^{-8}$

Figure 17 depicts the normalised (i.e. Major Event Days data excluded) system average interruption duration index (SAIDI, in minutes) and unnormalised (i.e. inclusion of all events) SAIDI trends over the 10-year period from financial year 2013/2014 to financial year 2023/2024.

The probability of both the interruption to the power supply, and an exceedance of the relevant air quality criteria occurring can be calculated through the multiplication of the probability of each event occurring. Those values are incredibly small and have been placed into context by calculating the likelihood of an exceedance occurring in a number of years. Table 157 presents the results of those calculations. It presents likelihood as "*an exceedance is likely to occur once every X years*".

The results indicate that the chance of an additional exceedance of the air quality criteria during a power outage is low.

Figure 22 Endeavour Energy SAIDI performance information



Source: (Endeavour Energy, 2024)

Table 157 Likelihood of an exceedance during a power outage

Scenario	Minutes per year power outage	Exceedance likely to occur once every *X* years		
		PM_{10}	$PM_{2.5}$	NO_2
Scenario E1 - 1 feeder outage	1	2,997,563	1,728,324	12,084,661
	82	36,556	21,077	147,374
Scenario E1 - 2 feeder outage	0.013	169,118,678	1,410,618	445,258,966
Scenario E1 - 3 feeder outage	0.007	237,823,140	1,253,882	626,145,422
Scenario E2 - 1 feeder outage	1	1,453,364	1,191,578	4,007,185
	82	17,724	14,531	48,868
Scenario E2 - 2 feeder outage	0.013	123,273,253	114,320,447	251,598,689
Scenario E2 - 3 feeder outage	0.007	173,353,012	160,763,128	353,810,656
Scenario E3 - 1 feeder outage	1	1,296,243	1,054,088	4,636,713
	82	15,808	12,855	56,545
Scenario E3 - 2 feeder outage	0.013	103,874,924	96,072,113	203,278,411
Scenario E3 - 3 feeder outage	0.007	142,458,416	133,225,000	257,221,006
Scenario E4 - 1 feeder outage	1	1,090,023	935,824	3,115,194
	82	13,293	11,412	37,990
Scenario E4 - 2 feeder outage	0.013	96,525,283	90,146,960	182,031,371
Scenario E4 - 3 feeder outage	0.007	132,611,060	122,453,617	222,141,653
Scenario E5 - 1 feeder outage	1	1,059,912	913,543	2,742,261
	82	12,926	11,141	33,442
Scenario E5 - 2 feeder outage	0.013	93,440,000	87,825,579	154,246,432
Scenario E5 - 3 feeder outage	0.007	126,213,158	119,902,500	187,928,816
Scenario E6 - 1 feeder outage	1	999,188	888,167	2,553,664
	82	12,185	10,831	31,142
Scenario E6 - 2 feeder outage	0.013	93,868,624	88,204,138	164,144,599
Scenario E6 - 3 feeder outage	0.007	126,213,158	119,902,500	208,463,145

Note: the most and least likely events are highlighted in the table

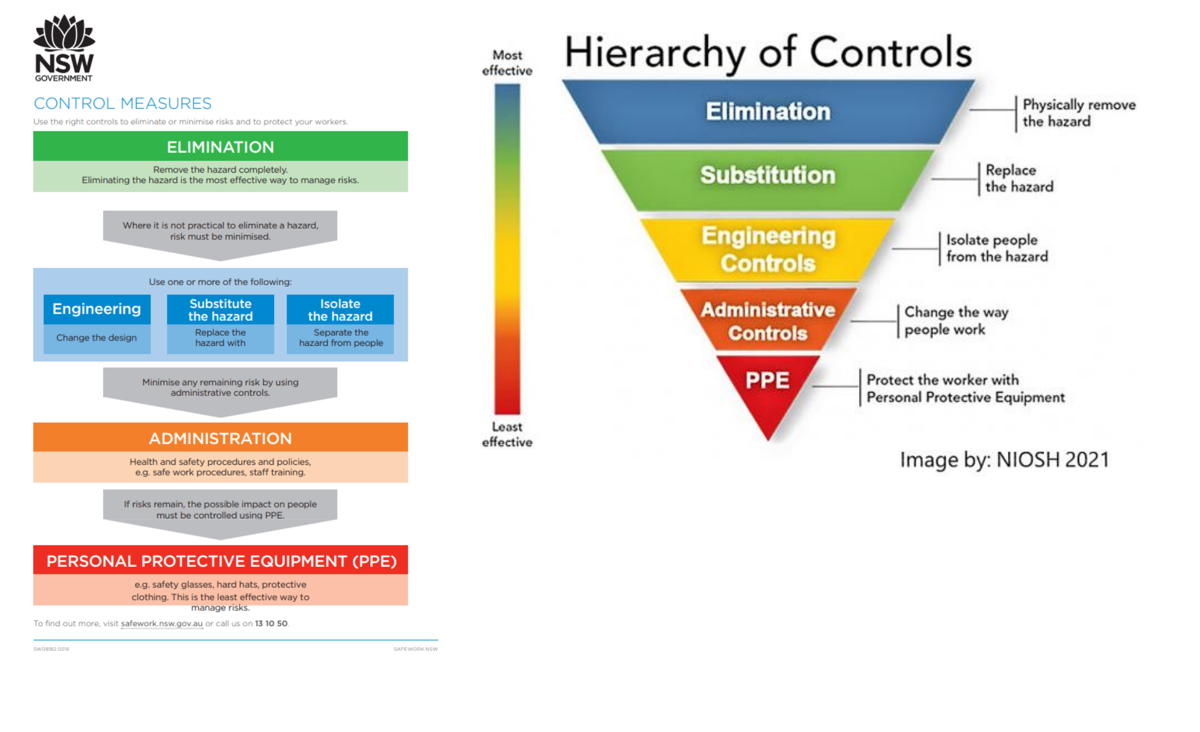
9.2.1.1. Contextualising the Risks

Demonstrably, the probability of concurrent failure of three feeders is very low. The design to include three feeders represents the primary mitigation to manage the risk of air emissions from generator operation during the emergency scenarios. In environmental assessment terms, this is often referred to as "embedded mitigation", where the mitigation is acknowledged from concept design and forms an intrinsic component of the Proposal.

Risk Management Hierarchy

From a risk management perspective, this embedded mitigation can be described in terms of its value within a risk management hierarchy. Two examples of risk management hierarchies, published by the NSW government (WorkSafe NSW) and CDC/NIOSH, are presented in Figure 23 below:

Figure 23 Risk management hierarchies



Source: SafeWork NSW[2], CDC/NIOSH[3],

Figure 23 provides just two examples of the risk management hierarchy, but this is a commonly adopted concept to prioritise risk mitigation to more effective (i.e. higher order) controls[4 5]).

The risk management hierarchy prioritises controls by their effectiveness to control risks, with the most preferable controls described as elimination. EPA Vic describes elimination controls as:

> *"1: Eliminate the hazard and its associated risk*
>
> *This is the most effective option because it eliminates the risk. Look to eliminate the hazard first. If this is not possible, consider substitution or administrative controls."*

It is reasonable to determine that reliance upon three electricity feeders represents a high-order risk control, essentially significantly reducing the probability the risk of air emissions from occurring (refer Table 157).

Due to the fact that the operation of the emergency generators during three feeder outages is technically possible, even if extremely low probability, it cannot be regarded as fully eliminated (i.e. *p*=0).

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2 https://www.safework.nsw.gov.au/__data/assets/pdf_file/0006/446028/hierarchy-of-controls-SW09182.pdf

3 https://www.cdc.gov/niosh/hierarchy-of-controls/about/index.html

4 https://www.epa.vic.gov.au/risk-management-process

5 https://www.aiha.org/blog/the-hierarchy-of-controls-as-a-risk-management-tool

The concept of non-achievable risk probability is common to risk management and is not unique to the Proposal. International Standard IEC 61508 'Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems' (IEC, 2021) provides guidance on this concept:

- Zero risk can never be reached, only probabilities can be reduced.
- Non-tolerable risks must be reduced (ALARP).
- Optimal, cost-effective safety is achieved when addressed in the entire safety lifecycle.

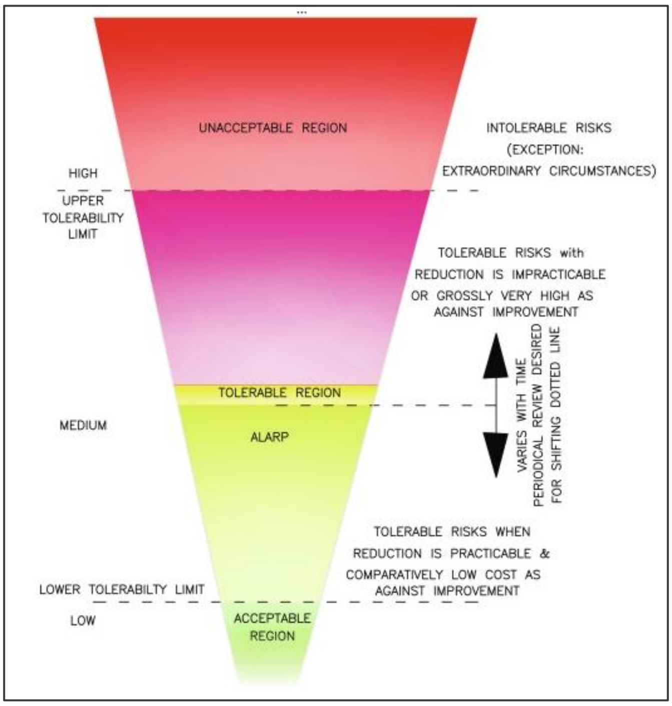
IEC 61508 is a highly relevant document as it is an international standard, subject to rigorous peer review on matters of system integrity and assurance.

To understand how very low probability risks are contextualized, a discussion of As Low As Reasonably Practicable (ALARP) is provided, as referenced in IEC 61508.

ALARP

Chapter 14 of 'The Power Plant Instrumentation and Control Handbook – A Guide to Thermal Power Plants' (Basu S., and Debnath A., 2019) presents an illustration of ALARP in terms of risk acceptability. This is reproduced as Figure 24.

Figure 24 ALARP principles



Source: (Basu S., and Debnath A., 2019)

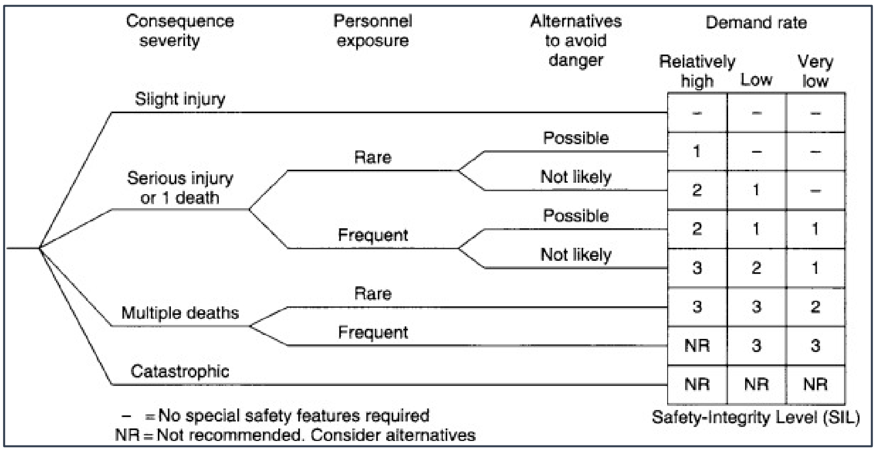
The risk of operation of emergency power generation as a consequence of power failure of three electricity feeders is demonstrably low, but the question is 'how low is ALARP'? To understand how this 'embedded mitigation' benchmarks against ALARP can be determined through the use of Safety Integration Levels (SILs).

Safety Integration is defined as:

> *"the probability of a safety-related system performing the required safety functions under all the stated conditions within a stated period of time."*

The required SIL is also a function of (a) the consequence of failure (i.e. the operation of the generators under emergency power failure) and (b) the rate of demand for that control. Figure 22.1 of (Basu S., and Debnath A., 2019) illustrates these factors to determine the appropriate SIL (rated from SIL1 to SIL4) for power generation safety systems:

Figure 25 Risk graph



Source: (Basu S., and Debnath A., 2019)

Considering the appropriate pathway in Figure 25 the operation of the emergency generators may, in some extreme circumstance, result in an outcome of '*multiple deaths*'.

Note: for clarity, it is not intended, nor should it be interpreted that the risks of emissions from the generator during emergency scenario would result in this outcome. This consequence is considered to be an extreme interpretation provided to contextualise the risk in context of the SIL and ALARP only and is provided as a benchmark applying a high level of conservatism.

Figure 25 determines that the risk of personal exposure would require a SIL of 3 (at a high or low demand rate) or 2 (at a very low demand rate). Given the very low probability of use, a SIL of 2 is considered to be commensurate with that risk.

The relevant probabilities at SILs representing ALARP are published in table 22.1 of (Basu S., and Debnath A., 2019), and these data are reproduced in Table 158.

Table 158 Safety integrity levels

Safety integrity level (SIL)	High demand rate (dangerous failures per year)	Low demand rate (probability of failure on demand)
4 (the 'highest' SIL)	$\geq 10^{-5}$ to 10^{-4}	$\geq 10^{-5}$ to 10^{-4}
3	$\geq 10^{-4}$ to 10^{-3}	$\geq 10^{-4}$ to 10^{-3}
2	$\geq 10^{-3}$ to 10^{-2}	$\geq 10^{-3}$ to 10^{-2}
1 (the 'lowest' SIL)	$\geq 10^{-2}$ to 10^{-1}	$\geq 10^{-2}$ to 10^{-1}

Source: (Basu S., and Debnath A., 2019)

For the emergency scenarios, the probability of electricity supply failure (of any duration) from 1, 2 and 3 feeders is discussed in Section 2.3.2.

- 1 feeder failure $p=1.6\times10^{-4}$ (corresponds to SIL 3)
- 2 feeder failure $p=1.8\times10^{-8}$ (corresponds to SIL 4)
- 3 feeder failure $p=1.3\times10^{-8}$ (corresponds to SIL 4)

It is demonstrated that the safety integrity of 1 no feeder failure equates to a safety integrity level of SIL3, and 2 or 3 no. feeder failures are four orders of magnitude greater than the lower threshold for SIL4 (the most stringent level). As such, the embedded mitigation of multiple feeders offers a risk reduction that comfortably equates to ALARP.

9.2.2. Scenarios M1 to M6 – Maintenance Testing

Annual average particulate matter concentrations (as TSP, PM_{10} and $PM_{2.5}$) resulting from maintenance testing are predicted to comply with the relevant impact assessment criteria, with no exceedances predicted.

No additional exceedances of the cumulative impact assessment criteria for 24-hour PM_{10} and 24-hour $PM_{2.5}$ are predicted as a result of the Proposal. While an exceedance of the 24-hour PM_{10} and $PM_{2.5}$ criteria are identified in Section 8.2, these are attributable to elevated background concentrations that already exceed the respective criteria and are not related to air emissions from the Proposal.

For 1-hour and annual average NO_2, no cumulative exceedances are predicted due to the Proposal. Predicted incremental and cumulative 1-hour NO_2 concentrations remain below the relevant criteria at all considered receptor locations.

Predicted concentrations of CO, SO_2, PAHs, VOCs, and CH_2O across all assessed averaging periods are also below the relevant impact assessment criteria at all receptor locations under Scenarios M1 to M6.

Correspondingly, it is anticipated that under operation of the testing schedule, as outlined in Section 2.3.2, that no significant air quality impacts are predicted to be experienced at sensitive receptors during routine operations.

9.2.3. Odour

Operational phase activities will not result in any odour emissions, except for the periodic operation of the diesel-fuelled generators for testing and back-up power generation purposes, as outlined in Section 2.3.3.

Toluene (C_7H_8) and xylene (C_8H_{10}) emissions have been assessed and compared against the relevant odour impact assessment criteria. No exceedances of the relevant odour criteria are predicted during either emergency or realistic operations.

9.2.4. POEO (Clean Air) Regulation – Standard of Concentrations

Section 8.3 assesses generator emissions against the applicable POEO CAR concentration standards for scheduled activities, demonstrating compliance with the relevant standards of concentration for total solid particles and volatile organic compounds (expressed as CO or TVOC concentrations).

9.3. Cumulative Impacts

Cumulative impacts during the routine operation of the Proposal have been considered in a quantitative manner taking account of the routine operation of surrounding data centres and including regional background concentrations (for PM and NO_2). The inclusion of those surrounding data centres does not result in any cumulative exceedances of the air quality criteria during any of the maintenance scenarios assessed. Based on those findings, impacts associated with other pollutants (e.g. CO, SO_2 etc) are not anticipated to result in any significant cumulative impacts when considering surrounding data centre operations.

9.4. Ozone Formation and Regional Influence

Ground level O_3 is a secondary pollutant formed by photochemical reactions between NO_2 and VOCs in the presence of sunlight. It is a key component of photochemical smog and an indicator of regional air quality. Regional background O_3 concentrations are influenced by precursor emissions, meteorology and regional transport. Precursor sources arise from industrial, transport and biogenic sources including vegetation. Tropospheric O_3 generation is non-linear, with NO_X capable of both promoting and inhibiting O_3 formation depending on the local NO_X to VOC ratio, solar intensity and the degree of atmospheric mixing. Elevated regional O_3 typically develops under warm, stable atmospheric conditions with light winds that limit dispersion and allow precursor accumulation and photochemical reactions over several hours to days.

Section 8 of the Approved Methods notes that photochemical smog, primarily comprised as O_3 and NO_2 is a regional issue within the Greater Metropolitan Region (GMR) of NSW which includes Sydney, the Lower Hunter and the Illawarra. The Approved Methods further states that while large sources of NO_X and VOCs within the

GMR may require detailed photochemical assessment, *"an assessment of impacts of a new source of NO_X and / or VOCs on NO_2 and / or O_3 formation is unlikely to be necessary outside the Greater Metropolitan Region."*

The 'NSW Tiered Procedure for Estimating Ground Level Ozone Impacts from Stationary Sources' (ENVIRON, 2011), as adopted by NSW EPA in 2015 applies to scheduled activities under Schedule 1 of the POEO Act (refer Section 3.1), that emit O_3 precursors (CO, CH_4, NO_X and VOCs) and are located within the GMR as defined in the POEO CAR[6].

Table 41 and table 42 of (ENVIRON, 2011) set emissions thresholds for new or modified sources in O_3 attainment and non-attainment areas. The Proposal site is located in the Sydney region, which is classified as a non-attainment area. This classification is supported by five-year average 1-hour and 4-hour maximums measured at St. Marys AQMS, as presented in table 38 and table 39 of (ENVIRON, 2011) which are 0.114 ppm and 0.097 ppm respectively. The relevant annual NO_X emission threshold is reproduced below:

Table 159 NO_X and VOC emission thresholds for new sources within ozone non-attainment areas

Source type	NO_X / VOC emission rate ($t \cdot yr^{-1}$)
New Source	
Any scheduled activity listed in Schedule 1 of the POEO ACT	> 90

Note: Corresponds to 'all other areas' as per table 42 of (ENVIRON, 2011)

Table 160 compares the calculated NO_X emissions from the Proposal against thresholds for new sources in O_3 non-attainment zones.

Table 160 Comparison of calculated NO_x emissions against regulatory threshold for new sources in ozone (O_3) non-attainment areas

Parameter	Units	Value
Generator operation	$hours \cdot yr^{-1}$	141
Generators per test	$no \cdot hr^{-1}$	6
NO_X emission rate (per generator)	$g \cdot s^{-1}$	8.1
	$kg \cdot hr^{-1}$	175.0
NO_X load (141 $hrs \cdot yr^{-1}$)	$kg \cdot yr^{-1}$	24 669
	$t \cdot yr^{-1}$	**24.7**
Threshold[(a)]	$t \cdot yr^{-1}$	90.0
NO_X load / Threshold	%	27.4

Note: (a): Threshold corresponds to 'all other areas' as per table 42 of (ENVIRON, 2011)

6 Defined as the Greater Metropolitan Area (GMA) meaning: the Sydney Metropolitan Area, and the local government areas of City of Blue Mountains, Central Coast, City of Cessnock, Kiama, City of Lake Macquarie, City of Lithgow, City of Maitland, Mid-Western Regional, Muswellbrook, City of Newcastle, Port Stephens, City of Shellharbour, City of Shoalhaven, Singleton, Wingecarribee, Wollondilly and City of Wollongong.

Emissions from the Proposal are well below the threshold and as such no further O_3 assessment is required, and it is considered that potential ground-level O_3 impacts are not anticipated to be significant.

To provide context, and for benchmarking purposes only, if it is assumed that all 846 generators operating under an emergency operation mode would generate 24.7 $t{\cdot}hr^{-1}$. Accounting for the planned maintenance testing (see Table 8) and an emergency operation of all 846 generators operating at 100 % load, the annual threshold specified in table 3 of (ENVIRON, 2011) would not be exceeded for approximately 2.6 hrs.

9.5. Identified Best Practice

9.5.1. Construction Phase Best Management Practice

Construction phase air quality management is addressed in detail in the CAQMP (Northstar, 2025c).

9.5.2. Operational Phase Best Management Practice

Appendix J (Northstar, 2025b) presents a review of best practice.

9.6. Air Quality Management

9.6.1. Construction Stage Air Quality Management

Construction phase air quality management is addressed in detail in the CAQMP (Northstar, 2025c).

9.6.2. Operational Phase Air Quality Management

Based on the findings of the dispersion modelling assessment under Scenarios M1 to M6, it is considered that the operation of the testing schedule would not result in exceedances being experienced at sensitive receptor locations surrounding the Proposal site. Based upon the assumptions presented in this AQIA, the operation of the Proposal does not necessitate any additional management strategies.

The operation of the Proposal will be performed in accordance with the conditions imposed through the Ministers Conditions of Approval and the EPL.

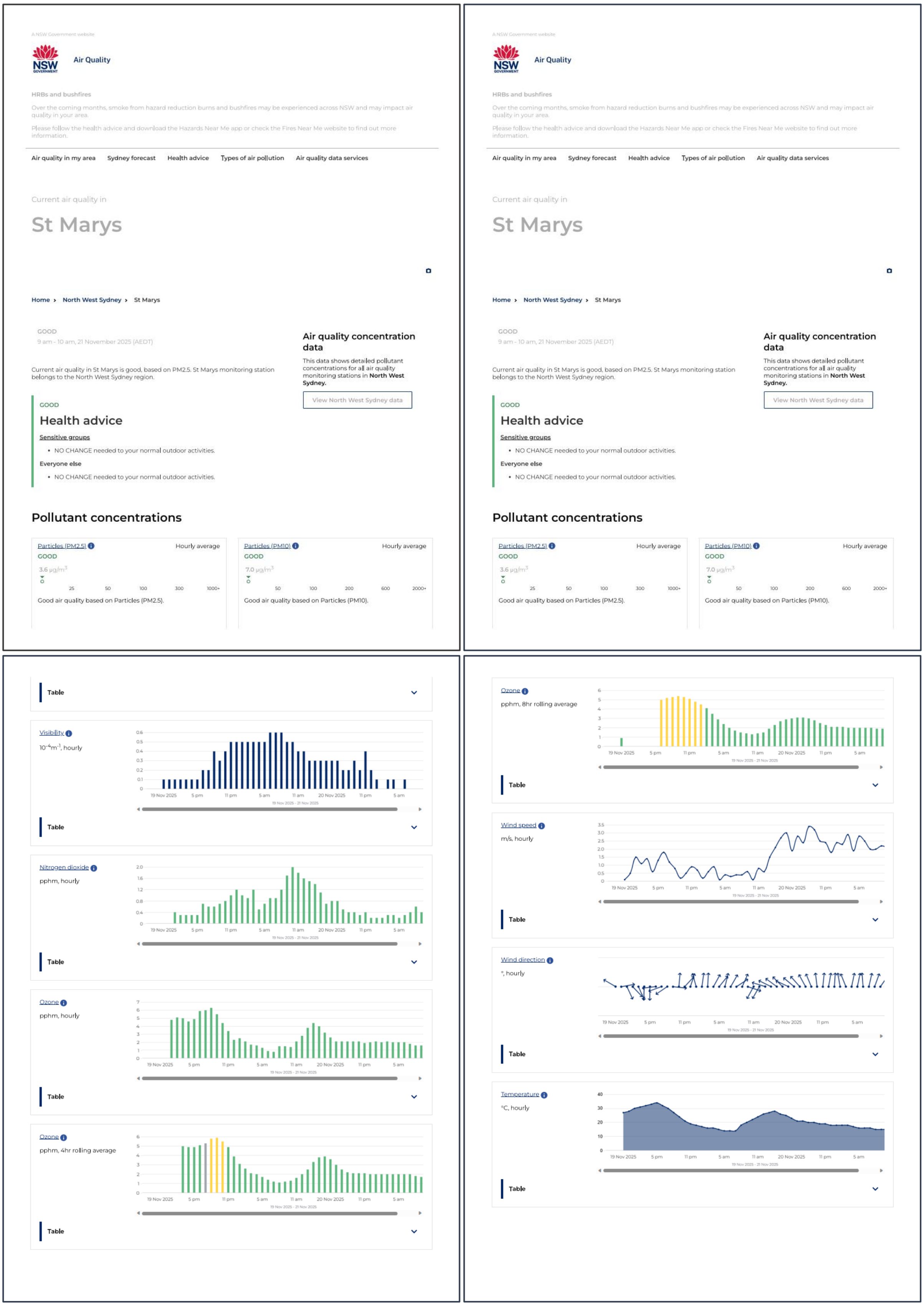
The following operational phase air quality management strategies are recommended:

- The performance of maintenance testing will be performed at times when other proximate data centres are not performing similar maintenance testing. This will involve communication and co-ordination between data centre operators to minimise simultaneous emissions.

- The performance of the maintenance testing will not be performed during periods of elevated background air quality conditions. Reference will be made to the NSW EPA webpage reporting the Air Quality Category (AQC) for St Marys AQMS[7] on the day of planned maintenance testing to determine background conditions. An example of the data for St Marys AQMS, accessed at 11:20 on 21 November 2025 is illustrated in Figure 26.

[7] https://www.airquality.nsw.gov.au/north-west-sydney/st-marys

Figure 26 St Mary's AQMS air quality categories (example)



Source: NSW EPA

10. CONCLUSIONS

This AQIA has been prepared by Northstar on behalf of the Applicant for the proposed construction and operation of the Mamre Road Data Centre Campus, to be located at 706-752 Mamre Road, Kemps Creek NSW.

The assessment evaluates the potential air quality impacts during both construction and operation.

10.1. Construction Phase

The construction phase assessment has been performed quantitatively with a focus on dust soiling and increased ambient PM concentrations due to dust arising from construction activities on the Proposal site.

Additional exceedances of the 24-hour PM_{10} criterion are predicted during Stage 1 construction works at several receptors close to the Proposal site. Whilst these generally occur on days with elevated regional background concentrations, they are not shown to be heavily influenced by surrounding construction activity. No additional exceedances of the 24-hour PM_{10} criterion are predicted at any receptor during Stage 2 construction works.

No additional exceedances of the 24-hour $PM_{2.5}$ criterion are predicted at any receptor during Stage 1 or Stage 2 construction works. The annual average TSP, $PM_{2.5}$ and dust deposition criteria are all predicted to be achieved at all receptors during both stages of construction works, even accounting for surrounding construction activities in the MRP.

An exceedance of the annual average PM_{10} criterion is predicted at receptors R2 and R4 (educational) during Stage 1 construction works, and at receptors R39 and R41 (industrial) during Stage 2 construction works, reflecting the change in location of those earthworks activities.

Whilst a range of mitigation measures representing best management practice have been applied within the assessment, further management would be required to ensure that exceedances of the relevant air quality criteria do not occur at surrounding receptors. A detailed Construction Air Quality Management Plan (CAQMP), including a Trigger Action Response Plan (TARP) would be implemented as part of the construction works. The CAQMP includes real-time short-term (i.e. 1-hour average) PM_{10} monitoring as part of the TARP and applies a hierarchy of responses to ensure that impacts associated with the construction works are effectively managed. Further detail is provided in the CAQMP provided under separate cover (Northstar, 2025c).

10.2. Operational Phase

The operational phase assessment has been performed quantitatively to assess the potential impact of air emissions from the diesel-fuelled generators during a range of routine maintenance testing scenarios and during any emergency operational scenarios.

10.2.1. Justified Worst Case Scenarios

Six scenarios have been assessed which assume that up to 846 generators would be operational at one time to provide critical IT load and house operations (at ultimate development). The predicted incremental concentrations under Scenarios E1 to E6 show exceedances of particulate matter (as PM_{10} and $PM_{2.5}$) and NO_2 at sensitive receptor locations if a power outage occurred, and the generators operating at a continuous 100 % load (refer Section 8.1).

The Proposal has been designed to incorporate a high level of redundancy, such that a power outage affecting one or two feeders at the site would not result in all generators being required. This assessment has considered the potential impacts under all three feeder outage scenarios.

To contextualise this impact, the probability of electricity feeder failure has been estimated, and the probabilities are very low. The estimated frequency of all three feeders failing simultaneously and conditions occurring that would give rise to off-site impacts has been estimated as being once in every 1 253 882 years. To further contextualise the risk, the safety margin created through provision of three electricity feeders has been benchmarked against power-supply industry standard Safety Integrity Intervals (SIL). It is demonstrated that the SIL for the Proposal is orders of magnitude better than would be required to demonstrate that the risk is 'as low as reasonably possible' (ALARP).

10.2.2. Maintenance Testing Scenarios

The AQIA demonstrates that under operation of the proposed routine maintenance testing schedule that no significant air quality impacts are predicted to be experienced at sensitive receptors during routine operations. There are predicted to be no additional exceedances of the NSW EPA air quality criteria for all assessed air pollutants.

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