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NSW GOVERNMENT

M1 Pacific Motorway extension to Raymond Terrace

Environmental impact statement – Chapter 18: Air quality

Transport for NSW | July 2021

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18. Air quality

This chapter describes the potential air quality impacts that may be generated by the construction and operation of the project and presents the approach to the management of these impacts.

The desired performance outcome for the project relating to air quality, as outlined in the SEARs, is to:

- Minimise air quality impacts (including nuisance dust and odour) to reduce risks to human health and the environment to the greatest extent practicable through the design, construction and operation of the project.

Table 18-1 outlines the SEARs that relate to air quality and identifies where they are addressed in this EIS. The full assessment of air quality impacts is provided in the Air Quality Working Paper (**Appendix R**).

Table 18-1 SEARs (air quality)

Secretary's requirement	Where addressed
14. Air quality	
1. The Proponent must undertake an air quality impact assessment (AQIA) for construction and operation of the project in accordance with the current guidelines.	The air quality impact assessment for the project is provided in the Air Quality Working Paper (**Appendix R**). A summary of the working paper is provided in this chapter, with details of current guidelines provided in **Section 18.1**.
2. The Proponent must ensure the AQIA also includes the following:	
(a) demonstrated ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Clean Air) Regulation 2010*;	The regulatory framework as relevant to the *Protection of the Environment Operations Act 1997* and the Protection of the Environment Operations (Clean Air) Regulation 2010 is discussed in **Section 18.1**. The compliance of the project with the regulatory framework is discussed in **Section 18.4**.
(b) an assessment of the impacts of the construction and operation of the project on sensitive receivers and the local community, including risks to human health;	The location of existing sensitive receivers is provided in **Section 18.3.1**. The risks of air quality issues to human health are provided in **Section 18.4.1**, while the assessment of these air quality issues during construction and operation is provided in **Section 18.4**.
(c) details of the proposed mitigation measures to minimise the generation and emission of dust (particulate matter and TSP) and air pollutants (including odours) during the construction of the project, particularly in relation to the operation of ancillary facilities (such as concrete and asphalt batching, treatment of acid sulfate soils and stockpiling of mulch), the use of mobile plant and machinery, stockpiles and the processing and movement of spoil, and construction vehicle movement along the alignment; and	Specific environmental management measures to minimise impacts from dust and air pollutants (including odours) during construction, including the operation of ancillary facilities and other construction activities are outlined in **Section 18.5**.
(d) a cumulative assessment of the local and regional air quality.	Potential cumulative impacts are assessed in **Chapter 23** (cumulative impacts).

18.1 Policy and planning setting

The air quality assessment was prepared to assess the potential impacts of the project in accordance with the *Protection of the Environment Operations Act 1997* (POEO Act), as construction of the project would constitute the Scheduled Activity of “Road construction” as defined in Schedule 1 of the POEO Act. As such, project construction activities would need to comply with the requirements of Chapter 5, Part 5.4 – Air Pollution of the POEO Act. In general, these requirements seek to ensure that emissions from a project do not result in unacceptable air quality, including at surrounding sensitive receivers.

The Protection of the Environment Operations (Clean Air) Regulation 2010 contains provisions for the regulation of emissions to air from motor vehicles, fuels and industry and specifies criteria for the assessment of the obligations imposed by Part 5.4 – Air Pollution of the POEO Act. The requirements of this Regulation have been incorporated into the air quality assessment for the project.

The air quality assessment was prepared to assess the potential impacts of the project in accordance with the following relevant legislation, policy and guidelines:

- Legislation:
  - POEO Act
  - Protection of the Environment Operations (Clean Air) Regulation 2010
  - National Environment Protection (Ambient Air Quality) Measure (National Environment Protection Council (NEPC) 2016)
  - National Environment Protection Measure for Air Toxics (NEPC 2011)
- Guidelines:
  - Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (the Approved Methods) (NSW Environment Protection Authority 2016)
  - Approved Methods for Sampling and Analysis of Air Pollutants in NSW (DEC 2005)
  - Air Emissions Inventory for the Greater Metropolitan Region in New South Wales (NSW Environmental Protection Authority 2019a)
  - Guidance on the assessment of dust from demolition and construction (UK IAQM 2014)
  - Assessment and Management of Odour from Stationary Sources in NSW (DEC 2006).

Although the Approved Methods do not relate specifically to road projects, the impact assessment criteria have been considered to provide an indication of the significance of the project’s effect on air quality. Ambient air quality data was collected from stations being operated by DPIE in accordance with The Approved Methods for Sampling and Analysis of Air Pollutants in NSW.

In the absence of a NSW guideline for the assessment of dust from construction activities, the UK IAQM was used. The UK IAQM provides an approach for assessing the potential for dust-related impacts during construction, taking into consideration the sensitivity of the local environment and the expected magnitude of different construction activities.

Further detail on legislation, policies and guidelines, and how they apply to the project, is provided in the Air Quality Working Paper (**Appendix R**).

18.2 Assessment methodology

18.2.1 Air quality data review

In order to determine existing air quality parameters, data from nearby air quality monitoring stations was examined. The closest air quality monitoring station to the area of interest is the DPIE station located at Beresfield, about 1.5 kilometres north of the project. Additional air quality parameters were measured at the next nearest DPIE station, in Newcastle, located about 14 kilometres south of the project.

18.2.2 Meteorological modelling

In order to determine the direction and rate at which emissions from a source would disperse, meteorological data collected over five recent years (2015 to 2019 inclusive) from the DPIE Beresfield monitoring station, located about 1.5 kilometres north of the project, were analysed in order to identify a representative year for the assessment. Hourly records of wind speed and wind direction were also examined. The process for identifying a representative meteorological year involved comparing statistics and wind patterns.

18.2.3 Construction assessment methodology

Dust impacts

Potential impacts to human health and ecology (e.g. impacts to plant health) as well as annoyance, represent the primary air quality-related risks from dust generation during construction. A study area of 350 metres from the construction footprint, extending to 500 metres from site egress points has been adopted for human receivers, and a study area of 50 metres from the construction footprint, extending to 500 metres from site egress points has been adopted for ecological receivers.

The UK IAQM was used to identify the potential for dust impacts during the project, arising from the following four primary activities:

- Demolition
- Earthworks
- Construction
- Trackout, or the transport-related handling of construction materials.

In accordance with the UK IAQM the following four-step assessment procedure (refer to **Figure 18-1**) was carried out:

- Step 1, a screening review to establish the study area and identify nearby human and ecological receivers which have the potential to be impacted by the project
- Step 2, an evaluation of the potential magnitude (Step 2A) and sensitivity of the surrounding environment to dust impacts (Step 2B). Step 2A and 2B were combined in Step 2C to estimate the risk of dust impacts if no mitigation measures are applied. Step 2 was completed for different work areas across the project so that changes in risk profiles could be identified and assessed across the entire project
- Step 3, the development of mitigation for each work location, commensurate to the level of risk determined in Step 2

- Step 4, an evaluation of any residual dust-related risks following the application of the control measures developed during Step 3 to verify that a suitable level of mitigation has been developed to reduce the impacts to the extent practicable.

This process is described further in **Section 18.4.2** and further details are provided in the Air Quality Working Paper (**Appendix R**).

Odour

The indicative odour impacts of an asphalt plant have been quantified by dispersion modelling. This involved estimating odour emissions from a typical asphalt plant and running the NSW EPA approved dispersion model, AUSPLUME, to predict odour levels at various distances from an asphalt plant. Based on simulated meteorological conditions, a 99th percentile odour level was predicted as a function of distance from a plant producing 100 tonnes per hour of asphalt. Based on this odour level and relevant criteria, a recommended separation distance between asphalt batching plants and residential receivers was identified. Further details are provided in the Air Quality Working Paper (**Appendix R**).

Odour from the handling of potentially contaminated materials was also investigated. The Areas of Potential Contamination Risk (AOPCRs) identified as part of the soils and contamination assessment for the project (refer to **Chapter 16** (soils and contamination)) were reviewed to determine AOPCRs that may result in odour impacts during construction.

Odour from the generation and stockpiling of mulch was also considered. The volume of mulch that would be generated for the project (refer to **Chapter 19** (waste)), was qualitatively assessed to determine if stockpiles would have potential to cause offensive odours due to the accumulation of odorous decomposition products.

Other impacts

Other air quality risks have the potential to result in impacts to sensitive receivers throughout local communities during construction. Potential impacts of exhaust emissions from construction plant and equipment are incorporated into the activities defined by the IAQM. Where available, data from projects that may result in cumulative impacts have been incorporated into the air quality assessment as described in **Chapter 23** (cumulative impacts). Where unavailable, a high-level qualitative cumulative assessment has been carried out.

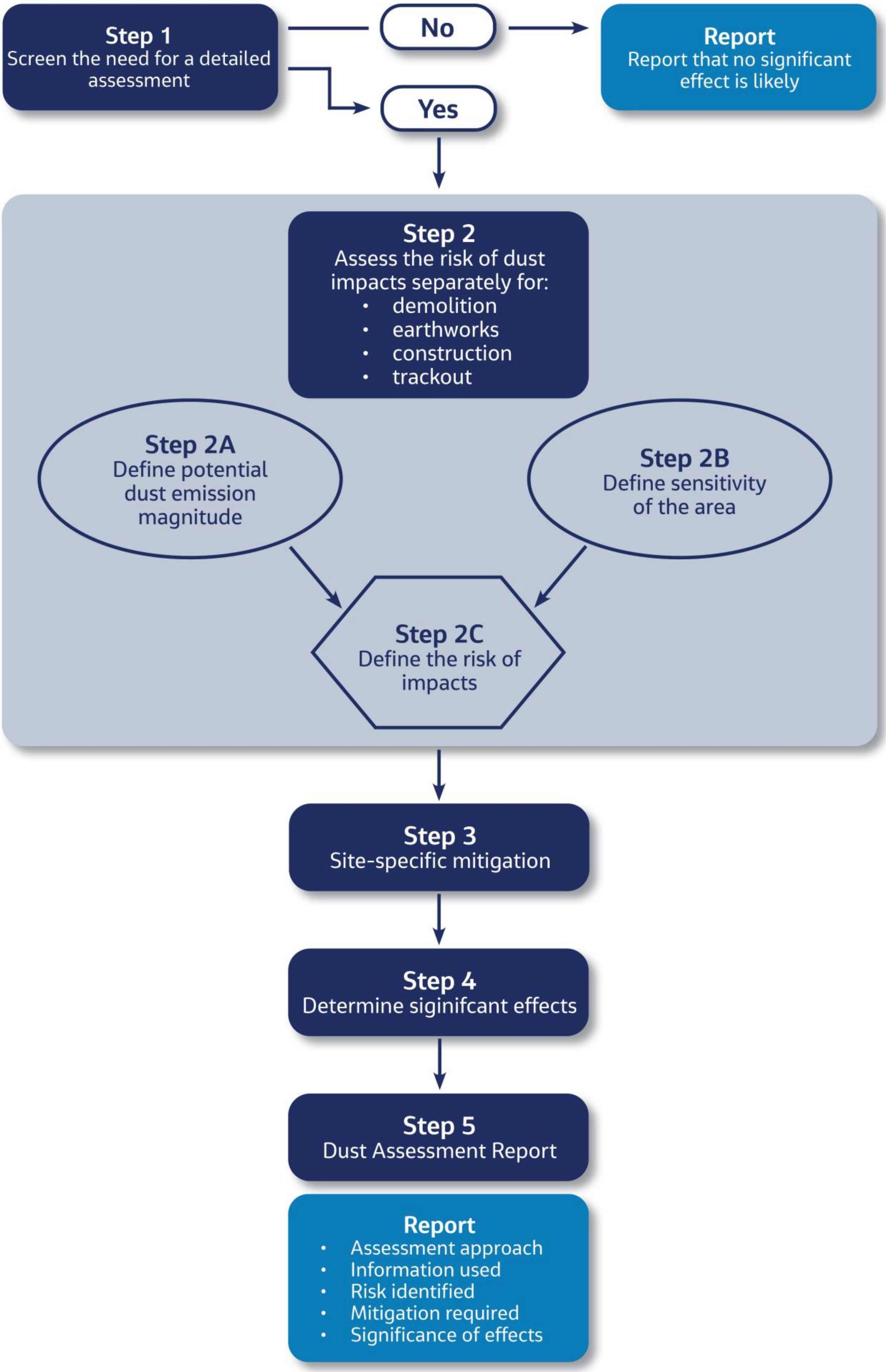

Figure 18-1 Construction air quality assessment procedure (UK IAQM 2014)

18.2.4 Operational assessment methodology

Overview

Air dispersion modelling was carried out in accordance with the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (NSW Environmental Protection Authority 2016) (hereafter referred to as the Approved Methods), which uses meteorological data, reporting requirements and air quality assessment criteria to assess dispersion model predictions.

Emissions from vehicles on the local road network at selected sensitive receivers (R1 to R9) have been estimated using information on traffic volumes, traffic mix and link locations, combined with emission factors from the NSW EPA. GRAL (a computer-based dispersion model) has been used to predict key air pollutant concentrations, including emissions of carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter and hydrocarbons (HC) under a range of operational scenarios, taking into account the local meteorological conditions. Further details on modelling of emissions, including traffic volumes and calculated hourly emissions is described in the Air Quality Working Paper (**Appendix R**).

While emissions of $PM_{2.5}$ have not been explicitly modelled, the potential for $PM_{2.5}$ impacts has been assessed by assuming that 100 per cent of the PM_{10} is $PM_{2.5}$. This is a conservative approach as not all the PM_{10} would be $PM_{2.5}$ and emissions of PM_{10} are anticipated to be higher than $PM_{2.5}$.

Model predictions for air toxics (including benzene, formaldehyde, toluene, xylenes and benzo(a)pyrene) as a marker for polycyclic aromatic hydrocarbons (PAHs) were derived from HC modelling results.

Study area

The study area for the operational air quality assessment has been identified based on surrounding local communities which would be sensitive to air quality impacts. Local communities adjacent to the project include Black Hill, Beresfield, Tarro, Hexham, Tomago, Heatherbrae and Raymond Terrace. The sensitive receivers that were selected, represent a range of potentially sensitive locations within surrounding local communities and are further described in **Section 18.3.1**.

During operation, changes in air quality at both ecological locations and identified sensitive receivers were assessed. As it was determined that impacts at the identified sensitive receivers would represent potential worst case outcomes, they have been further considered as representative receptors in this assessment.

Criteria

The Approved Methods contain criteria for assessing whether potential changes in operational air quality conditions predicted as a result of a project would lead to an unacceptable level of impacts (refer to **Table 18-2**). Although these criteria were developed for stationary sources of air pollutants, rather than moving sources such as vehicles, they are considered to provide an indication of the significance of the project's effect on air quality during operation, given that the criteria set out in the Approved Methods are a summary of criteria from other relevant guidelines and policies.

Table 18-2 Operational air quality impact assessment criteria contained within the Approved Methods

Pollutant	Averaging time	Criterion
Criteria pollutants		
Carbon monoxide (CO)	1-hour	30,000µg/m^3
	8-hours	10,000µg/m^3
Nitrogen dioxide (NO_2)	1-hour	246µg/m^3
	Annual	62µg/m^3
Particulate matter (as PM_{10})	24-hour	50µg/m^3
	Annual	25µg/m^3
Particulate matter (as $PM_{2.5}$)	24-hour	25µg/m^3
	Annual	8µg/m^3
Particulate matter (as TSP)	Annual	90µg/m^3
Air toxics		
Benzene	1-hour	29µg/m^3
Formaldehyde	1-hour	20µg/m^3
Toluene	1-hour	360µg/m^3
Xylenes	1-hour	190µg/m^3
PAHs as benzo(a)pyrene	1-hour	0.4µg/m^3

Assessment scenarios

To determine whether the project would result in an “unacceptable” outcome, pollutant concentrations of PM_{10}, $PM_{2.5}$, CO, NO_2 and benzene were predicted from road operations by dispersion modelling for the following assessment scenarios:

- 2017 base: Representing approximately existing traffic conditions
- 2028 Do Nothing (2028DN): Traffic conditions in the planned opening year, without the project
- 2028 With Project (2028WP): Traffic conditions in the planned opening year, with the project
- 2038 Do Nothing (2020DN): Traffic conditions 10 years after the planned opening year, without the project
- 2038 With Project (2028DN): Traffic conditions 10 years after the planned opening year, with the project.

Further details relating to the assessment scenarios, including the full details of the emission calculations and road links for each scenario, are provided in the Air Quality Working Paper (**Appendix R**).

18.3 Existing environment

18.3.1 Sensitive receivers

Nine sensitive receivers within the study area were selected for this assessment to represent a range of residential, occupational and other potentially sensitive locations within surrounding local communities (refer to **Table 18-3** and **Figure 18-2**). Due to their proximity to the project, these selected sensitive receivers have been used as the basis for summarising worst case potential impacts during the operational phase of the project on local communities.

In addition, there are various vegetation communities (i.e. ecological receivers), primarily around Hexham Swamp, north of the Hunter River and south and east of Heatherbrae. These habitat areas have been considered as ecological receivers for the purposes of this assessment due to their proximity to the project (within study area) and that they may be directly and indirectly impacted by dust soiling.

Table 18-3 Selected sensitive receivers

Selected sensitive receiver ID	Local community	Location of selected sensitive receiver
R1	Black Hill	Along Lenaghans Drive
R2	Beresfield	North of the New England Highway around the John Renshaw Drive Interchange
R3	Tarro	North of the New England Highway
R4		
R5	Hexham	Around the intersection of Maitland Road and the Pacific Highway
R6		Old Maitland Road
R7	Tomago	Tomago Road
R8	Heatherbrae	South east of the Pacific Highway
R9	Raymond Terrace	East of the Pacific Highway

Based on Step 1 of the UK IAQM (refer to **Section 18.4.2**), a construction study area was developed as described in **Section 18.2.3**.

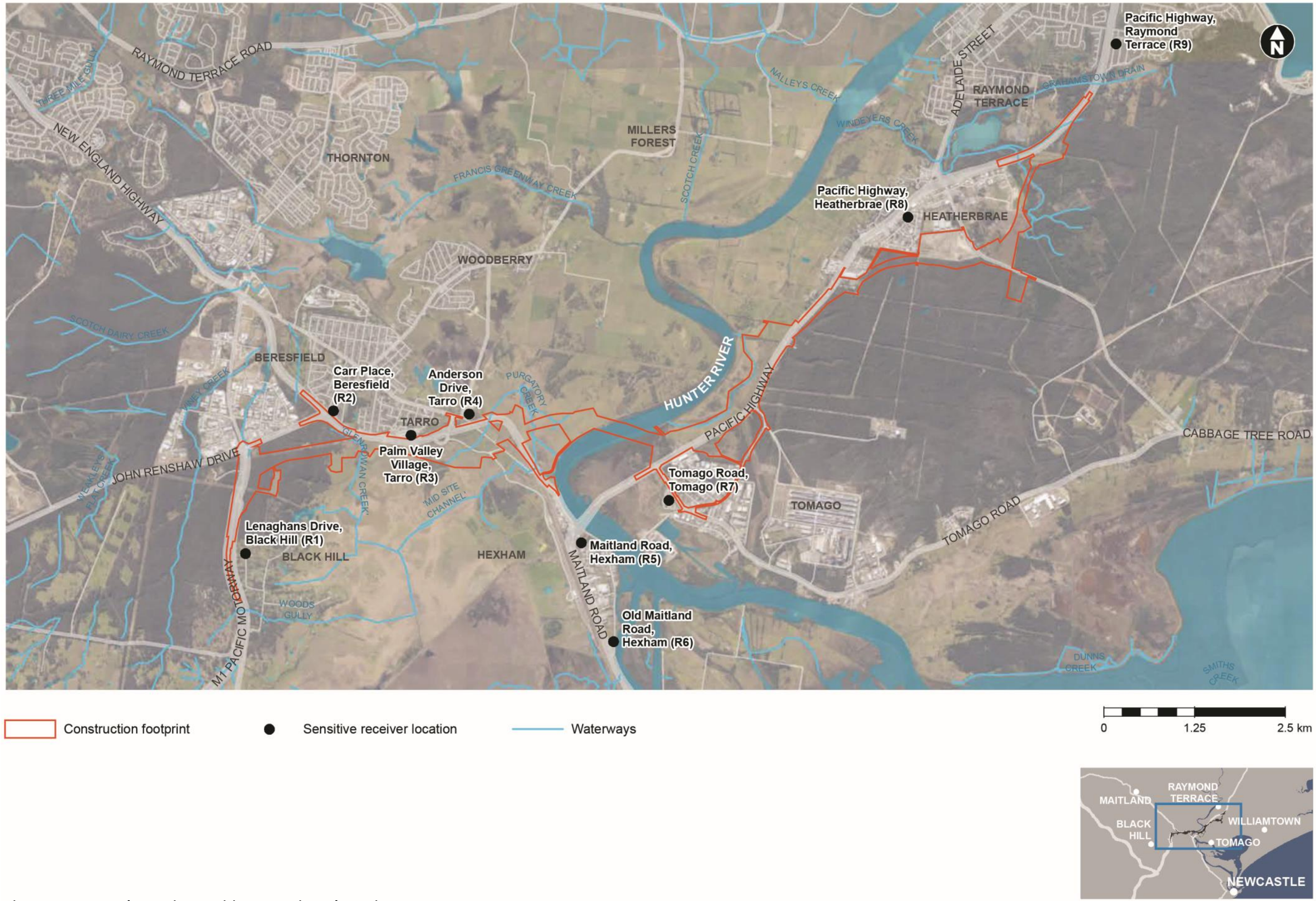

Figure 18-2 Selected sensitive receiver locations

18.3.2 Existing air quality conditions

Carbon monoxide

Table 18-4 provides a summary of measured CO concentrations at Newcastle monitoring station from 2015 to 2019. As shown, measured CO concentrations have consistently been below the criteria contained within the Approved Methods.

Table 18-4 Summary of measured background CO concentrations

Statistic	Criterion	2015	2016	2017	2018	2019
Maximum 1-hour average in µg/m^3	30,000	2,000	2,400	1,600	1,400	2,200
Maximum 8-hour average in µg/m^3	10,000	1,700	1,600	1,300	1,200	1,700

Nitrogen dioxide

Table 18-5 provides a summary of measured NO_2 concentrations from the Beresfield monitoring station from 2015 to 2019. As shown, measured NO_2 concentrations have consistently been below the criteria contained within the Approved Methods.

Table 18-5 Summary of measured background NO_2 concentrations

Statistic	Criterion	2015	2016	2017	2018	2019
Maximum 1-hour average in µg/m^3	246	92	77	75	75	105
Annual average in µg/m^3	62	17	15	16	17	15

While the air quality assessment was based on the modelling of NO_x emissions, NO_2 is the pollutant of interest for comparison with the air quality criteria. It is therefore important to distinguish between total NO_x and NO_2 and it is useful to assess the likely fraction of NO_x that is converted to NO_2 at locations where maximum impacts may be expected to occur. Based on the available data, it has been assumed that 20 per cent of the NO_x is NO_2 when assessing the maximum 1-hour average predictions.

PM_{10}

Table 18-6 provides a summary of measured PM_{10} concentrations from the Beresfield monitoring station in comparison to the daily impact assessment criteria contained within the Approved Methods.

From 2015 to 2019 there were multiple instances when the 24-hour average PM_{10} concentrations exceeded the criterion (refer to red shaded cells in **Table 18-6**). During this period, particle levels increased across NSW due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH 2019a), with a period of unprecedented bushfires in late 2019.

Table 18-6 Summary of measured PM_{10} concentrations

Statistic	Criterion	2015	2016	2017	2018	2019
Maximum 24-hour average in µg/m^3	50	65	48	49	149	137
Number of days above 50µg/m^3	N/A	2	0	0	8	30
Annual average in µg/m^3	25	19	19	20	22	26

$PM_{2.5}$

Table 18-7 provides a summary of measured $PM_{2.5}$ concentrations from the Beresfield monitoring station, in comparison to the daily impact assessment criteria contained within the Approved Methods.

From 2015 to 2019 there were multiple instances when the 24-hour average $PM_{2.5}$ concentrations exceeded the criterion (refer to red shaded cells in **Table 18-7**), with a higher frequency of exceedances occurring in 2019 as a result of the bushfires.

Table 18-7 Summary of measured $PM_{2.5}$ concentrations

Statistic	Criterion	2015	2016	2017	2018	2019
Maximum 24-hour average in µg/m^3	25	26	28	19	25	101
Number of days above 25µg/m^3	NA	1	1	0	0	23
Annual average in µg/m^3	8	7.4	7.4	7.6	8.7	12.2

Assumed background levels

Assumed background levels at the selected sensitive receivers were determined by reviewing local air quality monitoring data as described above. The assumed background levels for the receivers adjacent to the project, and how each background level was determined, is summarised in **Table 18-8**.

Table 18-8 Assumed project background levels

Pollutant	Averaging time	Assumed background level	Background level determination
CO	1-hour	2400µg/m^3	Maximum 1-hour concentration from Newcastle (2015 to 2019)
	8-hour	1700µg/m^3	Maximum 8-hour concentration from Newcastle (2015 to 2019)
NO_2	1-hour	105µg/m^3	Maximum 1-hour concentration from Beresfield (2015 to 2019)
	Annual	17µg/m^3	Highest annual concentration from Beresfield (2015 to 2019)
PM_{10}	24-hour	48µg/m^3	Maximum 24-hour average in 2016 (2017 to 2019 were excluded due to drought, dust storms and bushfires)
	Annual	22µg/m^3	Highest annual concentration from Beresfield (2015 to 2018)
$PM_{2.5}$	24-hour	28µg/m^3	Maximum 24-hour average in 2016 (2017 to 2019 were excluded due to drought, dust storms and bushfires)
	Annual	8.7µg/m^3	Highest annual concentration from Beresfield (2015 to 2018)

18.3.3 Meteorological conditions

Meteorological conditions are important for determining the direction and rate at which emissions from a source would disperse. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature and atmospheric stability.

Wind at a location can be summarised in data plots known as wind roses. Wind roses show the strength, direction and frequency of winds at a nominated location. The wind roses in **Figure 18-3** have been constructed in the following way:

- Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Eight directions are used
- The branches are divided into segments of different thickness and colour, which represent wind speed ranges from that direction. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

Meteorological data showed that the most common winds in the area of the project would be from the west-northwest, as shown in the wind roses in **Figure 18-3**. This pattern of winds is common for the Lower Hunter Valley and reflects the influence of the northwest to southeast alignment of the Hunter Valley. It is also clear from **Figure 18-3** that wind patterns were similar in all five years of data presented. This suggests that wind patterns do not vary significantly from year to year, and potentially the data from any of the years presented could be used as a representative year for modelling purposes.

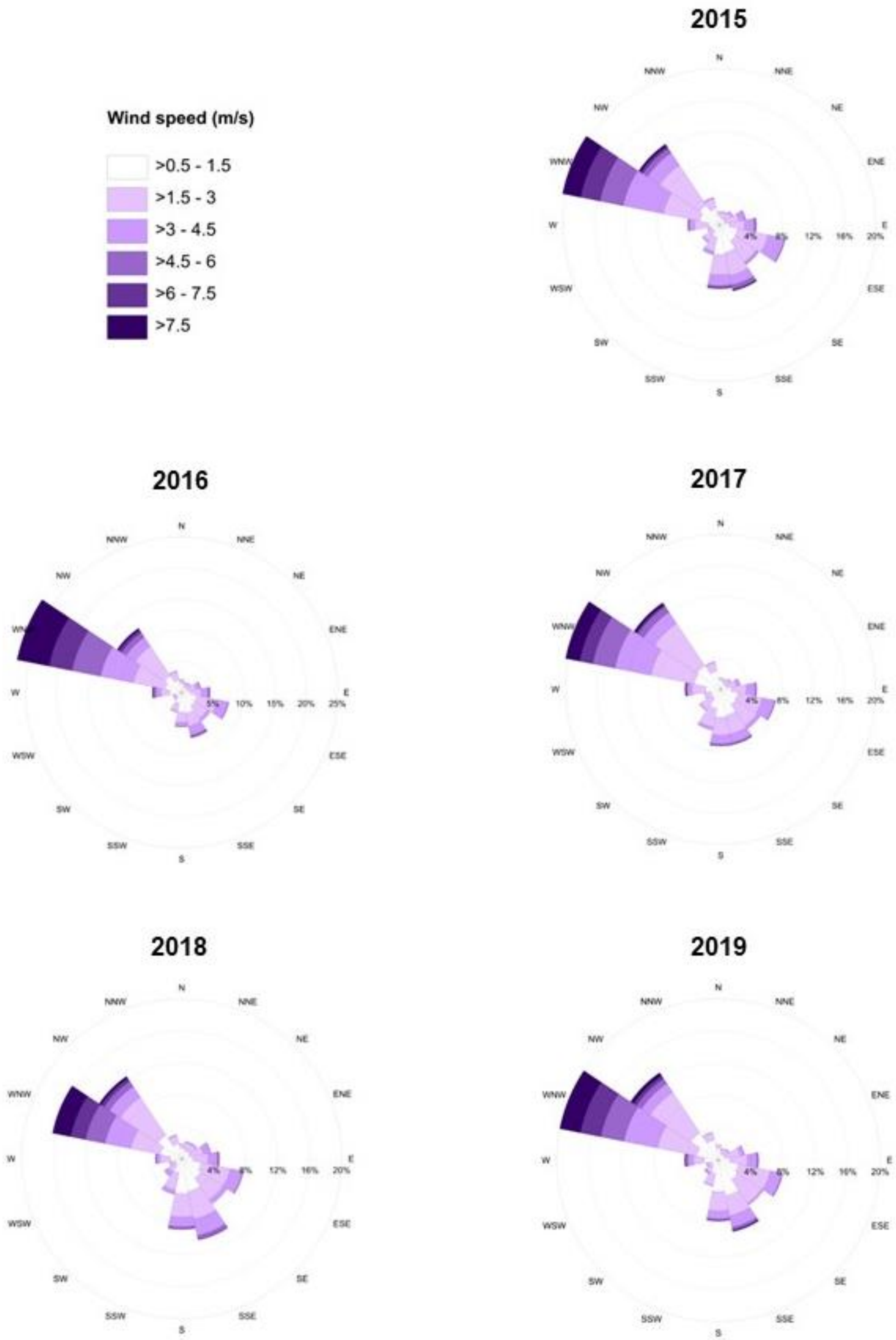

Figure 18-3 Annual wind roses for data collected at the DPIE Beresfield Station

18.4 Assessment of potential impacts

18.4.1 Air quality impacts

The project design as described in **Chapter 5** was developed using a multi-disciplinary process that identified and assessed routes against a range of engineering, environmental, social, land-use and economic criteria. This process (refer to **Chapter 4**) ultimately determined that the project alignment represented the best balance after a multi-criteria analysis of all known constraints and opportunities. The design of the project would result in free-flowing traffic conditions and reduced travel time, reducing motor vehicle emissions and the potential air quality impacts associated with these emissions compared to other alternatives considered.

Construction of the project could lead to emissions to air from a variety of activities including land clearing, earthworks, material handling, and material transport. Emissions may also arise from wind erosion of exposed areas. Construction-related emissions would mainly comprise of particulate matter in the form of:

- Total suspended particulates typically where particles are less than 30 microns in equivalent aerodynamic diameter (TSP)
- Particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10})
- Particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

Relatively minor emissions (i.e. smaller quantities) may also be generated from construction machinery exhausts such as CO, oxides of nitrogen (NO_x), PM_{10}, $PM_{2.5}$ and some HC. Odour and other volatile organic compounds also have the potential to be generated from asphalt batching, and the handling of potentially contaminated soils. Due to the relatively minor emissions anticipated (compared with operational traffic emissions), exhaust emissions from plant and equipment are not identified as a key issue. In addition, the UK IAQM notes that these emissions are unlikely to have a significant impact on local air quality.

Operation of the project could lead to emissions to air from vehicles using both the existing and modified road network. There are a variety of air pollutants associated with road vehicles with the most significant pollutants, in terms of potential impacts to health, being:

- CO
- NO_x, representing the total of nitrogen oxide (NO) and NO_2
- Particulate matter as PM_{10} and $PM_{2.5}$
- HC.

These pollutants may be generated from the combustion of fuel and emitted via the exhaust system. Particulate matter emissions may also be also generated from brake and tyre wear, as well as re-suspended road dust.

CO is widespread in an urban environment and comes from the burning of fuels that contain carbon, such as petrol, diesel or gas in motor vehicles. CO is absorbed into the bloodstream much more readily than oxygen so that small amounts of it inhaled can affect bodily function.

The main source of NO_x in the urban atmosphere is from the combustion of fossil fuels (petrol, diesel, coal, gas). NO_x emitted from combustion activities include NO and NO_2. While NO is generally not harmful to humans at the concentrations normally found in urban environments, NO_2 is known to affect the throat and the lungs.

Particulate matter in the atmosphere can have an adverse effect on health and amenity. The health effects of particles are largely related to the extent to which they can penetrate the respiratory tract. Common sources of particulate matter less than 10 microns (PM_{10}) include sea salt, pollen and combustion activities such as motor vehicles and industrial processes. High levels of PM_{10} particles in the air can irritate the eyes and throat, while finer particles can impair lung function.

HCs such as benzene have an adverse effect on human health, but the effects are thought to occur at concentrations higher than the levels of exposure found at roadsides from traffic emissions.

18.4.2 Construction impacts

Dust impacts

Dust is the key air quality issue during construction. Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. Air quality impacts to the study area during construction would largely result from vegetation clearing, topsoil stripping, lime stabilisation of soils and lime neutralisation of acid sulphate soils, demolition of redundant assets, stockpiling of soil operation, of batch plants, and general material handling.

As described in **Section 18.3**, the UK IAQM was used to assess the potential for dust impacts within the study area during construction of the project using a four-step assessment procedure. The findings of each step are presented in the following sections.

Step 1 (screening review)

Step 1 involved a screening review to confirm the presence of human and ecological receptors near the project that may be impacted by the proposed work. The IAQM considers human receivers as any location where people spend some period of time and where property may be impacted by dust, and ecological receivers as any ecological areas that might be sensitive to dust impacts. This definition is considered to include threatened ecological communities, as well as ecologically sensitive commercial developments. Based on the UK IAQM methodology, a study area of 350 metres from the construction footprint, extending to about 500 metres of site egress points has been adopted for human receivers, and a study area of 50 metres from the construction footprint extending to about 500 metres of site egress points has been adopted for ecological receivers (IAQM 2014).

As there are human and ecological receivers located within the construction footprint setback distances identified above, it was determined that the next stages of the assessment would be required.

Step 2 (risk assessment)

Step 2 involved a risk evaluation of dust impacts during construction. This step is further divided into three steps which are described in the following sections.

Step 2A (potential for dust emissions)

Step 2A involved estimating the magnitude of potential dust emissions associated with the project's construction activities. The magnitude of potential emissions was evaluated by considering the scale and nature of the anticipated activities and assigned a classification of large, medium or small. The dust emission magnitude classifications for the project and their corresponding IAQM classification are shown in **Table 18-9**.

Table 18-9 Dust emission magnitude classifications determined for the project

Activity	Potential dust emission magnitude classification	Corresponding classification (IAQM 2014)
Demolition	Medium	Total building volume 20,000 to 50,000m^3, potentially dusty construction material, demolition activities 10 to 20m above ground.
Earthworks	Large	Total site area greater than 10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving materials active at any one time, formation of bunds greater than eight metres in height, total materials moved exceeding 100,000t.
Construction	Large	Total building volume greater than 100,000m^3, on-site concrete batching, sandblasting
Trackout	Large	More than 50 heavy vehicle movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road lengths greater than 100m.

Step 2B (sensitivity of surrounding local environment)

Step 2B involved the evaluation of the sensitivity of the receiving environment described in Step 1. The sensitivity of the surrounding receiver areas to the effects of dust soiling and human health and ecosystem impacts were classified based on:

- The specific sensitivities of receptors in the area
- The proximity and number of nearby receivers
- Local background air quality conditions characterised based on PM_{10} concentrations
- Site-specific factors such as whether natural shelters are present, to reduce the risk of wind-blown dust.

The dust soiling, human health and ecological sensitivity classifications during the four assessed activities (demolition, earthworks, construction and trackout) for the project were all determined to be 'high' (refer to **Table 18-10**). Further detail regarding the methodology used to determine these sensitivities is provided in the Air Quality Working Paper (**Appendix R**).

Table 18-10 Surrounding receiver sensitivity classifications determined for the project

Potential impact	Surrounding receiver sensitivity rating	Corresponding classification (IAQM 2014)
Dust soiling	High	Surrounding land where: • Users can reasonably expect enjoyment of a high level of amenity • The appearance, aesthetics or value of a property would be diminished by soiling • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.
Human health impacts	High	Locations where members of the public are exposed over a time period relevant to the air quality criteria for PM_{10}. Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purpose of this assessment.

Potential impact	Surrounding receiver sensitivity rating	Corresponding classification (IAQM 2014)
Ecological effects	High	Locations with an international or national designation and the designated features may be affected by dust soiling. Locations where there is a community of particularly dust sensitive species

Step 2C (Evaluation of the risk of dust impacts)

The potential dust emission magnitude ratings determined in Step 2A and the surrounding area sensitivity classifications determined in Step 2B were combined in Step 2C to identify the risk of unmitigated impacts. **Table 18-11** lists unmitigated construction dust risk values associated with construction activities. As shown in **Table 18-11**, the highest unmitigated risk rating determined for the project was 'high risk', the highest risk rating classification under the UK IAQM. Dust soiling, impact to human health and ecological effects are considered high risk during earthworks, construction and trackout activities. Further detail on high risk rating classifications is described in the Air Quality Working Paper (**Appendix R**).

Table 18-11 Unmitigated construction dust risk values for the project

Activity	Potential impact		
	Dust soiling	Human health impacts	Ecological effects
Demolition	Medium risk	Medium risk	Medium risk
Earthworks	High risk	High risk	High risk
Construction	High risk	High risk	High risk
Trackout	High risk	High risk	High risk

Step 3 (mitigation and management)

As shown in **Table 18-11**, a 'high' potential risk was the highest unmitigated level determined for the construction of the project. This outcome represents the worst case, unmitigated outcome across the whole project. Based on this result, measures commensurate to this level of risk have been recommended with guidance from the IAQM method. These measures include the preparation and implementation of an Air Quality Management Plan (AQMP) and are presented in **Section 18.5**.

Step 4 (residual risks)

Based on the application of the measures detailed in **Section 18.5**, residual risks from key activities during construction are considered to be reduced to the extent where impacts could be effectively managed. Adverse residual dust impacts as a result of the project construction activities are therefore not anticipated.

Odour impacts

Odour from asphalt batching plants, the handling of potentially contaminated materials and mulch stockpiles has the potential to impact on sensitive receivers throughout local communities during construction.

Asphalt batching plants

Odour is one of the key air quality issues for asphalt batching plants, with the most significant emissions arising from the dryer, storage tanks and loadout areas. Potential locations for asphalt batching plants in Black Hill, Tarro, Tomago and Heatherbrae have been considered based on the construction report prepared for the project. The number of asphalt plants would be dependent on the construction needs for the project. Each necessary plant would occupy an area of approximately one hectare.

Based on the typical odour levels from an asphalt batching plant, the 99th percentile odour levels as a function of distance from a plant producing 100 tonnes per hour of asphalt were modelled based on simulated meteorological conditions as described in the Air Quality Working Paper (**Appendix R**). These results reflect an assumed production and anticipated operating arrangements of a typical plant and are therefore indicative of the expected odour levels. Based on these 99th percentile odour levels, it was determined that if a temporary project-specific asphalt batching plant is required it should be located a minimum of 300 metres from the closest residence. This is reflected in the environmental management measures described in **Section 18.5**. It is noted that odour impacts from asphalt laying have not been assessed due to the temporary nature of the work.

Contaminated materials

The following contaminated materials have been identified as potentially resulting in odour impacts during construction:

- ASS
- Buried waste and asbestos waste at Tarro and Tomago
- Illegally dumped waste at various locations
- Hunter River sediments.

When exposed during construction actives, ASS has the potential to oxidise and generate odours by releasing hydrogen sulphide gas. As identified in **Chapter 16** (soils and contamination), a number of AOPCRs contain or potentially contain ASS. Given that ASS will be handled, tested, treated and reused during construction in accordance with the ASSMP to minimise environmental impacts, including odour impacts, ASS are not considered likely to result in significant odour impacts.

Buried waste, asbestos waste and illegally dumped waste may result in odour impacts through exposure of unknown contaminants. As identified in **Chapter 16** (soils and contamination), buried waste, asbestos waste and illegally dumped waste would be managed through unexpected contamination procedures. As a result, disturbance of these wastes during construction is not considered likely to result in significant odour impacts.

Further consideration of contamination impacts, such as from disturbance of Hunter River sediments, would confirm specific remediation, treatment and management requirements for areas of potential contamination risk, and odour from contamination, prior to construction. With the implementation of the environmental management measures described in **Section 18.5**, adverse odour impacts are not anticipated.

Mulch

Mulch would be generated by clearing of vegetation. Construction of the project is estimated to generate about 75,000 cubic metres of mulch, about half of which would be stockpiled within ancillary facilities for landscape planting and site rehabilitation.

While odour from the generation and stockpiling of mulch would generally be of a fresh cut wood or soil nature, mulch stockpiles have potential to cause offensive odours due to the accumulation of odorous decomposition products. Mulch would be turned regularly to prevent accumulation of odorous decomposition products and minimise odour impacts.

18.4.3 Operational impacts

The potential operational impacts of the project have been quantified using dispersion modelling for the scenarios described in **Section 18.2.4**. Traffic network changes assumed for these scenarios are described in the Traffic and Transport Working Paper (**Appendix G**).

Results from the traffic modelling have been assessed by examining the spatial differences between with and without project scenarios, and also in terms of the potential for the project to cause exceedances of NSW EPA air quality impact assessment criteria at sensitive receivers. Where the project would result in a decrease in the concentrations of key air quality indicators, due to the redirection of traffic that would result from the project, this has been identified within this section.

Operation of the project would lead to a redistribution of vehicle emissions across the road network, generally from existing main roads to the proposed new roads. The highest concentrations of key air quality indicators are expected to occur close to main roads under all 'with project' and 'without project' scenarios (refer to **Section 18.2.4**). Increases in the concentrations of key air quality indicators, due to the project, are generally expected in areas where there are no existing main roads such as east of Tarro, north of the Hunter River. In these locations there are generally few sensitive receivers. Decreases are expected to occur along the existing main connection from the M1 Pacific Motorway to Heatherbrae, and most significantly from Tarro to the Hexham Bridge.

Carbon monoxide

The predicted CO concentrations within the study area for each project scenario are shown in **Figure 18-4** to **Figure 18-7**. These results represent the contribution of emissions from those roads that are expected to undergo the most change as a result of the project. In summary:

- The highest 1-hour and 8-hour average CO concentrations are predicted to occur close to existing main roads and where applicable, the project, as this is where traffic would be concentrated
- The highest maximum 1-hour average CO concentrations are predicted to be in the order of 2000 to 5000µg/m^3 under all scenarios (refer to **Figure 18-4**)
- Increases in the maximum 1-hour average CO concentrations are expected in areas where there are no existing main roads such as east of Tarro, north of the Hunter River where there are few sensitive receivers (refer to **Figure 18-5**). Some decreases in maximum 1-hour average CO concentrations are expected along the New England Highway, east of Quarter Sessions Road where there are sensitive receivers
- The highest maximum 8-hour average CO concentrations are predicted to be in the order of 1000 to 2000µg/m^3 under all scenarios (refer to **Figure 18-6**)
- Increases in maximum 8-hour average CO concentrations are expected in areas where there are no existing main roads (refer to **Figure 18-7**). Some decreases in maximum 8-hour average CO concentrations are expected along the M1 Pacific Motorway, south of John Renshaw Drive, along the New England Highway, east of Quarter Sessions Road, and in the vicinity of the existing Hexham Bridge.

The predicted changes in CO concentrations due to the project (both increases and decreases) represent less than five per cent of the NSW EPA air quality assessment criteria. These changes are also within the range of historically measured fluctuations in CO concentrations for the region (refer to **Table 18-4**).

Table 18-12 provides a summary of the model results at the selected sensitive receivers. These results show that, at the selected sensitive receivers and local communities located near main roads along the proposed route, the project would lead to very little change to maximum CO concentrations. The changes in CO concentrations are predicted to be less than one per cent of the NSW EPA criteria. Accordingly, the project would not cause exceedances of the NSW EPA air quality impact assessment criteria.

Table 18-12 Predicted CO concentrations at selected sensitive receivers

Location	Criterion	Concentration due to modelled sources					Background level	Cumulative with project concentrations[1]	
		2017	2028DN	2028WP	2038DN	2038WP		2028	2038
Maximum 1-hour average CO (µg/m3)									
R1	30000	266	465	464	432	459	2400	2399	2427
R2		402	344	451	292	355		2507	2463
R3		585	479	651	348	588		2572	2641
R4		811	725	851	520	665		2526	2545
R5		1087	778	791	690	735		2413	2445
R6		817	716	663	495	542		2347	2448
R7		157	162	212	129	176		2450	2447
R8		167	224	228	198	221		2404	2423
R9		163	299	397	253	333		2498	2480
Maximum 8-hour average CO (µg/m3)									
R1	10000	135	244	221	197	215	1700	1676	1717
R2		214	193	238	155	208		1745	1753
R3		287	221	330	163	328		1809	1865
R4		449	345	431	264	383		1786	1819
R5		575	449	444	374	408		1696	1735
R6		383	345	366	272	297		1721	1725
R7		93	88	107	70	94		1719	1724
R8		96	120	127	101	122		1706	1721
R9		93	160	216	145	192		1756	1747

[1] This is the background level plus the difference between the 'with project' and 'without project' scenarios

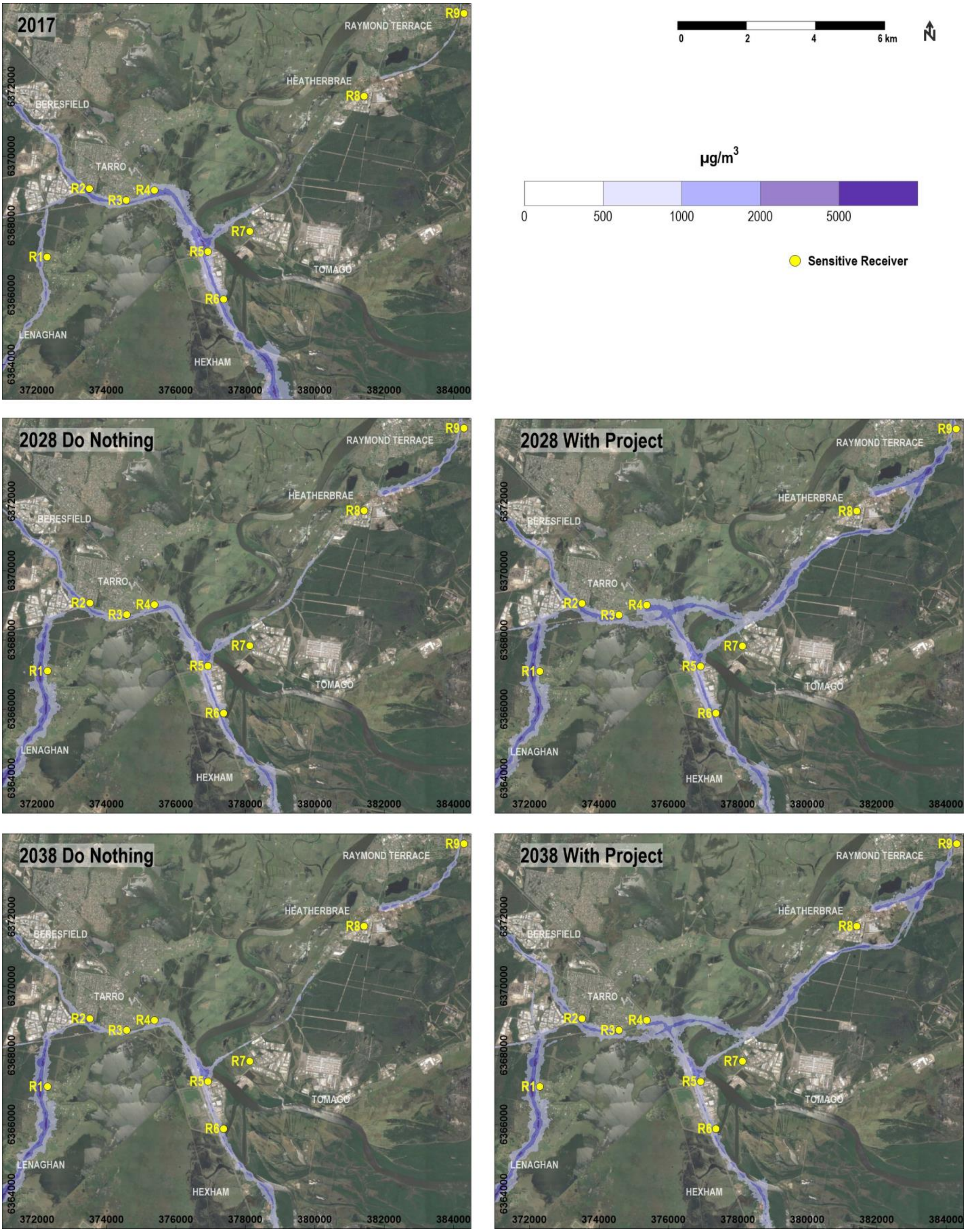

Figure 18-4 Predicted maximum 1-hour average CO

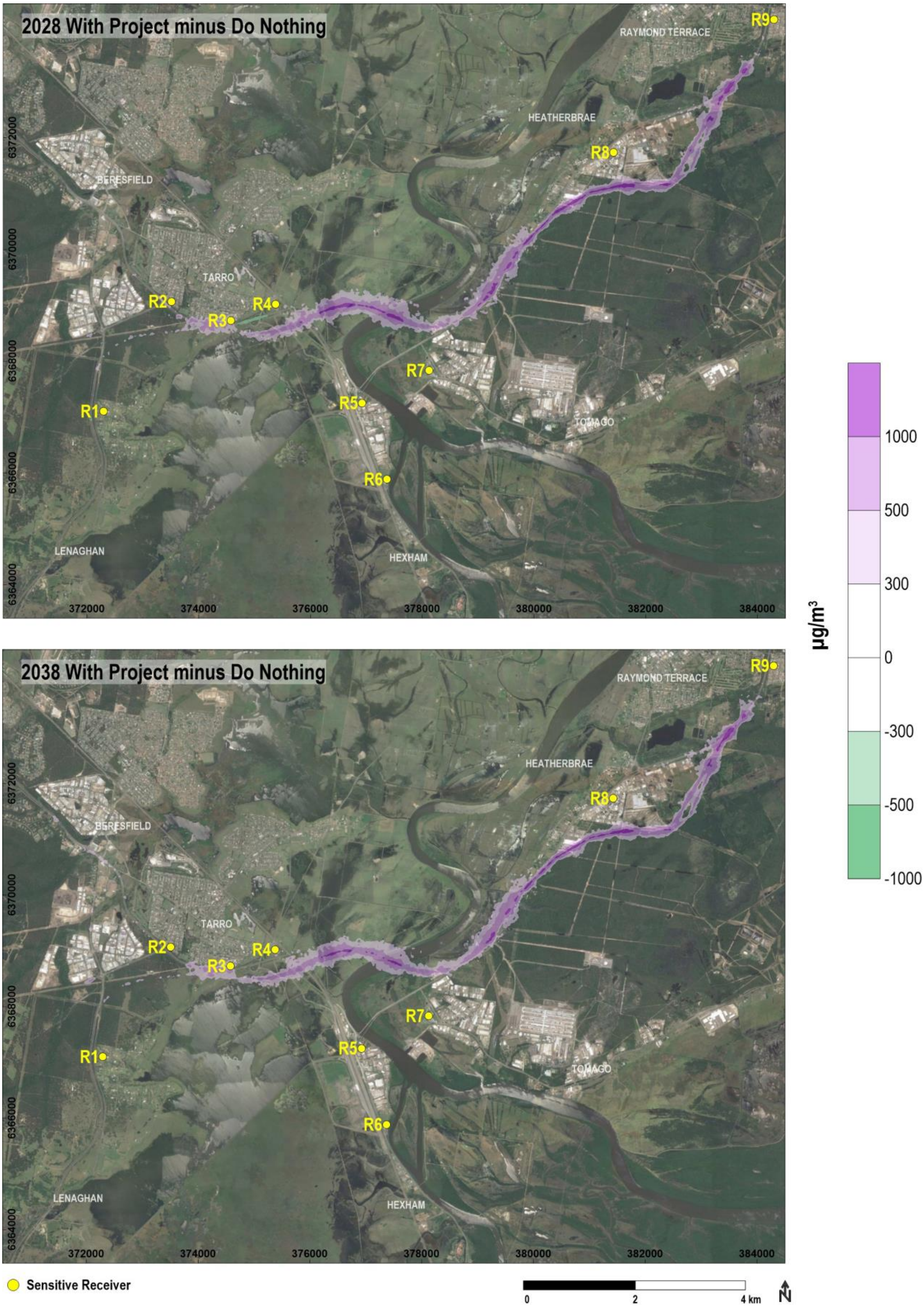

Figure 18-5 Predicted change in maximum 1-hour average CO

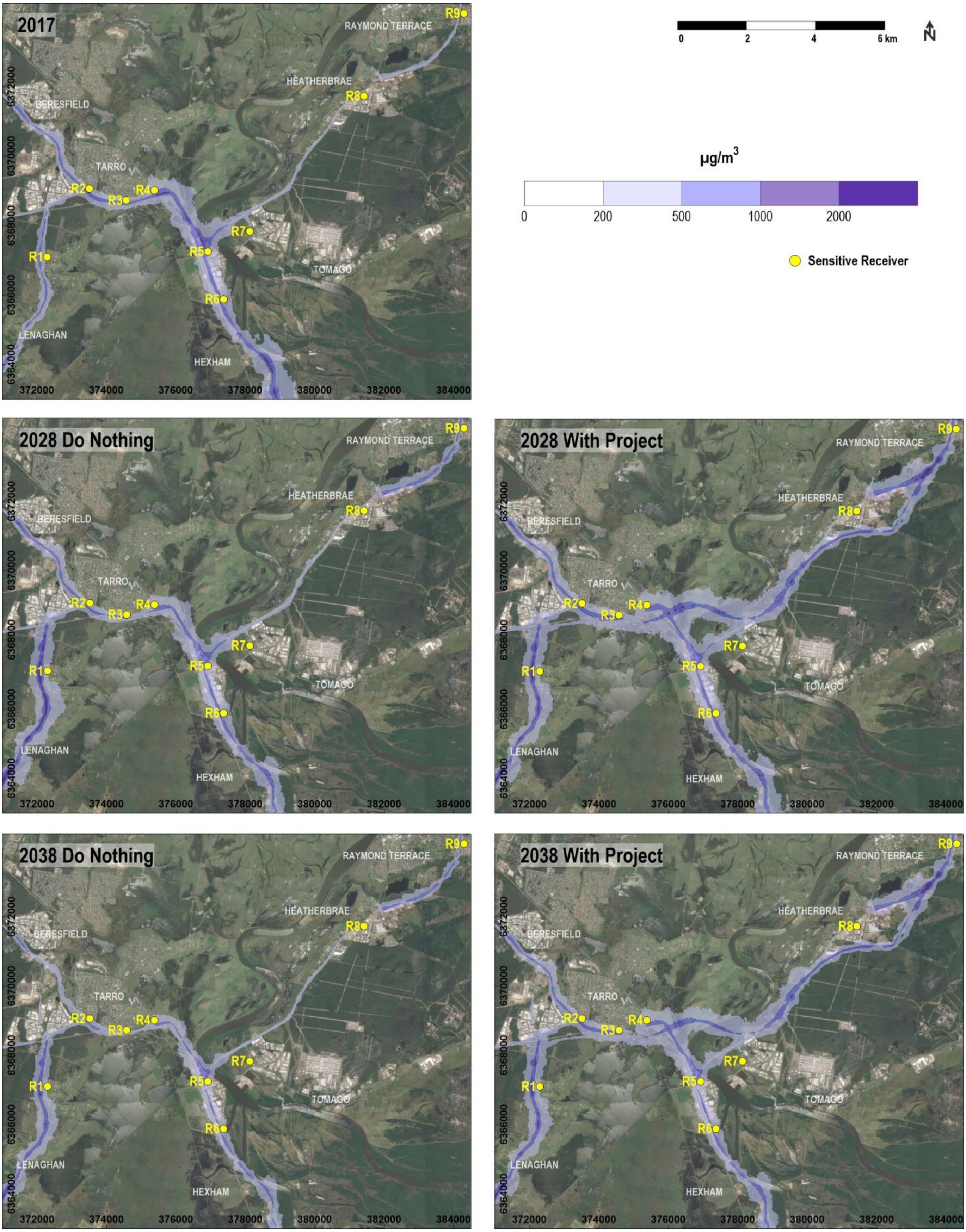

Figure 18-6 Predicted maximum 8-hour average CO

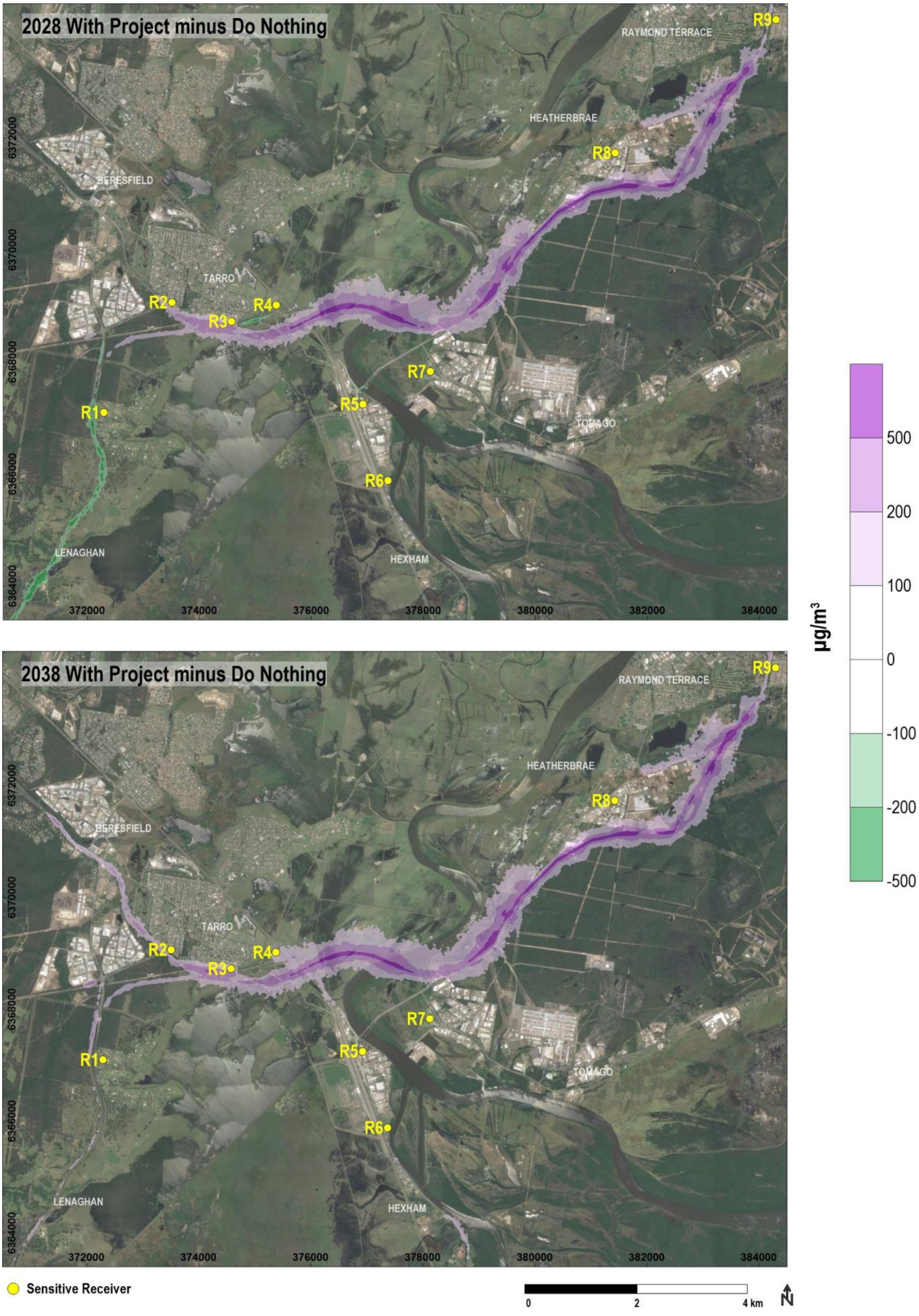

Figure 18-7 Predicted change in maximum 8-hour average CO

Nitrogen dioxide

The predicted NO_2 concentrations within the study area for each project scenario are shown in **Figure 18-8** to **Figure 18-11**. These results represent the contribution of emissions from those roads that are expected to undergo the most change as a result of the project. In summary:

- The highest 1-hour and annual average NO_2 concentrations are predicted to occur close to existing main roads and where applicable, the project, as this is where traffic would be concentrated
- The highest maximum 1-hour average NO_2 concentrations are predicted to be in the order of 100 to 200µg/m^3 for all scenarios (refer to **Figure 18-8**)
- Increases in the maximum 1-hour average NO_2 concentrations are generally expected in areas where there are no existing main roads such as east of Tarro, north of the Hunter River where there are few sensitive receivers (refer to **Figure 18-9**). Decreases in maximum 1-hour average NO_2 concentrations are expected along the New England Highway, east of Quarter Sessions Road, and on the Pacific Highway around the Hexham Bridge where sensitive receivers are located
- The highest annual average NO_2 concentrations are predicted to be in the order of 20 to 50µg/m^3 under all scenarios (refer to **Figure 18-10**). The greatest changes in annual average NO_2 concentrations are predicted at the New England Highway at Tarro
- Increases in annual average NO_2 concentrations are generally expected in areas where there are no existing main roads such as east of Tarro, north of the Hunter River where there are few sensitive receivers (refer to **Figure 18-11**). Decreases in annual average NO_2 concentrations are expected along the existing connection from the M1 Pacific Motorway to Heatherbrae (specifically, from M1 Pacific Motorway, New England Highway, Hexham Bridge and Pacific Highway), with the highest decreases from Tarro to the Hexham Bridge where sensitive receivers are located.

The predicted maximum changes in NO_2 concentrations due to the project (both increases and decreases in 1-hour averages) are generally within the range of historically measured fluctuations in maximum NO_2 concentrations for the region (refer to **Table 18-5**).

Table 18-13 provides a summary of the model results at the selected sensitive receivers. These results show that, at the selected sensitive receivers and local communities located near main roads along the proposed route, the project would lead to very little change to maximum and annual NO_2 concentrations, relative to background levels. Accordingly, the project would not cause exceedances of the NSW EPA air quality impact assessment criteria.

Table 18-13 Predicted NO_2 concentrations at selected sensitive receivers

Location	Criterion	Concentration due to modelled sources					Background level	Cumulative with project concentrations[1]	
		2017	2028DN	2028WP	2038DN	2038WP		2028	2038
Maximum 1-hour average NO_2 (µg/m³)									
R1	246	25	30	33	30	38	105	108	113
R2		36	32	37	39	36		111	102
R3		50	36	43	36	39		112	108
R4		84	78	47	53	54		74	107
R5		112	74	84	70	61		115	96
R6		75	52	50	42	47		103	109
R7		20	18	17	18	18		104	105
R8		21	25	24	24	19		104	100
R9		14	18	27	19	21		114	107
Annual average NO_2 (µg/m³)									
R1	62	3	4	4	4	4	17	17	17
R2		8	5	6	6	5		17	17
R3		9	6	5	6	5		16	16
R4		12	7	6	7	6		16	16
R5		18	12	12	12	11		17	16
R6		13	8	9	8	8		18	17
R7		3	3	2	2	2		17	17
R8		3	3	2	3	2		16	16
R9		2	2	3	2	3		18	17

[1] This is the background level plus the difference between the ‘with project’ and ‘without project’ scenarios

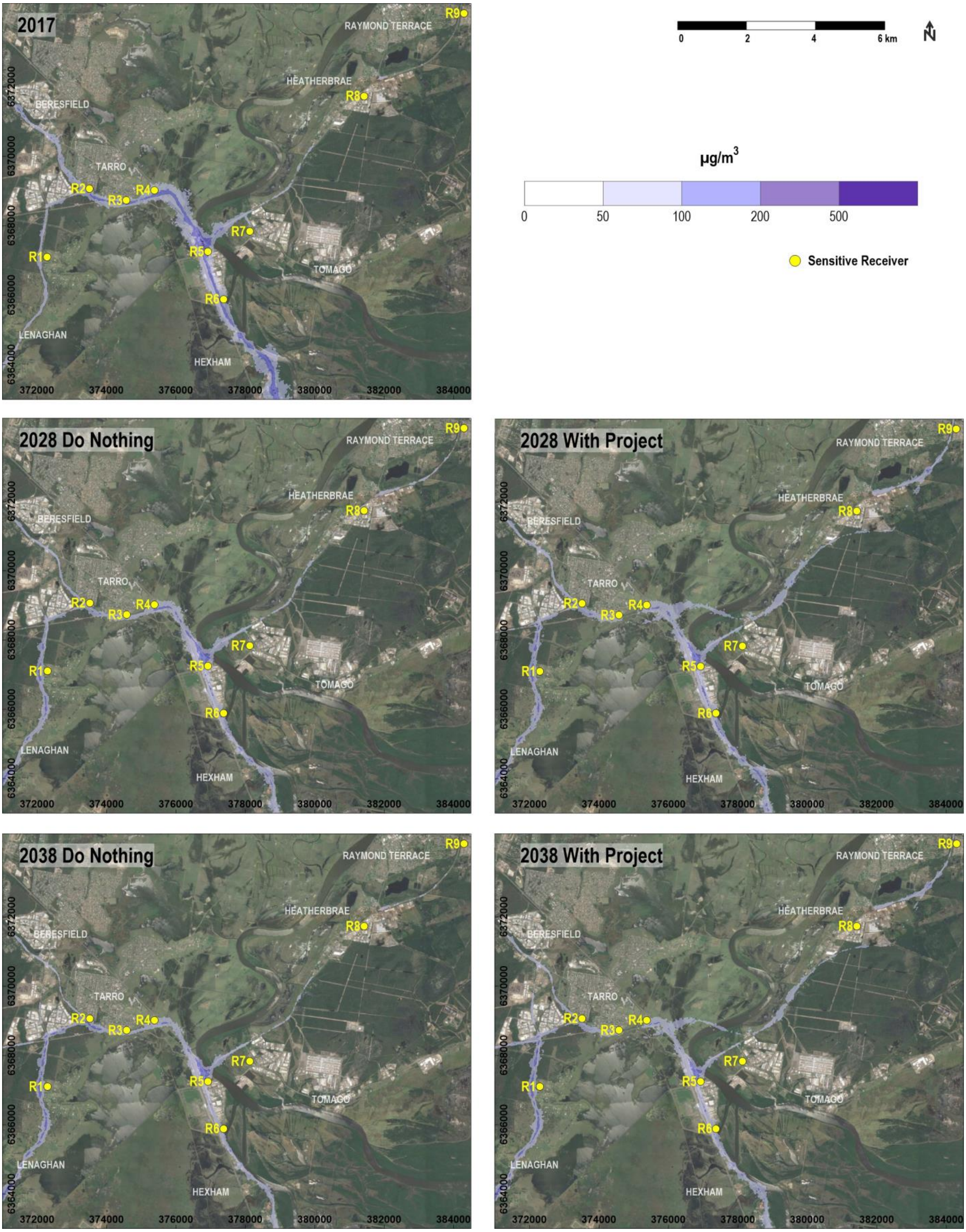

Figure 18-8 Predicted maximum 1-hour average NO_2

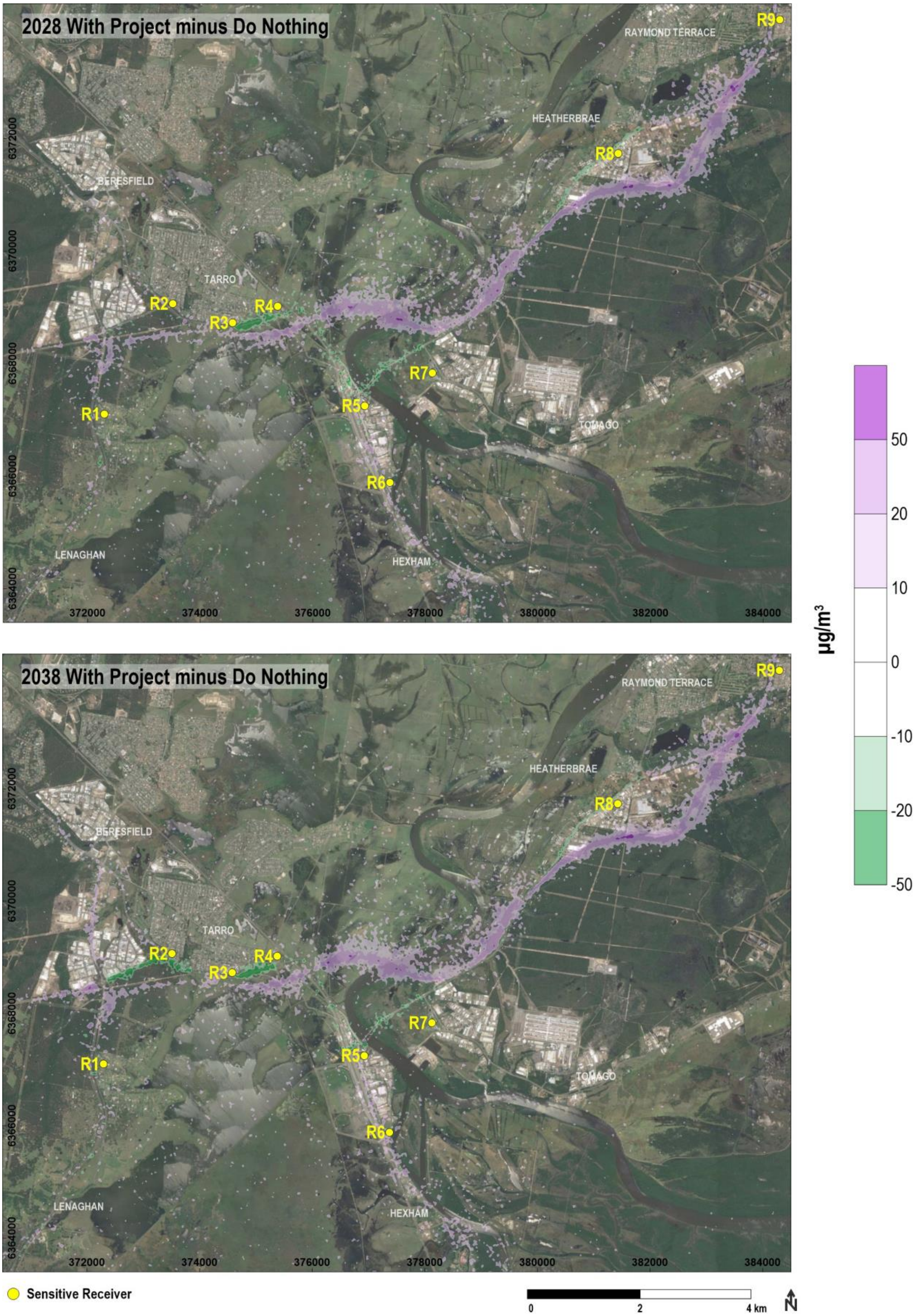

Figure 18-9 Predicted change in maximum 1-hour average NO_2

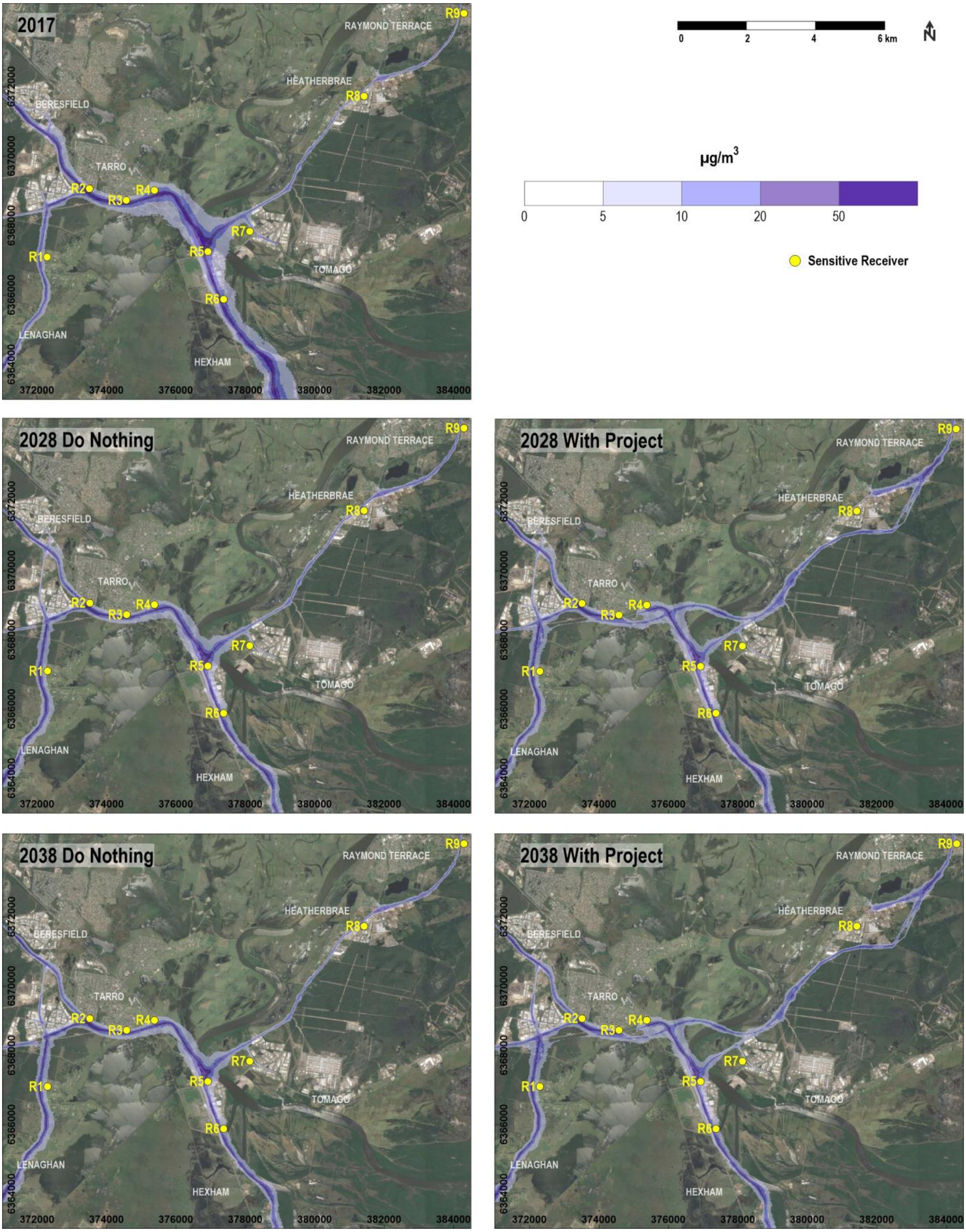

Figure 18-10 Predicted annual average NO_2

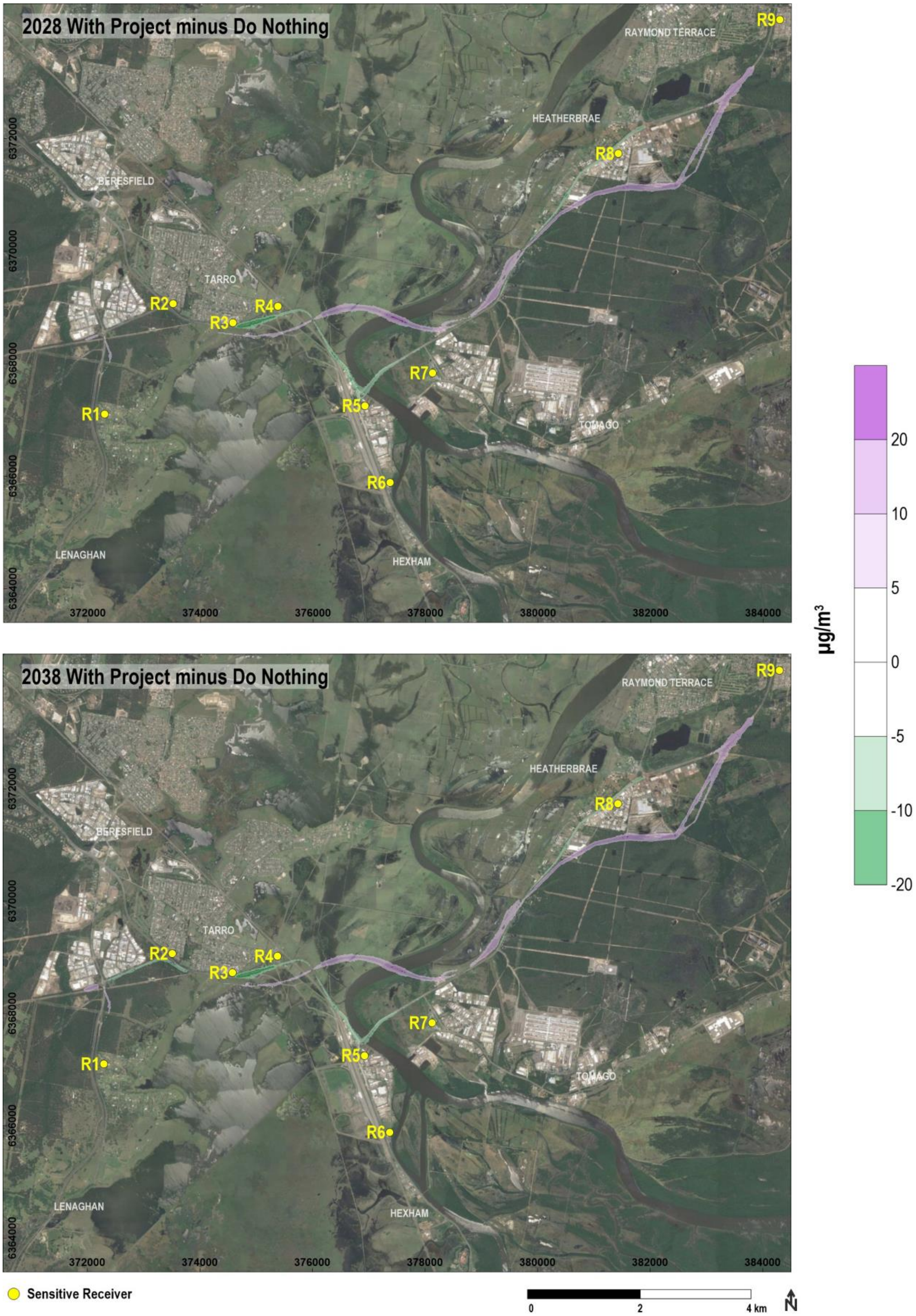

Figure 18-11 Predicted change in annual average NO_2

PM_{10}

The predicted PM_{10} concentrations within the study area for each project scenario are shown in **Figure 18-12** to **Figure 18-15**. These results represent the contribution of emissions from those roads that are expected to undergo the most change as a result of the project. In summary:

- The highest 24-hour and annual average PM_{10} concentrations are predicted to occur close to existing main roads and where applicable, the project, under all scenarios, as this is where traffic would be concentrated
- The highest maximum 24-hour average PM_{10} concentrations are predicted to be in the order of 20µg/m^3 under all scenarios (refer to **Figure 18-12**). The greatest changes in concentration are predicted on the main roads around the existing Hexham Bridge, including Maitland Road and the Pacific Highway
- Increases in the maximum 24-hour average PM_{10} concentrations are generally expected in areas where there are no existing main roads such as east of Tarro, north of the Hunter River where there are few sensitive receivers (refer to **Figure 18-13**). Decreases in maximum 24-hour average PM_{10} concentrations are expected along the existing connection from the M1 Pacific Motorway to Heatherbrae (that is, from M1 Pacific Motorway, New England Highway, Hexham Bridge and Pacific Highway), with the largest decrease from Tarro to the Hexham Bridge
- The highest annual average PM_{10} concentrations are predicted to be in the order of 5 to 10µg/m^3 (refer to **Figure 18-14**). The greatest changes in concentrations are predicted on the main roads around the existing Hexham Bridge
- Increases in annual average PM_{10} concentrations as a result of the project are generally expected in areas where there are no existing main roads such as east of Tarro, north of the Hunter River where there are few sensitive receivers (refer to **Figure 18-15**). Decreases in annual average PM_{10} concentrations are expected along the existing main connection from the M1 Pacific Motorway to Heatherbrae, with the largest decrease from Tarro to the Hexham Bridge.

The predicted maximum changes in PM_{10} concentrations due to the project (both increases and decreases in maximum 24-hour and annual averages) are within the range of historically measured fluctuations in maximum PM_{10} concentrations for the region (refer to **Table 18-6**).

Table 18-14 provides a summary of the model results at the selected sensitive receivers. These results show that, at the selected sensitive receivers and local communities located near main roads along the proposed route, the project would lead to very little change to maximum 24-hour and annual average PM_{10} concentrations, relative to background levels. Accordingly, the project would not cause exceedances of the NSW EPA air quality impact assessment criteria.

Table 18-14 Predicted PM_{10} concentrations at selected sensitive receivers

Location	Criterion	Concentration due to modelled sources					Background level	Cumulative with project concentrations[1]	
		2017	2028DN	2028WP	2038DN	2038WP		2028	2038
Maximum 24-hour average PM_{10} (µg/m^3)									
R1	50	2	3	3	3	3	48	48	48
R2		3	4	5	4	4		48	48
R3		4	4	4	4	5		48	49
R4		8	9	7	8	8		47	48
R5		9	11	11	10	11		48	48
R6		6	7	8	7	8		48	49
R7		2	2	2	3	3		48	48
R8		2	4	3	4	3		47	47
R9		1	2	3	2	3		49	49
Annual average PM_{10} (µg/m^3)									
R1	25	0.2	0.6	0.5	0.6	0.5	22	22	22
R2		0.7	1.0	0.9	1.0	0.9		22	22
R3		0.8	0.9	0.8	1.0	1.0		22	22
R4		1.3	1.3	1.1	1.5	1.3		22	22
R5		2.0	2.4	2.2	2.7	2.6		22	22
R6		1.4	1.6	2.0	2.0	2.0		22	22
R7		0.4	0.5	0.4	0.5	0.5		22	22
R8		0.3	0.6	0.4	0.6	0.4		22	22
R9		0.1	0.3	0.4	0.3	0.4		22	22

[1] This is the background level plus the difference between the 'with project' and 'without project' scenarios

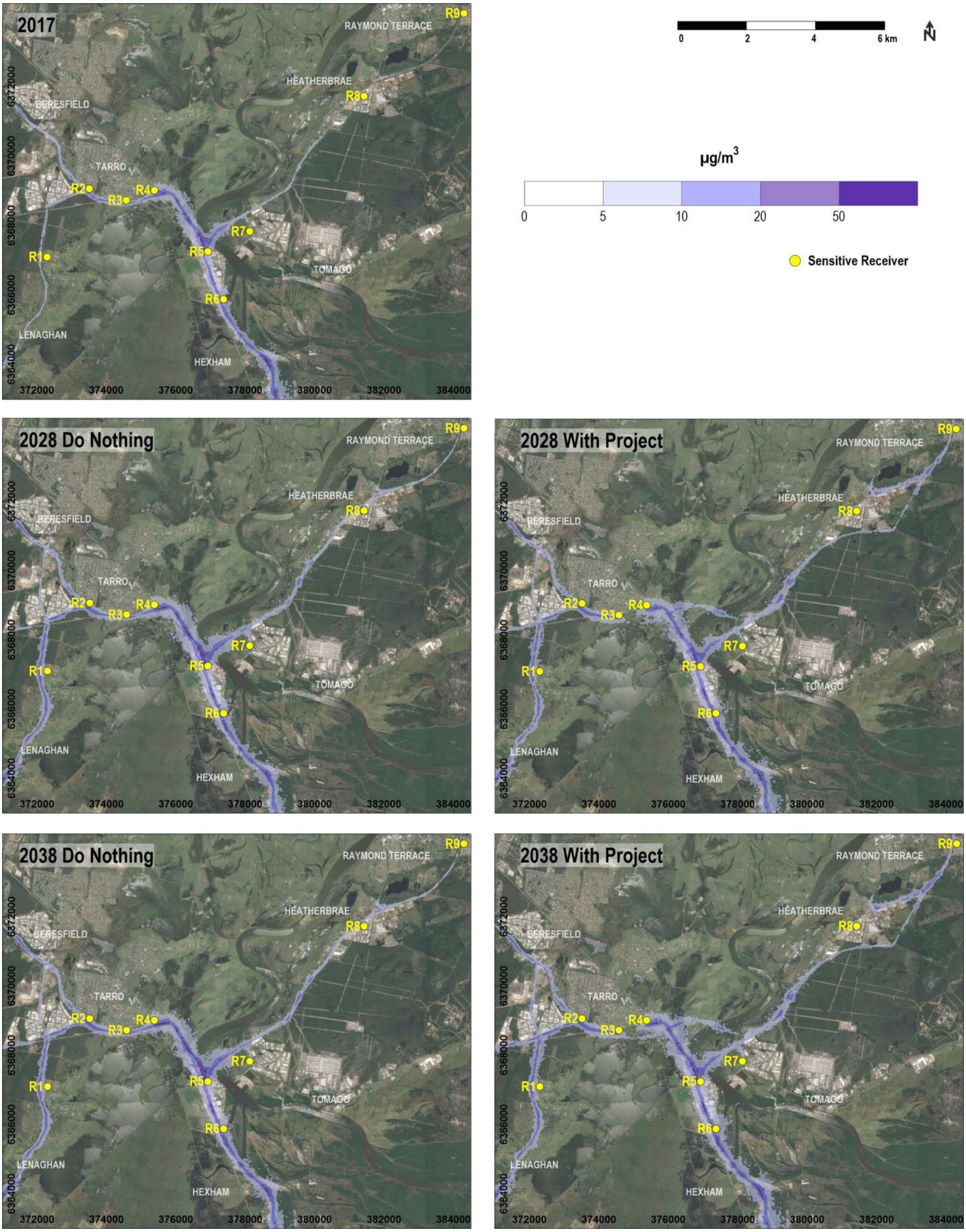

Figure 18-12 Predicted maximum 24-hour average PM_{10}

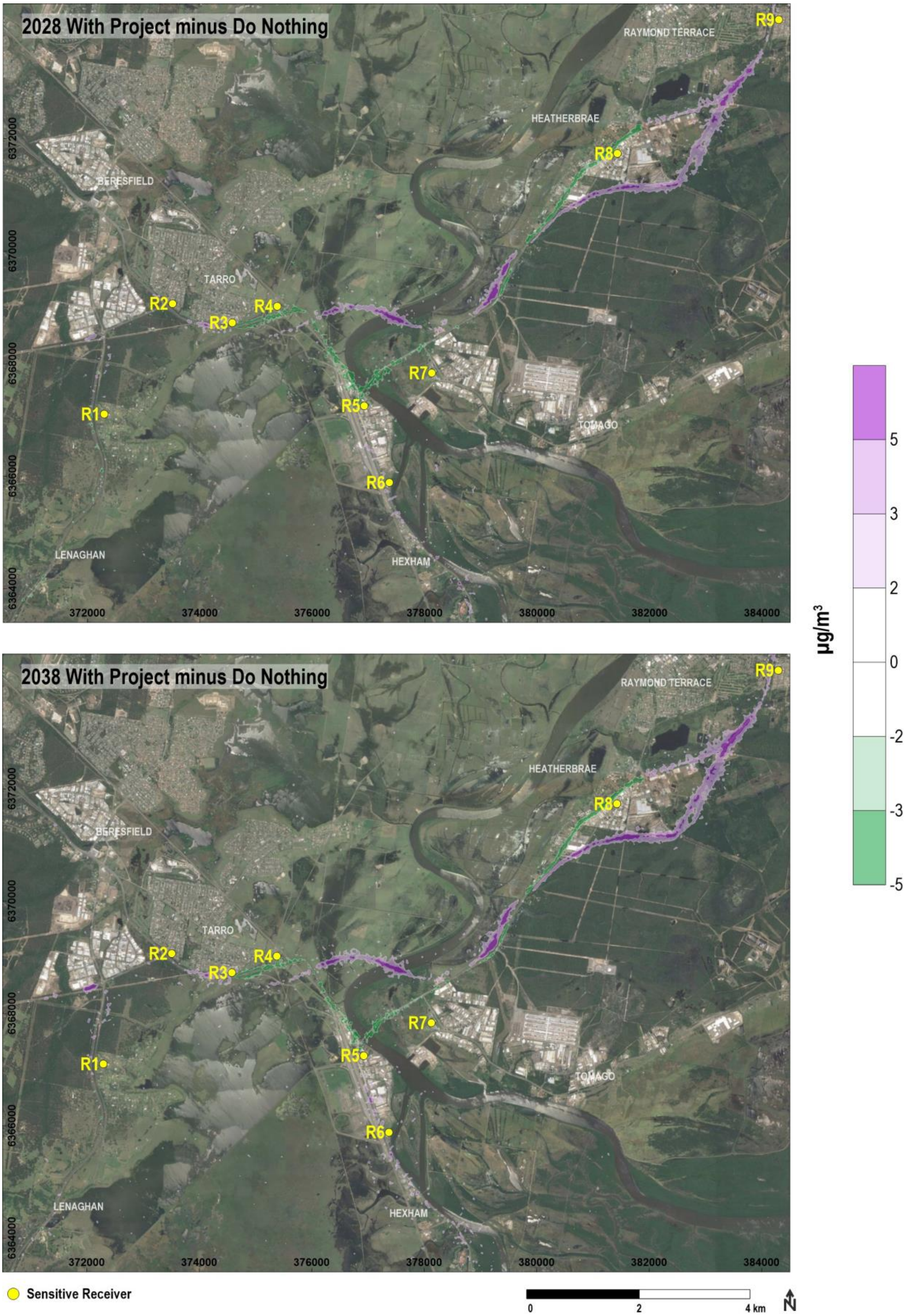

Figure 18-13 Predicted change in maximum 24-hour average PM_{10}

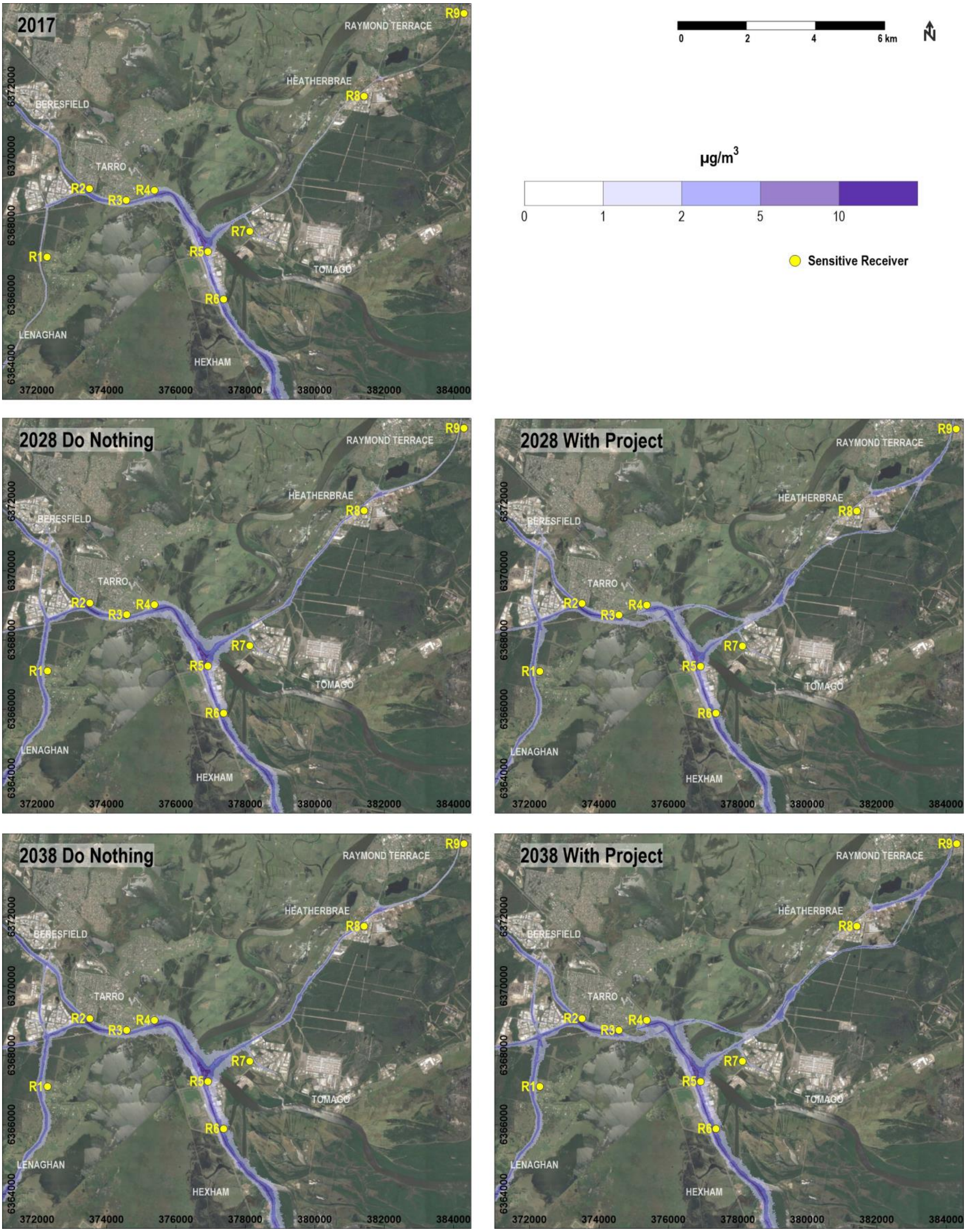

Figure 18-14 Predicted annual average PM_{10}

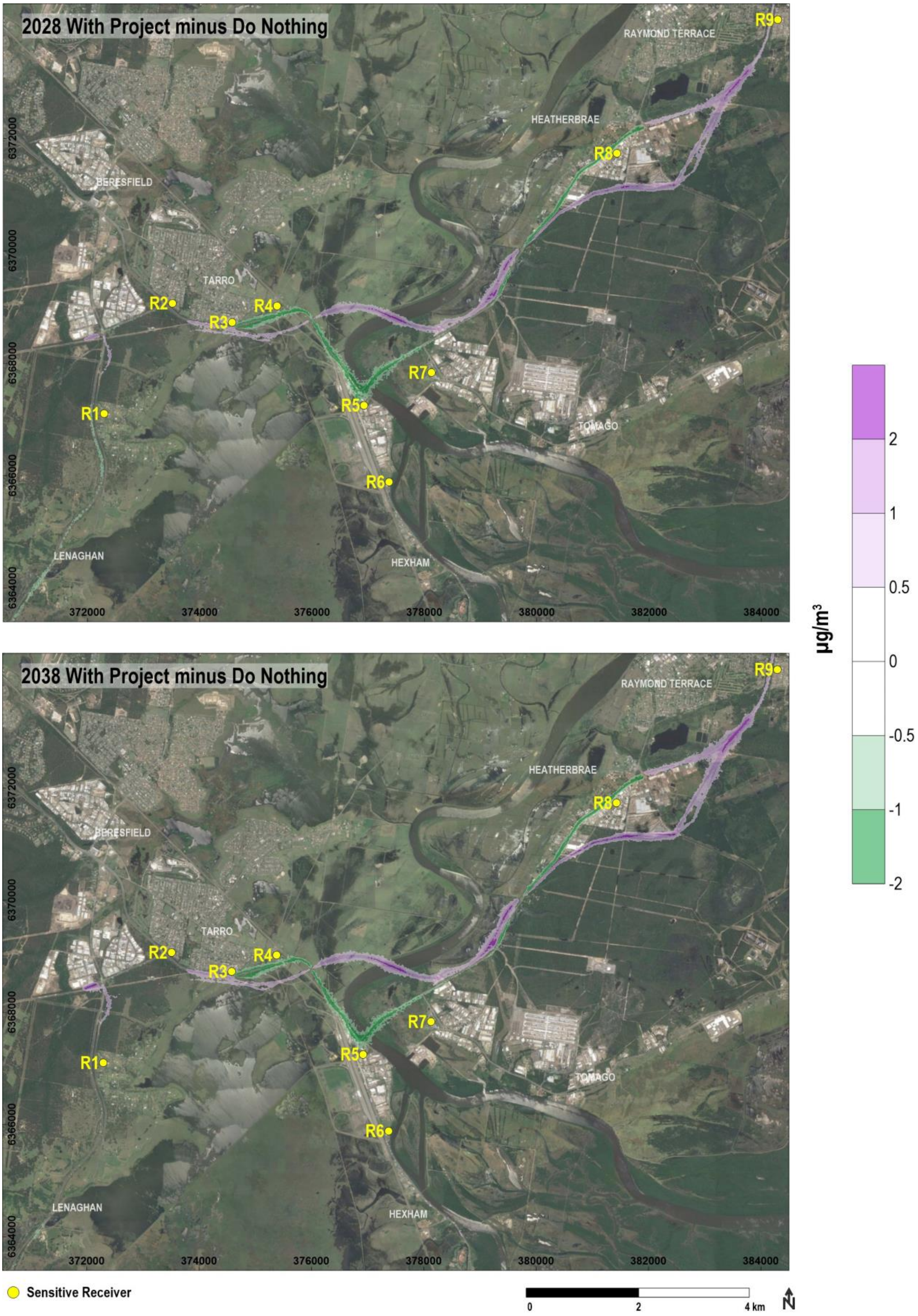

Figure 18-15 Predicted change in annual average PM_{10}

PM2.5

As described in **Section 18.2.4**, the potential for $PM_{2.5}$ impacts has been assessed by assuming that 100 per cent of the PM_{10} is $PM_{2.5}$. **Figure 18-13** and **Figure 18-15** show model predictions of PM_{10} concentrations. On the assumption that all PM_{10} is $PM_{2.5}$, the contribution of emissions discussed for $PM_{2.5}$ would be the same as the contribution of emissions for PM_{10} discussed above.

A comparison of existing background levels to the predicted cumulative with-project concentrations shows that the predicted changes in $PM_{2.5}$ concentrations due to the project represent less than five per cent of the criteria contained within the Approved Methods. The predicted changes in $PM_{2.5}$ concentrations are within the range of historically measured fluctuations in $PM_{2.5}$ concentrations for the region.

Table 18-15 provides a summary of the model results for selected sensitive receivers. These results show that, at the selected sensitive receivers located near main roads along the main alignment, the project would lead to very little change to maximum 24-hour and annual average $PM_{2.5}$ concentrations, relative to background levels, as this is where traffic is already concentrated. Background particle levels (as $PM_{2.5}$) have historically exceeded the criteria contained within the Approved Methods, particularly in recent years due to the widespread, intense drought and smoke from bushfires and hazard reduction burning. The project would not cause additional exceedances of the criteria.

The change in annual average $PM_{2.5}$ concentration is a key metric for assessing the risk to human health. An increment change in annual average $PM_{2.5}$ of 1.7µg/m^3 has recently been determined as the criterion to manage the risk of all-cause mortality below one in 10,000 (ERM 2020). None of the selected sensitive receivers identified in **Table 18-15** are expected to experience increases in $PM_{2.5}$ concentrations above 1.7µg/m^3 due to the project, relative to either the 2017 baseline or the future without project scenarios.

Table 18-15 Predicted $PM_{2.5}$ concentrations at selected sensitive receivers

Location	Criterion	Concentration due to modelled sources					Background level	Cumulative with project concentrations[1]	
		2017	2028DN	2028WP	2038DN	2038WP		2028	2038
Maximum 24-hour average $PM_{2.5}$ (µg/m^3)									
R1	25	2.0	3.5	3.1	3.2	3.2	28	28	28
R2		3.5	4.4	4.7	3.6	4.0		28	28
R3		3.8	4.2	3.8	4.2	5.0		28	29
R4		8.2	8.6	7.4	8.0	8.2		27	28
R5		9.0	10.7	10.6	10.5	11.0		28	28
R6		5.7	7.5	8.0	6.7	7.9		28	29
R7		2.2	2.5	2.5	2.5	2.9		28	28
R8		2.4	3.5	2.8	3.6	2.7		27	27
R9		1.2	1.7	2.9	2.0	2.9		29	29

Location	Criterion	Concentration due to modelled sources					Background level	Cumulative with project concentrations[1]	
		2017	2028DN	2028WP	2038DN	2038WP		2028	2038
Annual average $PM_{2.5}$ (µg/m^3)									
R1	8	0.2	0.6	0.5	0.6	0.5	8.7	8.6	8.7
R2		0.7	1.0	0.9	1.0	0.9		8.6	8.6
R3		0.8	0.9	0.8	1.0	1.0		8.6	8.7
R4		1.3	1.3	1.1	1.5	1.3		8.5	8.5
R5		2.0	2.4	2.2	2.7	2.6		8.5	8.6
R6		1.4	1.6	2.0	2.0	2.0		9.1	8.7
R7		0.4	0.5	0.4	0.5	0.5		8.6	8.7
R8		0.3	0.6	0.4	0.6	0.4		8.4	8.5
R9		0.1	0.3	0.4	0.3	0.4		8.8	8.9

[1] This is the background level plus the difference between the 'with project' and 'without project' scenarios

Air toxics

Table 18-16 presents the predicted air toxics concentrations for each emissions scenario at selected sensitive receivers. These results show that, at the selected sensitive receivers along the main alignment, air toxic concentrations would not exceed criteria contained within the Approved Methods (refer to **Table 18-2**). Lower concentrations are predicted at locations further from main roads. It is therefore concluded that the project would not lead to any adverse air quality impacts with regards to air toxics.

Table 18-16 Predicted air toxics concentrations at selected sensitive receivers

Selected sensitive receiver ID	Criterion	Concentration due to modelled sources under each scenario				
		2017 base (Existing conditions)	2028 Do Nothing	2028 With Project	2038 Do Nothing	2038 With Project
Maximum 1-hour average benzene (µg/m^3)						
R1	29	2	3	3	2	3
R2	29	4	4	3	3	3
R3	29	4	3	3	3	3
R4	29	7	6	6	5	5
R5	29	8	5	6	5	6
R6	29	7	5	6	4	5
R7	29	3	2	3	2	2
R8	29	2	3	2	2	2
R9	29	2	2	2	2	2

Selected sensitive receiver ID	Criterion	Concentration due to modelled sources under each scenario				
		2017 base (Existing conditions)	2028 Do Nothing	2028 With Project	2038 Do Nothing	2038 With Project
Maximum 1-hour average formaldehyde (µg/m^3)						
R1	20	0.6	0.9	0.9	0.6	0.8
R2	20	1.0	1.0	0.7	0.8	0.9
R3	20	1.0	0.8	0.8	0.8	0.9
R4	20	2.0	1.5	1.7	1.3	1.5
R5	20	2.1	1.4	1.7	1.4	1.6
R6	20	1.8	1.2	1.6	1.2	1.4
R7	20	0.7	0.7	0.7	0.6	0.5
R8	20	0.7	0.9	0.6	0.6	0.5
R9	20	0.6	0.4	0.6	0.5	0.6
Maximum 1-hour average toluene (µg/m^3)						
R1	360	2.0	3.2	3.3	2.0	2.9
R2	360	3.6	3.6	2.5	2.8	3.0
R3	360	3.3	2.8	2.8	2.9	3.1
R4	360	6.9	5.2	5.8	4.6	5.2
R5	360	7.2	5.0	6.1	4.8	5.8
R6	360	6.2	4.4	5.7	4.1	4.9
R7	360	2.5	2.3	2.6	2.1	1.7
R8	360	2.3	3.0	2.1	2.2	1.6
R9	360	2.0	1.5	2.1	1.7	2.2
Maximum 1-hour average xylene (µg/m^3)						
R1	190	1.5	2.4	2.4	1.5	2.1
R2	190	2.6	2.7	1.8	2.0	2.2
R3	190	2.4	2.1	2.1	2.2	2.3
R4	190	5.0	3.8	4.2	3.4	3.8
R5	190	5.2	3.7	4.5	3.5	4.2
R6	190	4.5	3.2	4.2	3.0	3.6
R7	190	1.8	1.7	1.9	1.5	1.2
R8	190	1.7	2.2	1.5	1.6	1.2
R9	190	1.5	1.1	1.5	1.3	1.6

Selected sensitive receiver ID	Criterion	Concentration due to modelled sources under each scenario				
		2017 base (Existing conditions)	2028 Do Nothing	2028 With Project	2038 Do Nothing	2038 With Project
Maximum 1-hour average PAHs as benzo(a)pyrene µg/m^3						
R1	0.4	0.05	0.08	0.08	0.05	0.07
R2	0.4	0.09	0.09	0.06	0.07	0.07
R3	0.4	0.08	0.07	0.07	0.07	0.08
R4	0.4	0.17	0.13	0.14	0.11	0.12
R5	0.4	0.17	0.12	0.15	0.12	0.14
R6	0.4	0.15	0.11	0.14	0.10	0.12
R7	0.4	0.06	0.05	0.06	0.05	0.04
R8	0.4	0.06	0.07	0.05	0.05	0.04
R9	0.4	0.05	0.04	0.05	0.04	0.05

18.5 Environmental management measures

The environmental management measures that will be implemented to minimise the air quality impacts of the project, along with the responsibility and timing for those measures, are presented in **Table 18-17**.

Table 18-17 Environmental management measures (air quality)

Impact	Reference	Management measure	Responsibility	Timing
Adverse air quality during construction	AQ01	Preparation and implementation of an Air Quality Management Plan (AQMP) to minimise risks to air quality. The AQMP will identify: • Potential sources of air pollution (including odours and dust) during construction • Air quality management objectives consistent with relevant published guidelines • Identification of all dust and odour sensitive receivers • Measures to manage dust • Requirements to separate temporary project specific asphalt batching plants, if feasible, from the nearest residences by at least 300m • Community notification and complaint handling procedures.	Contractor	Detailed design/ prior to construction