In the Environment Court of New Zealand
Auckland Registry

I Mua I Te Kōti Taiao O Aotearoa
Ki Tāmaki Makaurau

ENV-2023-AKL-160

Under	the Resource Management Act 1991
In the matter of	An application for a direct referral to the Environment Court under section 87G of the Act for an order granting the applicant's resource consent applications to construct and operate a new asphalt plant at 54 Aerodrome Road, Mt Maunganui, together with an application for consent to authorise the continued operation of the existing asphalt plant on the site pending construction of the new plant
Between	**Allied Asphalt Limited**
	Applicant
And	**Bay of Plenty Regional Council and Tauranga City Council**
	Consent Authorities

Statement of Evidence of Jennifer Simpson

Date: 29 February 2023

Counsel acting:
Stephen Christensen
Project Barrister
421 Highgate, Dunedin 9010
p 027 448 2325
stephen@projectbarrister.nz

Qualifications and experience

1 My full name is Jennifer Mary Simpson.

2 I hold the position of Technical Director - Environmental Engineering at Tonkin & Taylor Ltd (**T+T**). My qualifications are a Bachelor of Engineering (Chemical and Materials) and a Diploma in Environmental Management, both from the University of Auckland. I am a Life Member of the Clean Air Society of Australia and New Zealand and a member of the Professional Accreditation Review Panel.

3 I have over 25 years' experience in environmental engineering and was employed as a specialist in air quality and hazardous substances management at T+T in January 1998.

4 My previous work experience includes the preparation of air quality assessments for a wide range of industrial processes. I am familiar with the air quality issues in the Mount Maunganui area and have been involved in recent Environment Court proceedings in relation to the Bay of Plenty Regional Natural Resources Plan Change 13 (Air Quality) and the Port of Tauranga Limited application to extend berthing facilities at the Port.

5 My role in relation to Allied Asphalt Limited's (**Allied**) application for resource consents for a new asphalt plant and the continued operation of an existing plant pending construction of the new plant at 54 Aerodrome Road, Mt Maunganui (**Application**) has been to provide advice in relation to air quality effects. I was the technical lead for the Air Quality Assessment (**AQA**) report to the Assessment of Environment Effects (**AEE**) accompanying the Application, which appears at Appendix 6 of the AEE, the preparation of further information (**S92 response**) and the Updated Air Quality Assessment (**Updated AQA**) dated January 2024.

6 My assessment is based upon the proposal description provided in the planning evidence of Mr Craig Batchelar.

7 In preparing this statement of evidence I have considered the following documents:

(a) the AEE accompanying the Application;

(b) submissions relevant to my area of expertise;

(c) the statement of evidence on health risk prepared by Dr Denison;

(d) planning and regulatory provisions relevant to the management of air quality effects; and

(e) section 87F report.

8 I have visited the site on several occasions and the wider Mt Maunganui industrial area on more than 10 occasions.

Code of Conduct for Expert Witnesses

9 I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

10 This statement of evidence addresses the following:

(a) the existing air quality environment in the Mount Maunganui area

(b) The key differences between the existing and proposed asphalt plants as they relate to air quality effects;

(c) the key findings of my assessment of effects, including additional analysis to respond to questions that arose from mediation and the Council's review of the Updated AQA;

(d) additional information requested by parties during mediation

(e) matters raised by submitters on the Application;

(f) matters raised in the Bay of Plenty Regional Council and Tauranga City Council s87F report; and

(g) Proposed conditions of consent for air discharge.

Executive Summary

11 Allied Asphalt Limited is applying for resource consent to authorise the continuation of discharges to air from the existing asphalt plant for a period of no more than 2 years from the granting of consent, to enable the construction and commissioning of a new asphalt plant, which would be authorised by a separate resource consent. The proposed conditions would preclude the operation of the new asphalt plant at the same time as the existing plant (Proposed Condition 3 of air discharge consent for new plant).

12 The proposed asphalt plant has a different configuration to the existing plant (batch plant compared to continuous drum plant), improved engineering controls that include a baghouse for particulate control, a taller stack and will operate on natural gas rather than used oil (although Allied needs to retain the ability to use diesel in the future if necessary). Together, these improvements will mean the proposed asphalt plant will have significantly lower emissions of particulate matter and odour compared to the existing plant.

13 In my opinion, the key air quality issues for this application are:

(a) Particulate matter, because the site is located in the Mount Maunganui airshed which is a polluted airshed for PM_{10} under the National Environmental Standards for Air Quality; and

(b) Odour, because current impacts of asphalt odours, which are likely to be a combined effect of the existing Allied and Higgins asphalt plants, are a key concern for submitters.

14 With the replacement of the existing asphalt plant, the effects of emissions from the Site on both PM_{10} and $PM_{2.5}$ air quality will be reduced to levels that can be described as insignificant (less than 5%) compared to relevant New Zealand assessment criteria and the WHO 2021 air quality guidelines. The improved controls over particulate emissions compared to the existing plant will result in a net decrease of PM_{10} emissions into the Mount Maunganui airshed, as well as a lower effect on PM_{10} air quality.

15 The effects of odour have been assessed using dispersion modelling and other qualitative assessment techniques consistent with good practice guidance. This assessment shows that:

(a) For the existing asphalt plant, there is the potential for localised odour effects close to the plant and also in the residential area northeast of the Site. As such, I consider a maximum term of 2 years to enable the new asphalt plant to be constructed and commissioned is appropriate to minimise odour effects.

(b) The modelled concentrations of odour from the proposed plant based on odour emissions from a similar plant in Laverton, Melbourne, are an order of magnitude below the odour modelling criteria at all locations and therefore it is very unlikely that the proposed plant would cause odours that might be considered offensive or objectionable either in the neighbouring industrial area or the more distant residential area. Odour emissions may be higher when the plant is processing reclaimed asphalt pavement (RAP). However, odour dispersion modelling indicates that the impacts will remain well below (50%) the relevant odour modelling assessment criterion and would not result in offensive or objectionable effects.

16 The worst-case impacts of both the existing and proposed asphalt plants on NO_2 air quality when operating on natural gas are similar. The worst-case impacts of the proposed plant would be higher than from the existing plant if it proves necessary to operate the plant on diesel. A conservative assessment of the effects of NO_2 shows that the emissions from the existing and proposed asphalt plants would not contribute to exceedances of the relevant New Zealand assessment criteria. A quantitative assessment of NO_2 emissions for comparison with the WHO 2021 air quality guidelines is more difficult because of the absence of monitoring data for existing NO_2 concentrations and the complications of accounting for atmospheric chemistry. However, assessments using several different methods suggest that the effects of the proposed asphalt plant will be small compared to the WHO 2021 guidelines.

17 SO_2 air quality has been identified as an issue of concern in parts of the Mount Maunganui area related to emissions from shipping and other industrial sources. The effects of emissions from the new asphalt plant on SO_2 air quality can be described as insignificant (less than 5%) compared to relevant New Zealand assessment criteria and the WHO 2021 guidelines.

18 The proposed asphalt plant will incorporate a number of design improvements and controls to minimise discharges of contaminants to air, in particular particulate matter and odour, to the greatest extent practicable and to ensure adequate dispersion to further minimise effects. To my knowledge, these measures are best industry practice in Australasia and I consider they are the best practicable option to minimise discharges to air.

Key differences between the existing and proposed asphalt plants for air quality

19 Allied is applying for resource consent to authorise the continuation of discharges to air from the existing asphalt plant for a period of no more than 2 years from the granting of consent, to enable the construction and commissioning of a new asphalt plant, which would be authorised by a separate resource consent. The proposed conditions would preclude the operation of the new asphalt plant at the same time as the existing plant (Proposed Condition 3 of air discharge consent for new plant).

20 I will briefly summarise the key differences between the existing and proposed asphalt plants that are relevant to air quality effects.

21 **Particulate matter emissions** – the proposed asphalt plant will have a baghouse for particulate control, which will be more efficient than the wet scrubber on the existing plant.[1] This will enable the consented emissions of particulate matter to be reduced by almost two thirds.

22 **Odour** emissions – odours from asphalt plants principally arise from the hot bitumen. The proposed plant will be a batch mix plant[2]. Batch mix plants generate less odour than drum mix asphalt plants (like the existing plant) because the bitumen is not exposed to high temperatures within eh drying drum[3]. Two key additional engineering controls will be used to minimise odours:

(a) Odours from the mixing unit will be drawn back into the dryer burner (prior to being vented through the baghouse and stack), which will thermally oxidise (burn) odorous compounds.

(b) Vapours from the hot mix storage and asphalt loadout area will be extracted through a bluesmoke aerosol treatment system to remove condensable organics prior to discharge to the combined stack.

23 Based on stack testing of an asphalt plant with the same configuration (in Laverton, Australia), odour emissions from the proposed asphalt plant are expected to be an order of magnitude lower than from the existing plant.

24 **Fuel** – the existing asphalt plant uses used lubricating oil (**ULO**) as a fuel. Allied intends to operate the new asphalt plant on natural gas. However, given the uncertainty in availability and cost of natural gas in the longer term, Allied wishes to retain the ability to use diesel or biodiesel. In relation to air emissions, key differences in the fuel used are:

(a) ULO can contain greater amounts of sulphur and metals compared to natural gas or diesel, so emissions of these contaminants will be reduced by the change to natural gas (or diesel).

(b) Both natural gas and diesel are considered to be low sulphur fuels (up to 50 ppm sulphur and 10 ppm sulphur respectively, compared to 50,000 pm for ULO).

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[1] Allied has proposed that the consent limit be reduced from 4.2 kg/hour Total Suspended Particulate (TSP) to 1 kg/hour PM_{10} (which is equivalent to approximately 1.25 kg/hour TSP).

[2] Batch mix - the aggregate drying and blending of bitumen with the aggregate are undertaken in separate vessels

[3] Drum mix – A single vessel is used to dry the aggregate and mix the aggregate with the hot bitumen. This exposes the bitumen to higher temperatures resulting in greater odour emissions.

(c) Published emission factors for of oxides of nitrogen (NOx) from asphalt plants are about half as much for burning natural gas compared to liquid fuels (diesel or ULO).

25 Overall, natural gas is the optimal fuel for the new asphalt plant to minimise discharge to air. Although sulphur dioxide (SO_2) emissions are slightly higher from burning natural gas compared to diesel the effects of SO_2 are small compared to air quality guidelines and standards (as discussed in paragraph 70). The assessment shows that the effects of emissions from use of both natural gas and diesel in the proposed asphalt plant are well within acceptable levels.

26 **Stack height** – there will be improved dispersion and dilution of residual emissions from the proposed plant because of the taller stack height (27.6 m compared to the existing plant 18 m). The improved dispersion is particularly relevant to minimising effects of odour in the industrial area around the site.

27 **Production capacity** – The consent for the existing asphalt plant does not include any constraints on production capacity. Similarly, the original consent applications for the short-term consent and the consent for the new plant did not propose any constraints on production. Allied has subsequently revised its application for the proposed plant and proposed daily and annual production limits (3,500 tonnes per day and 300,000 tonnes per annum) that prescribe the maximum that may occur over the term of consent being sought. The actual amount of asphalt production will continue to be driven by demand, which is variable as it is a mix of smaller jobs and occasional large projects, such as major roading or construction works. This is described in more detail in the evidence of Brian Palmer.

28 The maximum capacity of the proposed plant is 200 tonnes per hour compared to 80 tonnes per hour for the existing plant. This means that the new plant will be able to meet the required production in less time than the existing plant. As the plant will operate fewer hours (for the same output), this reduces the likelihood of emissions occurring during worst case meteorological conditions. However, it also means that emission rates of some contaminants, such as oxides of nitrogen (NOx), which are assumed to be proportional to production/fuel consumption, are slightly higher than from the current smaller plant. The assessment shows that the effects of emissions on short term average concentrations are well within acceptable levels.

The existing environment

29 Since 2019, BOPRC has undertaken air quality monitoring, predominantly for PM_{10} and SO_2, at a number of sites in the Mount Maunganui area. The monitoring is largely focussed on measuring air quality in locations influenced by industrial emissions. A plan of the monitoring sites and parameters measured is included in Attachment One.

30 The Mt Maunganui airshed is a polluted airshed for PM_{10} under the National Environmental Standards for Air Quality (**NESAQ**). This means that air quality exceeds the Ambient Air Quality Standard (**AAQS**) for PM_{10} of 50 $\mu g/m^3$ (24-hour average) on more than one occasion in a 12-month period. The airshed will remain polluted until there has been a 5-year period with no more than one exceedance.

31 The most recent report by BOPRC summarising the available data and trends covers the period up to the end of 2022.[4] The data shows that air concentrations of PM_{10} at the different monitoring sites are variable, reflecting the influence of localised sources at some locations.

32 The closest BOPRC monitor (for PM_{10}) to the Allied site is located at De Havilland Way. The De Havilland Way (also sometimes referred to as Aerodrome Road) monitoring site is approximately 500 m southeast of the Site.

33 The BOPRC monitoring report highlights the adjacent bulk storage/processing operation as the likely source of elevated levels PM_{10} at De Havilland Way. Theil Sen regression analysis, which is a statistical technique to identify trends in data, does not identify any apparent trends in the PM_{10} concentrations recorded at De Havilland Way over the period 2019 to 2022.[5] This is consistent with the annual average concentration remaining between 18 and 20 $\mu g/m^3$ (24-hour average) over this time. Validated data for the 2023 period is not yet available on the BOPRC environmental data portal.

34 Reported exceedances of the 24-hour AAQS value for PM_{10} at De Havilland Way (that are not related to “exceptional circumstances”) occurred in 2019 (three occasions) and on 31 January 2023 (daily average of 51 $\mu g/m^3$).[6]

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[4] Bay of Plenty Regional Council. (2023). Ambient air quality update 2023

[5] Ibid, p 75

[6] Ibid, p 106

35 The De Havilland Way monitoring data reflects existing levels of PM_{10} air pollution and will therefore include any effects of the existing Allied asphalt plant. Therefore, the measurements do not reflect “background” air quality, which is air quality in the absence of effects from the Site. Measurements at De Havilland Way also do not reflect background air quality at locations further from the influence of localised industrial sources.

36 There is no air quality monitoring of other contaminants in the vicinity of the Site. Appendix A of the Updated Air Quality Assessment outlines the various techniques that have been used to estimate a representative “background” air quality value. I will discuss appropriate background concentrations for the key contaminants included in the air quality assessment later in my evidence.

Assessment approach

37 The effects of the existing asphalt plant (ULO fuel) and the proposed asphalt plant (natural gas and diesel fuel) have been assessed using the CALPUFF air dispersion model. CALPUFF is commonly used in New Zealand for air quality assessments and is one of the internationally accepted dispersion models. The modelling uses a 3-year meteorological dataset prepared by the Bay of Plenty Regional Council (BOPRC) for 2014 to 2016 for use in the CALPUFF model.

38 At mediation, a question was raised about the implications of a comment in the Updated AQA that the windrose for the Site prepared using data from the modelling meteorological dataset contained a higher proportion of wind speeds greater than 5 m/s compared to the observed data from the Tauranga Airport Automated Weather Station (AWS).[7] The inference is that the modelled data may contain a higher frequency of high wind speeds that will better disperse pollutants and may therefore underestimate pollutant concentrations.

39 In the dispersion modelling, the wind patterns that give rise to worst case ground level concentration are, broadly, low to moderate wind speeds in the range 1.5 to 4 m/s. In the modelling meteorological dataset (for the three years), the percentage of winds between 1.5 and 4 m/s is 36%.

40 The Tauranga Airport AWS was relocated in March 2023 to a location approximately 580 m south (on the other side of the runway) of its previous location behind and to the west of the airport terminal. Comparing annual

[7] Tonkin and Taylor. (2024). Updated air quality assessment – Existing and proposal asphalt plants, Mt Maunganui. Footnote 10 on page 7

wind roses from the Tauranga Airport AWS for 2021 to 2023, the more recent 2023 data contains a higher frequency of wind speeds greater than 5 m/s compared to 2021 and 2022 and the wind rose is closer to the model data-generated wind rose for the Site (see Attachment Seven). Although I cannot be certain, this suggests the previous Tauranga AWS location may have been subject to some wind shading from nearby buildings (i.e. rather than the model overstating the frequency of higher winds, the Tauranga Airport AWS may have been understating them).

41 The percentage of winds between 1.5 and 4 m/s in the 2023 Tauranga AWS dataset is 40%, which is very close to the frequency in the modelling data (36%). As such, this gives me some confidence that worst case meteorological conditions are appropriately represented and the model is unlikely to be biased towards under-reporting pollutant concentrations.

42 The dispersion modelling assessment considers the envelope of effects that would be authorised by the consents. This is the appropriate basis to assess effects for consenting purposes, even though the modelled effects will be greater than the effects that will actually occur, from either the existing or proposed plants.

43 The dispersion modelling assessment assumes continuous operation at maximum production capacity for both the existing and proposed plants. This approach is conventionally used to represent the maximum envelope of effects that would be permitted by a resource consent. This will overstate the air quality effects of both the proposed and existing plants.

44 For the proposed asphalt plant, the proposed maximum annual production of 300,000 tonnes would be achieved in about 2,500 hours at a typical production rate of 120 tonnes per hour. This means that even if the plant is operating to produce the maximum annual asphalt production allowed by the proposed consent it is unlikely to be operating about two thirds of the time. A more realistic (lower) estimate of the effects of emissions from the asphalt plants, would require a probabilistic assessment of the meteorological conditions (and resulting effects at each receptor) occurring in each hour of plant operation.[8] Given the very low model predictions, based on continuous operation at maximum production capacity, compared to assessment criteria I do not consider that the detailed work to undertake a probabilistic assessment (that would generate more realistic, lower estimates of effects) is warranted. However, the conservativism in the

[8] For example a Monte Carlo simulation where many hundreds of thousands of hourly model outputs would be randomly selected to determine the probability distribution of the annual average concentration.

assessment, should be considered when evaluating the model predictions and drawing conclusions.

45 The dispersion modelling results have been compared with assessment criteria selected in accordance with recommended good practice guidance.[9] This includes the use of current New Zealand ambient air quality guidelines and standards as primary assessment criteria. For odour, the modelling results have been compared with recommended odour modelling assessment criteria.[10]

46 The modelling results have also been compared against the World Health Organization (WHO) 2021 air quality guidelines (WHO 2021 guidelines). The WHO 2021 guidelines are generally lower than the current New Zealand air quality standards and guidelines. The WHO 2021 guidelines are intended to be used as science-based recommendations to policymakers at a national or local level for consideration in setting their own standards and frameworks for managing air pollution. They were not developed to be used as assessment criteria for site-specific operations but for the purpose of assisting countries and agencies to manage population exposure to air pollution. At the time of writing, the Ministry for the Environment has not provided any indication of the regulatory or policy response in New Zealand to the WHO 2021 guidelines.

47 Consistent with recommended good practice, the model predictions have been assessed at locations where people can be exposed for the relevant averaging period.[11] In practice this means that 1-hour average exposure is considered anywhere beyond the site boundary whereas 24-hour and annual average exposure is generally only relevant for residential locations. A more conservative approach has been adopted for childcare centres and schools. Long term exposure at these locations has been considered even though people cannot be present continuously. This is particularly relevant for annual average concentrations where the most impacted receptor considered in the assessment is a preschool located at 1 MacDonald Street. Modelled concentrations at residential locations where people could be present continuously over an entire year are lower than at this location.

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[9] Ministry for the Environment. (2016a). Good practice guide for assessing discharges to air from Industry. Wellington. p 57

[10] Ministry for the Environment. (2016b). Good practice guide for assessing and managing odour. Wellington. p 51

[11] Ministry for the Environment. (2016). Good practice guide for assessing discharges to air from Industry. Wellington p 47

48 The model predictions have been added to representative background concentrations of pollutants (intended to represent air quality in the absence of the effects of the existing plant) to provide a simplified assessment of cumulative effects.

49 The modelled concentrations of almost all pollutants are lower for the proposed plant compared to the existing plant and the incremental effects of both plants are small compared to assessment criteria. In this statement I will focus on the key aspects of the air quality assessment, which I consider are:

(a) The effects of emissions of PM_{10} and $PM_{2.5}$, which are a key issue for this application because the Mt Maunganui airshed is a polluted airshed with respect to PM_{10}.

(b) The effects of emissions of SO_2, because SO_2 air quality has been identified as an issue of concern in the airshed related to emissions from shipping and other industrial sources.

(c) The effects of benzene and nitrogen dioxide (NO_2) because the modelled worst-case effects of the proposed plant for these contaminants are marginally higher than from the existing plant. In the case of NO_2 this principally relates to the operation of the plant on diesel, not natural gas. The modelled effects of the proposed plant using natural gas on NO_2 air quality are similar to the modelled effects of the existing plant.

Fine particulate matter (PM_{10} and $PM_{2.5}$)

50 The modelling assessment of PM_{10} and $PM_{2.5}$ emissions is based on the proposed consent limits for both the existing and proposed plants (so are not sensitive to the fuel used) and assumes PM_{10} and $PM_{2.5}$ comprise 80% and 40% of TSP, respectively.

51 The model results for PM_{10} and $PM_{2.5}$ are compared with relevant New Zealand assessment criteria and the WHO 2021 guidelines in Table 2-1 and Table 2-2, respectively, in Attachment Two. The worst case predicted concentration from the asphalt plant emissions at any relevant sensitive receptor is referred to as the Maximum Ground Level Concentration (**MGLC**).

52 The key points in relation to the modelled effects of PM_{10} and $PM_{2.5}$ emissions from the Site are that:

(a) The incremental effects of the existing asphalt plant on PM_{10} and $PM_{2.5}$ air quality are generally low (less than 10%) compared to relevant New Zealand assessment criteria.

(b) The only incremental effect that is greater than 10% of any assessment criterion is the effects of the existing asphalt plant on 24-hour average $PM_{2.5}$ (14.7% of the WHO 2021 criterion).

(c) With the replacement of the asphalt plant, the effects of emissions from the Site on both PM_{10} and $PM_{2.5}$ air quality will be reduced to levels that can be described as insignificant (less than 5%) compared to relevant New Zealand assessment criteria and the WHO 2021 guidelines.

53 To assess cumulative effects of PM_{10} and $PM_{2.5}$, the modelled concentrations have been added to a nominal background concentration. This is a screening approach that does not take into account the temporal and spatial variation in air quality. Another approach that can be used (which takes into account temporal, but not spatial variability) is to add contemporaneous hourly background data to the hourly model outputs. In theory this could be done using the monitoring data at De Havilland Way to demonstrate cumulative effects at that location (noting that the effects of the existing asphalt plant would need to be removed).

54 However, contemporaneous modelling can only be done where there is monitoring data available for the same year(s) as the modelling (2014 to 2016). I understand that the only available particulate monitoring data that overlaps with these years is Total Suspended Particulate (TSP) at Totara Street. Therefore, this analysis would require remodelling the Site emissions for a year where PM_{10} monitoring data is available.

55 I understand that BOPRC has made a modelling meteorological dataset for the 2021 year available, which could be used for a contemporaneous assessment. However, given the very low level of effects of the proposed plant, I do not consider additional modelling is warranted as it is unlikely to alter the conclusions.

56 In 2020, the BOPRC provided me with recommended background PM_{10}, $PM_{2.5}$ and SO_2 concentrations to use in the AQA. These were based on monitoring data available at the time from the BOPRC air quality monitoring stations at De Havilland Way, Whareroa Marae, Sulphur Point and Bridge Marina. For 24-hour average concentrations, the recommended values are based on the 98th percentile of the available data at the time considering all these sites. I understand the industrial sites adjacent to the Port were deliberately excluded as the data is overly influenced by local emission

sources. However, the inclusion of data from De Havilland Way contradicts this approach (see paragraph 33).

57 The use of a 98th percentile is a technique to avoid the overly conservative approach of adding worst case modelled concentrations to worst case background concentrations. I consider this approach is reasonable unless the emission and dispersion characteristics are such that these peaks are likely to occur at the same time.

58 The most impacted receptor for 24-hour average PM_{10} and $PM_{2.5}$ concentrations is the worker accommodation units at De Havilland Way. The average of the 98th percentile 24-hour average PM_{10} concentrations at De Havilland Way (2019 to 2022) is 41.2 µg/m^3 (see Appendix A of the AQA), which is higher than the BOPRC recommended background value of 30.2 µg/m^3.

Cumulative PM_{10}

59 The monitoring data includes the effects of the existing Allied asphalt plant. Therefore, the effects of the asphalt plant would be double-counted if the modelled concentrations were added to the measured concentrations at De Havilland Way.

60 Further, on days with high PM_{10} concentrations at De Havilland Way, the main contributing source is likely to be the adjacent bulk storage facility. The highest impacts from fugitive dust emissions typically occur on days with relatively high wind speeds that will entrain and transport fugitive dust. This is apparent from the monitoring data across Mount Maunganui where PM_{10} concentrations are correlated with wind speed (including onshore winds that drive marine aerosol contributions). These are not the same meteorological conditions that give rise to the greatest impacts from stack emission sources such as the asphalt plants.

61 However, because of the very close proximity of the De Havilland Way monitor to the bulk storage facility and the intermittent nature of operations, peak concentrations may be activity-driven (for example times when shipments are being unloaded) rather than being correlated with wind speed. Given the intermittent nature of dust generating activities at the bulk storage facility and the non-continuous nature of the asphalt plants, it remains unlikely that worse case impacts of the Site emissions will coincide with worst case impacts of the bulk storage facility (and in any case the contribution from the asphalt plant to cumulative effects will be very small).

62 Even if the modelled worst case impacts of the proposed plant (1 µg/m^3 as a 24-hour average) are added to a background value based on the average

of 98th percentile of measured concentrations at De Havilland Way (which includes the effects of the existing asphalt plant emissions that will have been removed), the resulting cumulative concentration would remain below the NESAQ and WHO 2021 guideline for 24-hour average PM_{10}.

Cumulative $PM_{2.5}$

63 The background annual average $PM_{2.5}$ concentration recommended by BOPRC of 7.5 µg/m^3 is higher than the WHO 2021 air quality guideline of 5 µg/m^3. The BOPRC only monitors for $PM_{2.5}$ at Totara Street, which is an industrial monitoring site. The recommended background value is higher than the annual average concentrations measured at Totara Street in 2020, 2021 and 2021 (which were all 6 µg/m^3).[12] Therefore the recommended background value probably overstates background $PM_{2.5}$ concentrations. However residential heating sources may impact $PM_{2.5}$ air quality in the Mount Maunganui residential area.

64 For comparison, Auckland Council undertakes monitoring for $PM_{2.5}$ at Queen Street, Takapuna, Penrose and Patumahoe (a rural monitoring site). In 2022, the annual $PM_{2.5}$ concentration exceeded the WHO 2021 guideline at all these sites.

65 Based on this, it is reasonably likely that background $PM_{2.5}$ exceeds the WHO 2021 annual average air quality guideline. However, this is not indicative of an air quality issue specific to the Mount Maunganui area, but represents a wider issue across New Zealand that will require a coordinated policy response and consideration of the New Zealand air quality context with regard to non-anthropogenic sources, such as marine aerosols.

66 For this application, I consider that the key point is that the proposed asphalt plant will have a lower effect on $PM_{2.5}$ air quality compared to the existing plant. This means that regardless of the background concentration, cumulative effects will reduce.

Sulphur dioxide

67 The emission rates used in the modelling assessment of SO_2 emissions is based on the sulphur content of the fuel and maximum rate of fuel used. ULO can contain up to 5000 ppm sulphur. Both natural gas and diesel are considered low sulphur fuels (up to 50 ppm sulphur and 10 ppm sulphur, respectively).

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[12] Bay of Plenty Regional Council. (2023). Ambient air quality update 2023. p 47

68 For cumulative effects, the 98th percentile 1-hour average SO_2 concentration measured at Totara Street in 2020 (23.4 µg/m^3) has been adopted as a representative background value. Concentrations in the area around the Site and in the residential areas east of the Site are likely to be lower than at Totara Street due to the increased separation distances (at least 650 m) from the main sources of SO_2 in the Mount Maunganui area (shipping and the fertiliser plant).

69 The worst-case model results for SO_2 are compared with relevant New Zealand assessment criteria and the WHO 2021 guidelines in Table 2-3 in Attachment Two.

70 The key points in relation to SO_2 are that:

(a) The short term (1-hour) MGLC for the existing asphalt plant is 39% of the NESAQ lower value (noting that the NESAQ allows 9 exceedances of this lower value in a year). The 1-hour MGLC occurs in the industrial area close to the plant.

(b) The incremental effect of the existing asphalt plant on 24-hour average SO_2 concentrations is low compared to the New Zealand ambient air quality guideline and the WHO 2021 guideline.

(c) The effects of emissions from the new asphalt plant on SO_2 air quality can be described as insignificant (less than 5%) compared to relevant New Zealand assessment criteria and the WHO 2021 guidelines.

(d) The cumulative effects of both the existing and proposed asphalt plants remain well below any of the assessment criteria (New Zealand or WHO 2021).

Nitrogen dioxide

71 Oxides of nitrogen (**NOx**) are generated from burning fossil fuel. NOx emissions from the asphalt plant stack will be mainly (90 to 95%) in the form of nitric oxide (**NO**), with the remainder emitted as NO_2 (referred to as Primary NO_2). NO_2 is the contaminant of interest with respect to effects on people's health.

NOx emission rates

72 The NOx emission rates used in the Updated AQA are based on published emission factors.[13] As discussed later (paragraph 107), there is a limited

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[13] US EPA AP 42 Compilation of emission factors Volume 1 Section 11.1 Hot mix asphalt plants

dataset to support the published emission factors for batch asphalt plants. The BOPRC's technical reviewer asked at mediation if there was stack testing data available from other asphalt plants to support the emission rates used in the assessment.

73 Allied has obtained information from stack testing at Marini vertical batch plants in Australia. Seven of the test results are for diesel-fired plants and one is for a natural gas fired plant. A summary of the test results is presented in Attachment Six. Table 1 compares the stack test results adjusted to a 200 tonne per hour production rate with the emission rates used in the dispersion modelling.

74 The data suggests that the worst-case modelled impacts (which are based on a diesel-fired plant) should be conservatively high. It may also indicate NOx emissions from use of natural gas could be higher than the modelled emission rate based on published emissions factors, but this is only based on one test result, and I do not consider this is enough data to draw a conclusion.

Table 1: Comparison of modelled NOx emission rates and emission rates based on emission testing results for Marini batch asphalt plants in Australia

Fuel	Measured emission rate scaled to 200 tph (kg/hour)	Modelled emission rate (kg/hour)
Diesel	2.7 (average of seven)	5.6
Natural gas	3.1 (one test result)	2.6

Background NO_2 concentration

75 The BOPRC does not undertake monitoring for NO_2 in the Mount Maunganui area. However, Waka Kotahi NZ Transport Agency provides estimates of annual average background NO_2 concentrations for each census area unit in New Zealand that can be used in air quality assessments. The default annual average NO_2 concentration in the Omanu Census Area Unit is 6.5 µg/m^3.

76 NO_2 concentrations in most urban areas are dominated by traffic emissions. The Waka Kotahi data is intended to represent background concentrations, so localised traffic impacts have been removed based on a Traffic Impact

Model that has been developed by NIWA.[14] This means the background data is not representative of roadside locations, or locations where there is a significant localised contribution from other sources, such as shipping or industry.

77 The main sources of NO_2 in the Mount Maunganui industrial area are shipping and port activities.[15] Given the location of the Site relative to these sources (for example at least 1.8 km from the nearest wharf at the Port) I consider the Waka Kotahi dataset will provide a reasonable background concentration for the wider area around the Site and east of Maunganui Road. However, this background concentration is unlikely to be representative of localised concentrations close to busy roads, in particular State Highway 2.

78 There is no reliable way to estimate short term background NO_2 concentrations from this annual average. However, NIWA has suggested an empirical method to estimate indicative values from relationships between short- and long-term concentrations in monitoring data.[16] Using this approach gives an indicative 24-hour average NO_2 concentration of 27.4 $\mu g/m^3$.

79 The empirical relationships are based on monitoring data from sites with annual mean concentrations significantly higher than expected in the Mount Maunganui area. This is illustrated Figure 1, which shows the empirical relationship (expressed as a straight line) between 1-hour average and annual average NO_2[17].

80 The key points from this plot are that:

(a) Most of the data is from locations with higher annual average NO_2 concentrations compared to expected levels in Mount Maunganui; and

(b) There is no logical explanation for why there would be a maximum 1-hour average NO_2 concentration of 28 $\mu g/m^3$ with an annual average NO_2 concentration of zero. I would have expected the line to pass

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[14] This method is described in Tonkin & Taylor (2023). Background Air Quality Concentrations: Summary of Methodology. Report prepared for Waka Kotahi

[15] Environet Limited. (2023). Mount Maunganui Emissions Inventory 2022. Report prepared for Bay of Plenty Regional Council

[16] A regression approach to assessing urban NO2 from passive monitoring

[17] To estimate the 24-hour average concentration it is necessary to estimate the 1-hour average concentration (from the annual average) and then apply a second empirical formula

through (0,0), which would result in a formula that gave a lower estimated 1-hour concentration from the annual average.

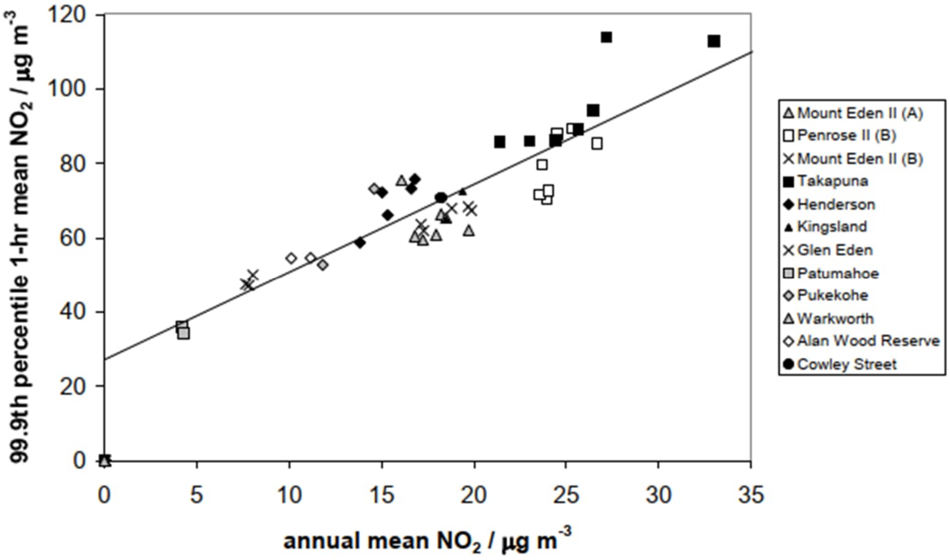

Figure 1: *Empirical relationship between 99.9th percentile 1-hour NO_2 concentrations and annual mean NO_2 concentrations (reproduced from NIWA (2014), Figure 4.1 p23)*

81 Based on this, I consider it likely that the empirical relationships will overestimate the 24-hour average background concentration in Mount Maunganui.

Assessing effects of NO_2 against New Zealand standards and guidelines

82 Emitted NO can be converted to NO_2 through a reaction in the atmosphere with ozone (referred to as Secondary NO_2). This reaction occurs during the daytime (and reverses at night, converting NO_2 back to NO). For large NOx emission sources the amount of NO that can be converted is often limited by the amount of ozone in the air. In areas with high background concentrations of NO_2 (e.g from other sources such as motor vehicles or other industries), most of the ozone will have been used up. This means that very little of the emitted NO from a new source would be converted to NO_2 and the incremental effect of the new source may be limited to the Primary NO_2. Conversely, in areas with no other significant sources of NOx, Secondary NO_2 can be more important than Primary NO_2.

83 New Zealand good practice guidance[18] recommends a tiered approach (with reducing levels of conservatism) to assessing effects of NO_2 emissions taking into account these atmospheric reactions:

(a) NO_2 screening method, which assumes that the MGLC of NOx is all present as NO_2 (i.e. 100% conversion of emitted NO to NO_2)

(b) Proxy NO_2 method, which assumes that all of the emitted NO is converted NO_2, but that this process is limited by the availability of ozone. A "Proxy NO_2" value for 1-hour and 24-hour averaging periods, which represents the combined background NO_2 and ozone concentration, is added to the modelled Primary NO_2 concentration.

(c) Advanced assessments, which might include modelling atmospheric chemistry or empirical approaches.

84 The AQA uses the Proxy NO_2 method in the first instance to evaluate the effects of the emissions from the Site on 1-hour and 24-hour average NO_2 for comparison with the NESAQ (200 $\mu g/m^3$ as a 1-hour average) and ambient air quality guideline (100 $\mu g/m^3$ as a 24-hour average). The higher Proxy NO_2 values recommended in the guidance for locations within 150 m of arterial roads have been adopted.

85 The Proxy NO_2 method is known to be very conservative in most cases. However, it is still commonly used to demonstrate compliance with the current New Zealand standards and guidelines.[19]

86 The assessment using the Proxy NO_2 method, which is summarised in Table 2-4 in Attachment Two, shows that the cumulative effects of NOx emissions from the Site:

(a) would not contribute to exceedances of the NESAQ or ambient air quality guideline for either the existing or proposed plant;

(b) that the worst-case cumulative 1-hour NO_2 concentrations are lower for the existing plant compared to the proposed plant; and

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[18] Ministry for the Environment. (2016). Good practice guide for assessing discharges to air from Industry, Appendix 3 p 93

[19] The Proxy NO_2 values for roadside sites are 113 $\mu g/m^3$ as a 1-hour average and 75 $\mu g/m^3$ as a 24-hour average. Even though using the Proxy NO_2 method is expected to overstate the effects of a project, there is sufficient margin between these values and the NESAQ and AAQG values to allow this method to be used to demonstrate that cumulative effects will not exceed these criteria.

(c) that worst-case cumulative 24-hour NO_2 concentrations are similar for the existing plant and the proposed plant.

87 For 1-hour NO_2 concentrations, the MGLC are predicted to occur close to the Site within the industrial area. Submissions have raised concerns about effects of emissions from the site on childcare centres and schools. There is a childcare centre located at 1 MacDonald Street approximately 550 m from the Site. Background NO_2 concentrations are likely to be elevated at this location due to its proximity to State Highway 2 (approximately 50 m) and the intersection with Maunganui Road (approximately 100 m). The modelled effects on cumulative 1-hour NO_2 concentrations at this location using the Proxy NO_2 method for roadside sites compared to the NESAQ are shown in Table 2. This method takes account of the likely elevated background concentrations in the Proxy NO_2 value.

88 It can be seen that the cumulative impacts remain well below the NESAQ value of 200 µg/m^3 and that the contribution from the Site emissions is small.

Table 2: Modelled 1-hour NO_2 concentrations at 1 MacDonald Street using the Proxy NO_2 method for comparison with the NESAQ

Parameter	MGLC (Allied plant Primary NO_2 contribution only)			Cumulative MGLC (Allied plus Proxy NO_2 representing background plus ozone)		
	Existing plant	Proposed plant		Existing plant	Proposed plant	
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
1-hour average						
Modelled concentration (µg/m^3)	1.3	1.3	2.3	116.3	116.3	117.3
Percentage of NESAQ 200 µg/m^3	0.7%	0.7%	1.2%	58%	58%	59%

Assessing effects of NO_2 against annual average WHO 2021 guidelines

89 The WHO 2021 air quality guidelines for NO_2 are set for a 24-hour and annual average. The Proxy NO_2 method is too conservative to allow a meaningful comparison with the 24-hour WHO 2021 guidelines for NO_2[20] and it does not address annual average concentrations. Therefore, I have looked at empirical assessment techniques to assess effects against the WHO 2021 guidelines.

90 Empirical assessment techniques establish the mathematical relationships in monitoring so that they can be applied to other locations where data may not be available.

91 For NOx and NO_2 there are two sets of empirical relationships that can help inform an assessment:

(a) the relationship between annual average NOx and annual average NO_2, which is not a linear relationship[21]; and

(b) The relationships (discussed in paragraphs 78 to 80) between:

(i) annual average NO_2 and 1-hour average NO_2, and

(ii) 1-hour average NO_2 and 24-hour average NO_2.

92 The worst case modelled annual average NOx concentration at a sensitive receptor occurs at 1 MacDonald Street. Concentrations at more distant residential receptors are lower.

93 For comparison with the WHO 2021 annual average guideline, I have calculated the worst case cumulative annual average NOx concentration (Site NOx contribution plus background). I have then used the relationship between annual average NOx and annual average NO_2 to estimate the annual average NO_2 concentration. The NO_2 contribution from the Site (combined Primary NO_2 and Secondary NO_2) can be inferred from the difference between the background and this calculated cumulative NO_2 value.

94 The results of this analysis are presented in Table 2-5 in Attachment Two. For the worst-case scenario of using diesel in the proposed asphalt plant, the worst case estimated cumulative NO_2 concentration increases by 0.5 $\mu g/m^3$ from 6.5 $\mu g/m^3$ to 7.0 $\mu g/m^3$, compared to the WHO 2021 guideline

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[20] It would be impossible to demonstrate compliance with the 24-hour WHO 2021 guideline of 40 $\mu g/m^3$ when the Proxy NO_2 method requires addition of 75 $\mu g/m^3$ to the modelled Primary NO_2 concentration.

[21] NIWA. (2019). Review of NO_2/NOx empirical conversion equations. Prepared for NZ Transport Agency

of 10 µg/m^3. For use of natural gas, the cumulative concentration would increase by 0.3 µg/m^3 to 6.8 µg/m^3.

95 For comparison, I have also calculated the incremental annual NO_2 concentration using the most conservative possible assessment method (the NO_2 Screening Method). The results are set out in Table 2-6 in Attachment Two. Using this method, the worst case incremental annual NO_2 concentration for the proposed asphalt plant using diesel is 0.9 µg/m^3. It is very unlikely that the actual effects could be this high as it assumes all emitted NO is all converted to NO_2. This gives me increased confidence that a worst-case incremental contribution of the order of 0.5 µg/m^3 (estimated using empirical methods) is reasonable.

96 As I discussed in paragraph 76, the Waka Kotahi default background concentration for annual average NO_2 is likely to be representative of the wider Mount Maunganui residential area, but probably understates NO_2 air quality at sites close to State Highway 2, such as 1 MacDonald Street. In the absence of monitoring data, it is difficult to know what the background annual average concentration is in this particular location. However, this does not affect the conclusions that:

(a) The worst case incremental contribution from the proposed asphalt plant will be small in comparison with the annual WHO 2021 guideline;

(b) The incremental effect of the Site will either not change (if the proposed plant uses natural gas as anticipated) or be very marginally higher (of the order of 0.3 µg/m^3 as an annual average or 3% of the WHO 2021 guideline) if it proves necessary to use diesel for an extended period.[22]

97 Dr Denison's health risk assessment and evidence address the health risk associated with the incremental effects of the Site's emissions on annual average NO_2.

Assessing effects of NO_2 against 24-hour average WHO 2021 guidelines

98 The method described above cannot be used to estimate impacts on 24-hour average NO_2 as NIWA's NO_2/NOx relationships are only for 1-hour and annual average monitoring data.

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[22] As this comparison is to the annual average WHO guideline, this increase would only occur if the plant operated on diesel for a year, i.e. any marginal increase would be smaller if it was necessary to use diesel for a short period of time, such as in the event of a sort-term interruption of gas supply.

99 The MGLC for 24-hour average NOx from the proposed plant occurs at De Havilland Way. I have considered the potential effects of the Site's emissions on 24-hour average NO_2 concentrations using a pro rated approach from modelling other contaminants and using the highly conservative NO_2 Screening assessment method.

100 The impact of the Site's emissions on 24-hour average NO_2 concentrations can be inferred from the impact on annual average NO_2 concentrations. The ratio between the worst case modelled 24-hour average and annual average concentrations of PM_{10} for the proposed asphalt plant is 3.6. Assuming this relationship also applies to NO_x, the worst-case incremental impact of the Site's emissions on 24-hour average NO_2 would be of the order of 1.8 µg/m^3 (3.6 x 0.5 µg/m^3), which is approximately 4.5% of the WHO 2021 guideline. This is not an accurate prediction, but I consider it gives a reasonable "order of magnitude" estimate that is small compared to the WHO 2021 guideline.

101 Calculating the incremental 24-hour NO_2 concentration using the most conservative possible assessment method (the NO_2 Screening Method), gives a value of 3.0 µg/m^3 for the existing plant using ULO, 3.2 µg/m^3 for the proposed plant using natural gas, and 5.5 µg/m^3 for the proposed plant using diesel (see Table 2-6 in Attachment Two), ie at worst 14% of the WHO 2021 guideline. The impacts will almost certainly be lower than this as 100% conversion of NO to NO_2 over a 24-hour period is impossible. Overall, an estimate of the order of 2 µg/m^3 is likely to be a more realistic worst case.

Discussion and key points

102 A conservative assessment of effects of NO_2, using the Proxy NO_2 method recommended in good practice guidance, shows that the emissions from the existing and proposed asphalt plants would not contribute to exceedances of the 1-hour NESAQ or the 24-hour ambient air quality guideline for either the existing or proposed plant.

103 A quantitative assessment of NO_2 emissions for comparison with the WHO 2021 guidelines is more difficult because of the absence of monitoring data for existing NO_2 concentrations and the complications of accounting for atmospheric chemistry.

104 The effects of NO_2 estimated using relationships between NO_2 and NOx (in annual average data), and between short- and long-term NO_2 concentrations, developed by NIWA from a review of monitoring data, suggests that the effects of the proposed asphalt plant are small compared to the WHO 2021 guidelines. Existing NO_2 concentrations at locations

close to busy roads (particularly State Highway 2) are likely to be elevated compared to the WHO 2021 guidelines, but the contribution of emissions from the Site to these elevated concentrations is expected to be negligible.

105 The worst-case impacts of the existing plant and proposed plant when operating on natural gas are similar. The worst-case impacts of the proposed plant are higher when using diesel compared to natural gas, but the change in effects is low in comparison with the WHO 2021 guidelines.

Benzene

106 Bitumen contains small amounts of benzene because it is produced from crude oil that contains naturally occurring benzene. Benzene emissions have been estimated based on AP42 emission factors for asphalt plants.[23] The benzene emission factors are lower from batch plants compared to drum mix plants, which would be expected as the bitumen is not exposed to the higher temperatures in the dryer drum. As the benzene is from the bitumen, the emission factors are the same regardless of the fuel used in the dryer.[24]

107 The AP42 emission factors were published in 2004 and therefore reflect technology at the time. For batch plants, this means that there are fewer test results (as these were not the most common type of asphalt plant at that time) and the emission tests were not on plants that draw the fumes from the mixer back through the dryer burner, as this is a new technology developed to reduce emissions of odour and Volatile Organic Compounds (VOCs). Benzene is a VOC. Therefore, I expect that the AP42 emission factor for benzene will be conservatively high for the proposed asphalt plant as it does not account for any destruction of benzene in the dryer burner prior to discharge into the baghouse and stack.

108 I am not aware of any stack emission test data for benzene in asphalt plant emissions in New Zealand or Australia.

109 Toi te Ora expressed an interest in understanding the effects of benzene emissions compared to the acute and chronic Reference Exposure Levels (RELs) for benzene set by the California Office of Environmental Health and Hazard Assessment (OEHHA) as well as the New Zealand ambient air

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[23] US EPA AP 42 Compilation of emission factors Volume 1 Section 11.1 Hot mix asphalt plants

[24] The emission factors are 0.00028 lb per tonne of asphalt produced for batch plants and 0.00039 lb per tonne of asphalt produced for drum plants

quality guideline adopted as a criterion in the Updated AQA. The OEHHA guidelines are set for annual and 1-hour averaging periods.

110 Motor vehicle exhaust and evaporative emissions from petrol are the main sources of benzene in urban air in New Zealand. There is limited recent monitoring data available for benzene and most of the data is for longer averaging periods (typically monthly samples, which are used to calculate an annual average). The recommended default background concentration for benzene is 1.0 µg/m^3 (annual average).

111 There is a small dataset of hourly benzene concentrations from 2013 and 2014 at Khyber Pass, Auckland. The hourly and annual average monitoring data for this site is summarised in Attachment Four. Khyber Pass is a busy road[25] and the monitor is located close to an intersection, so the concentrations measured at this location reflect a traffic impacted site. The highest hourly concentration measured over these two years is 14.7 µg/m^3. Given the reduction in annual average concentrations since 2013/14, hourly benzene concentrations are now also likely to be much lower. However, for the purposes of a conservative assessment this value of 14.7 µg/m^3 has been used to provide an indicative worst-case cumulative 1-hour concentration.

112 The worst-case model results for benzene are compared with the relevant New Zealand ambient air quality guideline and the OEHHA acute and chronic RELs in Table 3. The incremental effects of emissions from the Site are small compared to these criteria.

113 Children are particularly sensitive to effects of benzene. For the proposed plant, the highest modelled 1-hour average benzene concentration at a childcare facility is 0.07 µg/m^3, which is 0.3% of the OEHHA acute REL.

Table 3: Assessment of worst case impacts of benzene

Parameter	**MGLC (Allied plant contribution only)**		**Cumulative MGLC (Allied plus background)**	
	Existing plant	**Proposed plant**	**Existing plant**	**Proposed plant**
1-hour average				
Modelled concentration (µg/m^3)	0.76	0.16	15.5	14.9

[25] Annual Average Daily Traffic (**AADT**) of around 25,000 to 30,000

Parameter	MGLC (Allied plant contribution only)		Cumulative MGLC (Allied plus background)	
	Existing plant	Proposed plant	Existing plant	Proposed plant
Percentage of OEHHA acute REL 27 µg/m^3	2.8%	0.6%	57.4%	55%
Annual average				
Modelled concentration (µg/m^3)	0.0034	0.0046	1.0034	1.0046
Percentage of New Zealand ambient air quality guideline 3.6 µg/m^3	0.09%	0.13%	27.9%	27.9%
Percentage of OEHHA chronic REL 3 µg/m^3	0.11%	0.15%	33.4%	33.5%

Dioxins

114 Toi te Ora expressed an interest in understanding the effects of dioxin emissions compared to the 24-hour Ontario Ambient Air Quality Criterion (AAQC), as well as the OEHHA annual average criterion adopted in the Updated AQA.

115 Dioxins are a mix of chemicals with differing toxicity. The combined concentration is expressed on the basis of Toxic Equivalents (TEQ). The Toxic Equivalence Factors used are the most recent values from the WHO (as explained in Appendix D Section D2.3.5) of the Updated AQA.

116 The modelled concentrations and air quality criteria for dioxins are very small numbers and are sometimes expressed in units of nanograms or picograms per cubic metre. For the purposes of presenting the data, all numbers have been converted to micrograms per cubic metre (µg/m^3).

117 There is very little ambient air dioxin monitoring data in New Zealand and I am not aware of any data that would be relevant to the Mount Maunganui area.

118 The worst-case model results for dioxins are compared with the Ontario AAQC and the OEHHA chronic REL in Table 4. The incremental effects of emissions from the Site are negligible compared to these criteria.

Table 4: Assessment of worst case impacts of dioxins

Parameter	MGLC (Allied plant contribution only)	
	Existing plant	**Proposed plant**
24-hour average		
Modelled concentration (µg/m^3)	2.36 x 10^{-10}	4.38 x 10^{-10}
Percentage of Ontario AAQC 1 x 10^{-7} µg/m^3	0.24%	0.44%
Annual average		
Modelled concentration (µg/m^3)	3.82 x 10^{-11}	7.13 x 10^{-11}
Percentage of OEHHA chronic REL 4 x 10^{-5} µg/m^3	0.00010%	0.00018%

Odour

119 Odour is another key issue for this application and has been identified as a concern by many submitters. The proposed asphalt plant is expected to have significantly lower odour emissions compared to the current plant due to its configuration (batch mix), improved odour controls and taller stack, as described in paragraph 22.

120 The techniques that have been used to assess odour effects of the existing and proposed plants are:

(a) Reviewing BOPRC complaints records for the existing plant;

(b) Comparing the proposed plant configuration and engineering controls to manage odour with controls/odour emissions at other asphalt plants;

(c) Odour dispersion modelling and comparison with odour modelling assessment guidelines. This is particularly useful as a comparative tool to understand the relative impact of the proposed and existing plants;

(d) Consideration of the potential for cumulative effects with another asphalt plant in the area; and

(e) An overall FIDOL evaluation[26].

121 The odour complaints records do not specify the exact location where asphalt odours were observed but many complaints are noted to occur during westerly or west-south westerly wind conditions around Omanu Primary and Preschool and the residential community northwest of the site.

122 Based on the weather conditions at the time of the complaints and considering the findings of the odour dispersion modelling, it is likely that some of these complaints are related to the Allied plant. However, some of these complaints are not related to the Allied plant (as the plant was not operating at the time the odour was reported).

123 A representative odour emission rate for the existing asphalt plant was based on stack testing and for the proposed plant was based on stack testing at a plant with an identical configuration and odours controls at Laverton, Melbourne. Odour stack emission measurements from other vertical batch plants in Australia provided to me by Allied (see Attachment Eight) are consistent with the odour emission rate that was modelled for the proposed plant.

124 The presence of two asphalt plants in the Mount Maunganui industrial area results in the potential for cumulative effects of asphalt odours. To evaluate cumulative effects, dispersion modelling was carried out for both the Higgins and Allied plants operating concurrently. This modelling was based on information contained in the Higgins Assessment of Environmental Effects report and therefore does not take account of any improvements that may have been proposed by Higgins through their recent consenting process. Therefore, the cumulative modelling likely represents the historical situation.

125 The modelling of cumulative effects shows that for the residential areas east of Maunganui Road:

(a) The plumes from the two asphalt plants do not "overlap" under the same weather conditions that would direct emissions towards these receptors, so there is not likely to be any increase in odour intensity; and

(b) The combined effect of emissions from the two existing asphalt plants is likely to increase the frequency at which noticeable asphalt odours

[26] FIDOL represents the frequency, intensity, duration and offensiveness (character) of odour and the location (sensitivity to odour effects). FIDOL assessments are used as a technique to characterize the effects of odour and draw conclusions in regard to offensive and objectionable effects.

may be present, which increases the risk of offensive and objectionable effects.

126 The odour controls that are proposed for the new Allied plant represent best industry practice and, to my knowledge, there are no other asphalt plants in New Zealand that have implemented the full suite of controls proposed for the Site. The odour stack emission monitoring at the Laverton plant in Melbourne (which has the same configuration) demonstrates an order of magnitude lower odour emissions compared to the existing asphalt plant at the Site.

127 The odour dispersion modelling results for the existing and proposed plants are shown in Table 1.

Table 5: Odour dispersion modelling predictions (assuming continuous operation)

Location	Sensitivity of location	MfE odour modelling assessment criteria (OU/m^3)	99.5th percentile odour concentration (OU/m^3)	
			Existing plant	Proposed plant
Peak off-site	Low	5-10	32.5	0.67
Peak sensitive receptor	High (neutral to stable conditions)	2	2.8	0.27

128 The odour dispersion modelling indicates that:

(a) For the existing plant, there is the potential for localised odour effects close to the plant and also in the residential area northeast of the Site.

(b) There will be a significant reduction in odour concentrations from the proposed plant compared to the existing plant.

(c) The modelled concentrations of odour from the proposed plant are an order of magnitude below the odour modelling criteria at all locations and therefore it is very unlikely that the proposed plant would cause odours that might be considered offensive or objectionable either in the neighbouring industrial area or the more distant residential area.

129 The odour emission rates used in the odour assessment were based on stack testing at a Marini plant in Laverton, which has the same configuration and odour controls as the proposed asphalt plant. This stack emission

testing did not coincide with the use of Reclaimed Asphalt Paving (RAP) in the plant. I will discuss how the use of RAP may influence odour effects later in this statement at paragraph 158.

Sensitivity and uncertainty in modelling

130 The key assumptions in the dispersion modelling are set out in the Updated AQA, particularly Appendix D, which describes the estimates of emission rates and the sources of other input data for the modelling.

131 These assumptions are intended to be either realistic (for example the height and diameter of the stack, buildings and terrain) or conservative (for example the assumption of continuous operation).

132 Dispersion model outputs are particularly sensitive to the emission rates of pollutants and meteorology.

133 The most common sensitivity analysis to modelled emission rates is to consider a “typical” and a “worst case” emissions scenario. The Updated AQA only considers a worst-case scenario for pollutant emissions. However, as there is only one stack in the model, the impact of different assumptions about emission rates can be easily inferred on a pro rata basis. There is a direct relationship between emission rates and model predictions. In other words, if emission rates are halved, the model predictions will also be halved.

134 The most common sensitivity analysis for the effects of meteorology is to model more than one year of meteorological data. The Updated AQQ uses a dataset prepared for the Bay of Plenty Regional Council containing three years of meteorological data (2014, 2015 and 2016). Only the highest results over the three modelled years have been reported. However, the time series of 1-hour and 24-hour model predictions of TSP at several receptors set out in Appendix F of the Updated AQA is useful in understanding the distribution of the concentration predictions in different years.

135 The worst-case weather conditions for dispersion appear to be realistically represented within the modelling meteorological dataset (see paragraphs 38 to 41).

Likelihood of modelled concentrations occurring

136 The conservative assumption of continuous operation at the maximum production rate was adopted as, if the effects based on this assumption are

acceptable, it follows that the actual air quality effects, which will be somewhat lower, will also be acceptable.

137 There is increasing conservativism in the model predictions with longer averaging times of the model outputs. The modelled 1-hour average concentrations are the most realistic and could occur if the plant was operating during the worst-case weather conditions for dispersion. The modelled annual average concentrations are likely to be higher than would occur in reality.

National Environmental Standards for Air Quality

138 An assessment of the proposal against Regulations 17, 20 and 21 of the NESAQ is set out in Section 7 of the Updated AQA.

139 Regulation 17 sets out restrictions on the granting of consent for new emissions of PM_{10} in a polluted airshed. In summary, the new consented emissions from the proposed asphalt plant will be more than offset by the cessation of emissions from the existing asphalt plant. The overall result will be a net reduction in PM_{10} emissions into the airshed. Therefore, there is no impediment to the granting of consent for the proposed asphalt plant under Regulation 17 of the NESAQ.

140 Regulation 20 sets out restrictions on the granting of consent for emissions of carbon monoxide (CO), NO_2 and VOCs where the discharge would cause a breach of the AAQS and the source is likely to be a principal source of that gas in the airshed. The dispersion modelling demonstrates that the discharges from the Site would not cause a breach of the AAQS for any of these contaminants, and neither the existing nor proposed asphalt plant would be considered a principal source of these contaminants in the airshed. As a result, there is no impediment to the granting of consent for either the existing or proposed asphalt plant under Regulation 20 of the NESAQ.

141 Regulation 21 restricts the granting of consent for emissions of SO_2 where the discharge would cause a breach of the AAQS. The dispersion modelling demonstrates that the discharges from the Site would not cause a breach of the AAQS and therefore there is no impediment to the granting of consent for either the existing or proposed asphalt plant under Regulation 20 of the NESAQ.

Matters arising from mediation

142 Several questions arose from the mediation, including requests for additional analyses and information.

Annual asphalt production

143 A question was raised about annual production from the existing asphalt plant over the last ten years to provide context for the proposed maximum annual production from the proposed plant. Annual production data for the last 20 years is provided in Table 6.

Table 6: Annual asphalt production

Financial year end	Annual production (tonnes)
June 2004	46,813
June 2005	49,411
June 2006	45,743
June 2007	41,284
June 2008	49,032
June 2009	47,265
June 2010	48,992
June 2011	42,021
June 2012	36,600
June 2013	29,322
June 2014	27,828
June 2015	22,965
June 2016	20,056
June 2017	40,698
June 2018	40,985
June 2019	47,840
Jun 2020	41,555
June 2021	60,814
June 2022	68,236

June 2023	67,946

Consideration of "actual" effects rather than effects authorised by consent

144 For the purposes of a resource consent application, it is necessary to assess the effects that would be authorised by the consent. This envelope of effects is typically larger than the effects that will occur in reality. For example, it is necessary to assume emissions will occur at maximum rates allowed by the consent (whereas actual emissions will almost certainly be lower most of the time) and to assume continuous operation unless there are specific conditions or circumstances that do not allow this.

145 Clear the Air and Toi te Ora were interested in a comparison of the actual effects of the existing plant in recent years with the actual effects of the proposed plant. In particular, they were interested in understanding the difference in mass emissions of pollutants, such as PM_{10} and NOx.

146 Two emission sources with the same mass emission rate but different emission characteristics and stack height will not have the same impact on air quality. This is important because the difference in emissions from the existing and proposed asphalt plant does not correlate with the difference in effects within the airshed.

147 For a plant that operates intermittently at different production rates and with varying emission rates of contaminants, it is difficult to accurately estimate "actual" emissions. For this reason I have presented several different scenarios.

PM_{10} annual emissions

148 For the purposes of comparing annual mass emissions of PM_{10}, I have looked at five scenarios:

(a) Existing plant:

(i) Mass emissions allowed by proposed consent conditions (consented PM_{10} emission rate and average production rate 365 days per year).

(ii) "Actual" emissions based on recent annual production (68,000 TPY) and stack testing results (3.0 kg/hr TSP, 80% of which is PM_{10}).

(b) Proposed plant

(i) Mass emissions allowed by proposed consent conditions (consented PM_{10} emission rate and average production rate to produce 300,000 TPY).

(ii) "Actual" emissions based on recent annual production + 10% growth (75,000 TPY) (assuming emissions at 80% of proposed consent limit for PM_{10} and average production rate).

(iii) "Actual" emissions allowed by proposed consent conditions (assuming emissions at 80% of proposed consent limit for PM_{10} and average production rate to produce 300,000 TPY.

149 The annual PM_{10} emission estimates are tabulated in Attachment Three. The key finding is that the new asphalt plant would not increase PM_{10} emissions into the Mount Maunganui Airshed compared to the estimated "actual" emissions from the existing plant.

NOx annual emissions

150 The estimates of NOx emissions are based on emission factors expressed as kg NOx per tonne of asphalt produced, depending on fuel type (which differs to the PM_{10} emissions which are expressed as kg/hour regardless of production rate or fuel). For the purposes of comparing annual mass emissions, I have looked at four scenarios for NOx:

(a) Existing plant:

(i) Plant operating at maximum production rate 365 days per year (used oil)

(ii) Plant producing 68,000 TPY (used oil)

(b) Proposed plant

(i) Plant producing 300,000 TPY (natural gas and diesel)

(ii) Plant producing 75,000 TPY (natural gas and diesel).

151 The results are tabulated in Attachment Three. As would be expected, the maximum annual NOx emissions that would be authorised by the proposed consent is higher than the estimated "actual" emissions from the existing plant. The increase is greater if the proposed plant operates on diesel compared to natural gas. However, as shown in the assessment of effects of NOx emissions and in the Health Risk Assessment, the higher NOx emissions do not result in unacceptable effects on air quality or human health.

Bluesmoke filter (Aerofilter)

152 A question was raised about the design and operation of the proposed bluesmoke filter (Aerofilter) that will be used to treat vapours extracted from the hot mix storage and asphalt loadout area.

153 “Bluesmoke” is the term used to describe the blue-tinged visible emissions that can occur from asphalt plant stacks and handling of hot asphalt. This is different to the visible water vapour plume from the existing asphalt plant, which uses a wet scrubber to reduce particulate emissions. Bluesmoke is caused by semi-volatile organic compounds that are present as a gas at high temperatures but condense to form fine droplets as they cool in ambient air.

154 I understand the Aerofilter is a proprietary device designed by Marini (the asphalt plant supplier). Information provided by Marini shows that it is a 2-stage filtration unit made up of:

(a) panels of woven aluminium wire that the semivolatiles condense and collect on; and

(b) glass fibre cartridge filters to separate the oily droplets from the airstream.

155 The oils are collected and disposed and the treated air is ducted to the asphalt plant stack.

Methods to minimise fugitive emissions from the asphalt loadout area

156 Another question raised at mediation was the steps that could be taken to maximise the capture of odours around the asphalt loadout area. Without adequate controls, odours from the loadout area could have localised impacts in the industrial area near the site.

157 In my experience with other similar types of truck loadout operations, full or partial enclosure of the load out area can significantly improve the effectiveness of capture of fugitive emissions, particularly on windy days. I understand that there are some practical difficulties and health and safety issues that may preclude fully enclosing the asphalt plant loadout area. However, I understand from Allied that partial enclosure, for example side walls, could be possible and is being explored with Marini, as discussed by Mr Garton. I support the enclosure of the loadout area to the greatest extent practicable, as this will assist in minimising fugitive odours.

Influence of use of Reclaimed Asphalt Paving (RAP) on odour emissions

158 The recovery and re-use of asphalt paving as RAP is becoming increasingly common in the asphalt industry and has wider environmental benefits. A question was raised about the impacts of addition of RAP to the dryer drum on odour emissions.

159 Anecdotally, the use of RAP appears to increase odour emissions from asphalt plants. However, I have not been able to find any studies or investigations that quantify the impact.

160 Allied has provided me with some additional odour stack testing data from the commissioning period of the Laverton, Melbourne plant while it was using RAP. The commissioning of the Laverton plant occurred during COVID. As such, a reduced odour panel, with only three panellists, was able to be used due to COVID 19 distancing protocols. This adds some increased uncertainty to the results. Also, as this data is from the commissioning phase of the new plant, there may have been other factors influencing odour emissions that are unrelated to the use of RAP and the measured levels of odour may not be representative. However, in the absence of any better information I have relied on this stack testing to indicate how the use of RAP may influence the modelled effects of odour.

161 The odour emission stack testing results are summarised Table 7. This shows that odour emissions were materially higher (3.6-fold) in July 2020 when RAP was being used. It is interesting to note that the odour emission rates were the same for both 10% and 20% RAP, which suggests that use of RAP may not have been a key factor in the higher odour emissions rates during this commissioning period,

162 Table 8 shows the odour modelling results for the proposed asphalt plant scaled based on the difference between the July 2020 and September 2022 odour emissions at Laverton (ie increased 3.6-fold). Although the odour concentrations are higher based on the Laverton data when RAP was being used they are still much lower than for the existing plant (e.g for the residential area 0.96 OU/m^3 compared to 2.8 OU/m^3 from Table 5) and remain well below (50%) the relevant odour modelling assessment criterion. This suggests that the impacts of odour emissions would be acceptable and would not result in offensive or objectionable effects.

Table 7: Stack odour emission testing, Laverton

Date	Production conditions	Average odour emission rate measured (OU/s)[A]	Odour emission rate scaled to 200 t/hour (OU/s)[A]

July 2020 Commissioning Test 1	10% RAP 120 tph	87,000	140,000
July 2020 Commissioning Test 2	20% RAP 120 tph	85,000	140,000
Average		86,000	140,000
Sept 2022 Test 1	No RAP 130 tph	23,000	36,000
Sept 2022 Test 2	No RAP 130 tph	28,000	44,000
Average (modelled rate)		25,000	39,000

Table Notes:
A. Rounded to 2 significant figures

Table 8: Odour modelling results for proposed asphalt plant scaled for use of RAP based on Laverton test data

Location	**Sensitivity of location**	**MfE odour modelling assessment criteria (OU/m^3)**	**99.5th percentile odour concentration (OU/m^3)**
Peak off-site	Low	5-10	2.4
Peak sensitive receptor	High (neutral to stable conditions)	2.0	0.96

Air quality effects of increased traffic onsite and on public roads

163 A question was raised about the impacts of the new asphalt plant on traffic emissions. There has not been sufficient time to prepare a response to this question within the timeframe for circulating this evidence. However, a response will be prepared and circulated before the hearing.

Matters raised by submitters

164 Based on the information in Attachment B of the s87F report, the submissions relating to air quality raised the following key concerns:

(a) Levels of air pollution generated by the proposal close to sensitive land use areas, including daycares, schools, businesses, sports fields, residential areas, and local marae.

(b) The renewal of the proposed discharge consent continuing to adversely impact on human health, particularly of vulnerable populations, by exacerbating emissions of dust and particulate matter, respiratory issues, and foul smells.

(c) Discharge to air of particulate matter and other contaminants that can have serious health impacts on the lungs of residents, particularly children, the elderly, and those with pre-existing respiratory conditions.

(d) The health effects of exposure to PM_{10} and $PM_{2.5}$ including increased risks of lung cancer, heart disease, and respiratory illnesses such as asthma and bronchitis as well as irritation of the respiratory system and exacerbation of respiratory conditions.

(e) The odour resulting in negative impact on the mental health of the local community.

165 I acknowledge that many submissions raise concerns about air quality, odour and health effects. I have not addressed these submissions individually but have addressed the matters raised collectively in the Updated AQA and in my evidence.

Matters raised by s87F report

166 There is one technical matter that I want to comment on in the s87F report. The s87F report refers to 24-hour and annual average background NO_2 concentrations in Mount Maunganui exceeding the WHO 2021 air quality guidelines (43 µg/m^3 as a 24-hour average and 16 µg/m^3 as an annual average).[27] The values quoted are from the original AQA, which were

[27] s87F report, p 15

based on the default background values for urban areas in good practice guidance[28].

167 In the Updated AQA, these background values were reviewed and updated with more recent information from the updated Waka Kotahi background air quality dataset for annual average NO_2 and an empirical estimate of the 24-hour average concentration (see paragraphs 75 to 81) (27.4 µg/m^3 as a 24-hour average and 6.5 µg/m^3 as an annual average). These values are below the WHO 2021 air quality guidelines.

168 I consider that the estimates presented in the Updated AQA are likely to be more representative of current background NO_2 concentrations in residential areas of Mount Maunganui than the default values recommended in good practice guidance based on:

(a) the general trends in NO_2 roadside monitoring data of reducing concentrations over time; and

(b) comparison with more recent monitoring data from the sites used to develop the values in the good practice guidance.

169 A more detailed explanation of my reasoning is set out in Attachment Five.

170 Localised NO_2 concentrations adjacent to main roads, particularly State Highway 2, will be higher than the background concentration.

Proposed consent conditions

171 I have seen the proposed conditions for the air discharge consents attached to the s87F Report.

172 The evidence of Mr Batchelar includes amended conditions which were prepared with my involvement. These include several matters that I comment on below:

Existing Plant

173 I consider that proposed Condition 3 of the air discharge consent for the existing plant, which would limit its operating hours, should be deleted.

~~*3. The plant shall be operational for no more than 5 hours between the hours of 7am and 5pm on any given day*~~

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[28] Ministry for the Environment. (2016a). Good practice guide for assessing discharges to air from Industry. Wellington. p 64

174 This condition appears to be a misinterpretation of an odour modelling scenario that was included in the AQA. Odour modelling assessment criteria are expressed on a different percentile basis for continuous odour sources and intermittent odour sources. The purpose of including a "typical" operating hours scenario (in addition to the assumption of continuous operation) was for comparison with the odour modelling assessment criteria for intermittent sources, to demonstrate that this did not alter the conclusions of the assessment.

175 I understand from the commentary on this condition in the s87F Report that the intention was to reduce the likelihood that odour levels will exceed guidelines. I do not consider this condition is appropriate as:

(a) It would be unlikely to achieve the intended outcome as the worst-case meteorological conditions for dispersion of odours from the asphalt plant are not limited to nighttime; and

(b) I understand from Allied that it is impractical for them to limit the hours of operation in this way as, for example, activities such as roadworks are often required to be undertaken at night.

176 In my opinion, limiting this consent to a 2-year duration while the new plant is constructed and commissioned is the best practicable way to reduce odour effects from asphalt production at the Site.

New Plant

177 The limit on particulate matter emissions in Proposed Condition 12 of the air discharge consent for the proposed plant incorrectly refers to total particulate matter rather than the PM_{10} component. The assessment considered a maximum PM_{10} emission rate of 1.0 kg/hour (or 1.25 kg/hour Total Suspended Particulate (**TSP**)). In my opinion, it would be preferable if the condition were expressed on the basis of PM_{10} rather than TSP and therefore I recommend that the condition is amended as follows:

12. The mass discharge of particulate matter from the asphalt plant shall not exceed 1.0 kg/hr ***PM_{10}****.*

Conclusion

178 The overall conclusions of my assessment with respect to air quality impacts are that:

(a) The Site is located in a polluted airshed for PM_{10}. The proposed plant has improved controls over particulate emissions compared to the existing plant and will result in a net decrease of PM_{10} emissions into the airshed, as well as a smaller effect on PM_{10} air quality.

(b) Dispersion modelling predictions, using conservative assumptions, indicate that the incremental effects of emissions of PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs, PAHs, dioxins and trace metals from the proposed plant are well below relevant New Zealand air quality standards and guidelines, relevant international assessment criteria (where there are no New Zealand criteria) and the WHO 2021 air quality guidelines.

(c) Background concentrations of 24-hour NO_2 may be elevated compared to the WHO 2021 guidelines. Although the effects of the proposed plant may be marginally higher than the existing plant, the contribution of emissions from the Site is small and would not materially contribute to cumulative exceedances of the WHO 2021 guideline.

(d) Background annual average $PM_{2.5}$ concentrations may exceed the WHO 2021 guidelines. The contribution of emissions from the Site is small compared to the WHO 2021 guideline and the proposed asphalt plant will have lower effects than the existing plant.

(e) The proposed asphalt plant will have significantly lower odour emissions than the existing asphalt plant because of its configuration and engineering controls. This corresponds to a significant reduction in modelled odour impacts compared to assessment criteria. The proposed plant is very unlikely to cause odours that might be considered offensive or objectionable either in the neighbouring industrial area or the more distant residential area.

(f) The proposed asphalt plant will incorporate a number of design improvements and controls to minimise discharges of contaminants to air, in particular particulate matter and odour, to the greatest extent practicable and to ensure adequate dispersion to further minimise effects. To my knowledge, these measures are best industry practice in Australasia and I consider they are the best practicable option to minimise discharges to air.

Jennifer Simpson

Dated this 29 day of February 2024

Attachment One: Location of BOPRC air quality monitoring sites

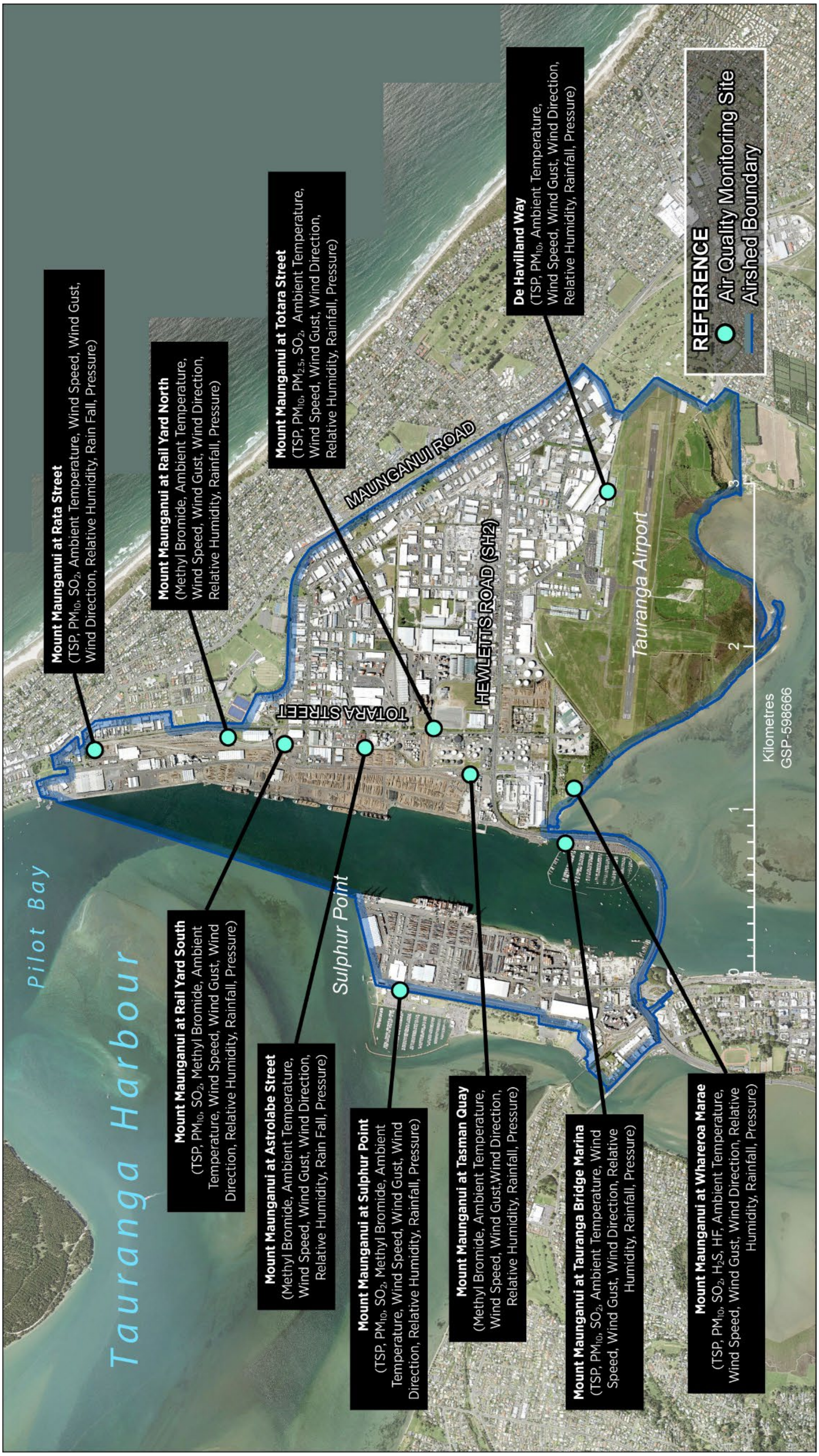

Figure 1 *Mount Maunganui air quality monitoring sites (Council map reference GSP-598666). Note: the methyl bromide label relates to a TVOC value.*

Attachment Two: Summary tables of modelling results

Table 2-1: Modelled effects on PM_{10} air quality

Parameter	MGLC (Allied plant contribution only)		Cumulative MGLC (Allied plus background)	
	Existing plant	Proposed plant	Existing plant	Proposed plant
24-hour average – maximum day				
Modelled concentration (µg/m^3)	4.5	0.98	34.7	31.2
Percentage of NESAQ 50 µg/m^3	9.0%	2.0%	69.4%	62.4%
24-hour average – fourth highest				
Modelled concentration (µg/m^3)	3.5	0.76	33.7	31.0
Percentage of WHO 2021 45 µg/m^3	7.8%	1.7%	74.9%	68.8%
Annual average				
Modelled concentration (µg/m^3)	0.7	0.16	15.3	14.8
Percentage of AAQG 20 µg/m^3	3.5%	0.8%	76.5%	74.0%
Percentage of WHO 2021 15 µg/m^3	4.7%	1.1%	102.0%	98.7%

Table 2-2: Modelled effects on $PM_{2.5}$ air quality

Parameter	MGLC (Allied plant contribution only)		Cumulative MGLC (Allied plus background)	
	Existing plant	Proposed plant	Existing plant	Proposed plant
24-hour average – highest				
Modelled concentration (µg/m^3)	2.2	0.49	16.2	14.5
Percentage of Proposed NESAQ 25 µg/m^3	8.8%	2.0%	64.8%	58.0%
24-hour average – fourth highest				
Modelled concentration (µg/m^3)	1.8	0.38	15.8	14.4
Percentage of WHO 2021 15 µg/m^3	12%	2.5%	105.3%	94.9%
Annual average				
Modelled concentration (µg/m^3)	0.4	0.08	7.9	7.6
Percentage of Proposed NESAQ 10 µg/m^3	4.0%	0.8%	79.0%	76.0%
Percentage of WHO 2021 5 µg/m^3	8.0%	1.6%	158.0%	152.0%

Table 2-3: Modelled effects on SO_2 air quality

Parameter	MGLC (Allied plant contribution only)			Cumulative MGLC (Allied plant plus background)		
	Existing plant	Proposed plant		Existing plant	Proposed plant	
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
1-hour average						
Modelled concentration (µg/m³)	136.1	0.4	0.06	159.5	23.8	23.5
Percentage of NESAQ 350 µg/m³	39%	0.11%	0.02%	46%	6.8%	6.7%
24-hour average - highest						
Modelled concentration (µg/m³)	3.7	0.06	0.01	17.5	13.86	13.81
Percentage of NESAQ 120 µg/m³	3.1%	0.05%	0.008%	14.6%	11.6%	11.5%
24-hour average – fourth highest						
Modelled concentration (µg/m³)	2.9	0.05	0.008	16.7	13.85	13.81
Percentage of WHO 2021 40 µg/m³	7.3%	0.13%	0.02%	41.8%	34.6%	34.5%

Table 2-4: Modelled effects on NO_2 air quality using NO_2 Proxy method

Parameter	MGLC (Allied plant Primary NO_2 contribution only)			Cumulative MGLC (Allied plus Proxy NO_2 representing background plus ozone)		
	Existing plant	Proposed plant		Existing plant	Proposed plant	
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
1-hour average						
Modelled concentration (µg/m^3)	10.9	1.9	3.3	123.9	114.9	116.3
Percentage of NESAQ 200 µg/m^3	5.5%	1.0%	1.7%	62.0%	57.5%	58.2%
24-hour average						
Modelled concentration (µg/m^3)	0.3	0.3	0.6	75.3	75.3	75.6
Percentage of NESAQ 100 µg/m^3	0.30%	0.30%	0.60%	75.3%	75.3%	75.6%

Table 2-5: Modelled effects on NO_2 air quality using empirical methods

Parameter	MGLC (Allied plant contribution only)			Cumulative MGLC (Allied plus background)		
	Existing plant	Proposed plant		Existing plant	Proposed plant	
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
Annual average						
Modelled concentration (µg/m^3)	0.2	0.3	0.45	6.7	6.9	7.0
Percentage of WHO 2021 10 µg/m^3	2%	3%	4.5%	67%	69%	70%

Table 2-6: Modelled effects on NO_2 air quality using Screening method (100% conversion of NOx to NO_2)

Parameter	MGLC (Allied plant contribution only)			Cumulative MGLC (Allied plus background)		
	Existing plant	Proposed plant		Existing plant	Proposed plant	
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
24 hour average Note 1						
Modelled concentration (µg/m^3)	3.0	3.2	5.5	30.4	30.6	32.9
Percentage of WHO 2021 40 µg/m^3	7.5%	8.0%	14%	76%	76%	82%
Annual average						

Modelled concentration (µg/m^3)	0.48	0.52	0.89	7.0	7.0	7.4
Percentage of WHO 2021 10 µg/m^3	4.8%	5.2%	8.9%	70%	70%	74%

Table Notes:

1. The WHO 24-hour guideline allows 3 to 4 exceedances per year. The modelled 24-hour concentration presented in this table is the worst-case value rather than the fourth or fifth highest, which will be lower.

Attachment Three: Annual mass emission estimates

Table 3-1: Description of emissions scenarios for PM_{10}

Scenario short name	**Description**
Existing plant	
Envelope of emissions	Mass emissions allowed by proposed consent conditions for existing plant (consented PM_{10} emission rate and average production rate 365 days per year)
"Actual" emissions	"Actual" emissions for current plant based on recent annual production (70,000 TPY) and stack testing results (3.0 kg/hr TSP, 80% of which is PM_{10}).
Proposed plant	
Envelope of emissions	Mass emissions allowed by proposed consent conditions (consented PM_{10} emission rate and average production rate to produce 300,000 TPY)
"Actual" emissions at recent annual production + 10%	"Actual" emissions based on recent annual production + 10% growth (77,000 TPY) (assuming emissions at 80% of proposed consent limit for PM_{10} and average production rate).
"Actual" emissions at annual production cap	"Actual emissions allowed by proposed consent conditions (assuming emissions at 80% of proposed consent limit for PM_{10} and average production rate to produce 300,000 TPY

Comment on emissions estimates:

PM_{10} emission rates are based on consent limits expressed in kg per hour. These apply regardless of asphalt production rate. Therefore, estimated annual emissions are affected by the length of time it takes to produce the required amount of asphalt (i.e. the assumed production rate). As such, the estimated annual emission is higher if the plant is assumed to operate at "typical" production rates compared to the maximum production rate.

Table 3-2: Annual emissions estimates for PM_{10}

Scenario	Emission rate (kg/hr)	Production volume (tonnes/year)	Production rate (tonnes/hour)	Annual PM_{10} (tonnes)
Existing plant				
Envelope of emissions	3.36	700,800	80	29
"Actual" emissions	2.4[A]	68,000	50	3.3
Proposed plant				
Envelope of emissions	1.0	300,000	120	2.5
"Actual" emissions at recent annual production + 10%	0.8	75,000	120	0.5
"Actual" emissions at annual production cap	0.8	300000	120	2.0

Table 3-3: Description of emissions scenarios for NOx

Scenario short name	Description
Existing plant	
Envelope of emissions	Plant operating at maximum production rate 365 days per year (used oil)
"Actual" emissions	Plant producing 70,000 TPY (used oil)
Proposed plant	
Envelope of emissions	Plant producing 300,000 TPY (natural gas and diesel)
"Actual" emissions at recent annual production + 10%	Plant producing 77,000 TPY (natural gas and diesel)

Comment on emissions estimation method:

NO_X emission rates are scaled to production volumes per the AP-42 factors (i.e. kg NOx per tonne of asphalt), Therefore the production rate does not affect the estimated annual NO_X mass emissions, only the total amount of asphalt produced.

Table 3-4: Annual emissions estimates for NOx

Plant	Fuel	Emission rate (kg/hr)	Production volume (tonnes/year)	Annual NO_X tonnes
Existing plant				
Envelope of emissions	Used oil	2.2	700,800	20
"Actual" emissions	Used oil	2.2	68,000	1.9
Proposed plant				
Envelope of emissions	Natural gas	2.6	300,000	3.9
	Diesel	5.6	300,000	8.4
"Actual" emissions at recent annual production + 10%	Natural gas	2.6	75,000	1.0
	Diesel	5.6	75,000	2.1

Attachment Four: Benzene monitoring data, Khyber Pass, Auckland

Data provided to me in spreadsheet form by Auckland Council

Table 4-1: Summary of 1-hour average benzene concentrations (calculated from 10-minute average data)

Parameter	2013	2014
Maximum (µg/m^3)	14.1	14.7
99th percentile (µg/m^3)	10.5	10.0
Average (µg/m^3)	3.1	2.5
Percentage valid data	87%	70%

Table 4-2: Annual average benzene concentrations

Year	Annual average benzene concentration (µg/m^3)
2009	2.4
2010	2.9
2011	2.6
2012	2.5
2013	2.3
2014	2.2
2015	1.4
2016	1.2
2020	<2.0
2021	<2.0

Attachment Five: Discussion of default background NO_2 concentrations in good practice guidance

The recommended default background NO_2 concentrations in the good practice guidance[29] are based on Auckland monitoring data collected up to 2013 (and includes data from as early as 1994).[30] The monitoring sites included in the estimates were Glen Eden, Henderson, Kingsland, Mt Eden and Musick Point. Of these, only the Glen Eden and Henderson monitoring sites are still operational. The Glen Eden monitoring site is in an urban residential neighbourhood and the Henderson site is located at the front of a school, 10 m from a main arterial road.[31]

The main source of NO_2 in urban areas is traffic emissions. Roadside concentrations of NO_2 have been steadily reducing, as illustrated in Figure 2, which shows the trend in monthly NO_2 concentrations at Penrose in Auckland.[32] Similar trends are observed in the Waka Kotahi NO_2 roadside passive monitoring.[33]

In 2023, the annual average NO_2 concentrations recorded at Glen Eden and Henderson were 7 µg/m^3 and 9.3 µg/m^3, respectively. These can be compared to the Waka Kotahi updated default background concentration for the Omanu area, which was developed for 2020, of 6.5 µg/m^3.

24-hour average NO_2 concentrations recorded at Glen Eden and Henderson are summarised in Table 5-1. The key points from this table are that:

(g) Apart from a single outlier value at Glen Eden, the maximum 24-hour average concentrations are well below the good practice guide default value of 43 µg/m^3 as a 24-hour average.

(h) The fourth highest 24-hour average concentrations are all below the WHO 2021 guideline of 40 µg/m^3 as a 24-hour average.

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[29] Ministry for the Environment. (2016). Good practice guide for assessing discharges to air from industry. p 64

[30] Glen Eden, Henderson, Kingsland, Mt Eden and Musick Point monitoring sites. Of these, only the Glen Eden and Henderson monitoring sites are still operational

[31] Lincoln Rd in the vicinity of the air quality monitor has a daily traffic count around 26,000 to 32,000 AADT and around 6 to 8 percent heavy vehicles, based on data from 2022-2023.

[32] The Penrose monitoring station is located approximately 100 m from the southern motorway. AADT counts in this area of SH1 are approximately 140,000 with approximately 6.2% heavy vehicles. For comparison AADT on SH1 in the vicinity of MacDonald Street is 42,600 with approximately 6.5% heavy vehicles. Source: Waka Kotahi Open Data State Highway traffic monitoring data – annual average daily traffic

[33] Waka Kotahi. (2023). Ambient air quality (nitrogen dioxide) monitoring programme. Annual report 2007 to 2022.

(i) Apart from a single outlier value at Glen Eden, the concentrations recorded at this site are lower than the background value of 27.4 µg/m³ adopted for this assessment, estimated using empirical method.

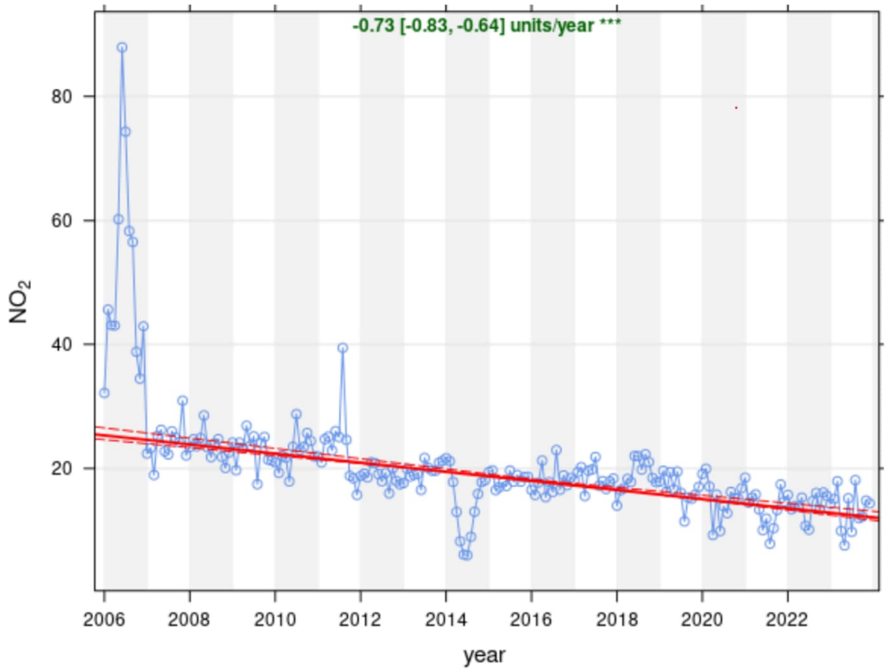

Figure 5-1: Trends in deseasonalised monthly mean NO_2 at Penrose site – January 2006 to December 2023 (reproduced from Auckland Council (2024), Figure 11) p 13[34])

[34] https://knowledgeauckland.org.nz/media/yfkg0ia4/auckland-air-quality-report-01january-2024.pdf.

Table 5-1: 24-hour average NO_2 concentrations at Glen Eden and Henderson, Auckland monitoring sites

Parameter	Glen Eden		Henderson	
	2022	2023	2022	2023
Percent valid data	88%	99%	99%	98%
Maximum (µg/m^3)	52.2 Note 1	16.6	34.4	28.5
Fourth highest (µg/m^3)	17.1	13.3	32.4	21.1
Fourth highest concentration as a percentage of WHO 2021 guideline 40 µg/m^3	43%	33%	81%	53%

Table Notes:

1. The value of 52.2 µg/m^3 appears to be an outlier. The second highest value recorded in this year was 18.6 µg/m^3

Attachment Six: NO_x stack emission test data from Marini vertical batch asphalt plants

Date	Site	Fuel	Production rate (tonnes/hour)	Concentration	Actual emission rate	Scaled emission rate (200 tph)
				(mg/m^3)	(kg/hr)	(kg/hr)
11/05/2021	Roseneath Queensland	Diesel	120	61	1.7	2.8
12/12/2019	Roseneath Queensland	Diesel	148	56.5	2.2	3.0
14/03/2018	Roseneath Queensland	Diesel	130	76	1.7	2.5
17/12/2021	Narangaba Queensland	Diesel	130	99	2.2	3.3
09/12/2020	Narangaba Queensland	Diesel	155	91.4	2.3	3.0
10/01/2023	Narangaba Queensland	Diesel	138	42	1.1	1.6
25/05/2021	Laverton, Melbourne	Natural gas	130	48	1.5	3.1

Attachment Seven: Information from Tauranga Airport Automated Weather Station

Table 7-1: Summary of wind speeds recorded at Tauranga Airport AWS and in modelling meteorological dataset

Note: Tauranga Airport AWS data for 2023 includes two months data from previous location (see Figure 7-1)

		Tauranga Airport AWS 2023	**Modelling meteorological dataset (2014-2016)**
Average windspeed		4.58	4.62
		Frequency (%)	
Calms		0.01	0.39
Wind speed (m/s)	0.5 -1.5	5.8	5.1
	1.5 - 4.0	39.8	35.7
	4.0 - 5	15.2	17.6
	5 - 7	22.6	26.4
	7 - 10	13.7	13.0
	>10	2.7	1.8

Figure 7-1: Location of Tauranga Airport AWS

<table>
<tr><th>2021</th><th>2022</th><th>2023</th><th>Key</th></tr>
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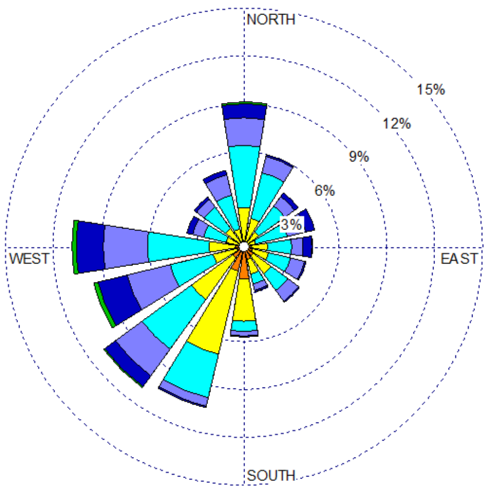
<td>
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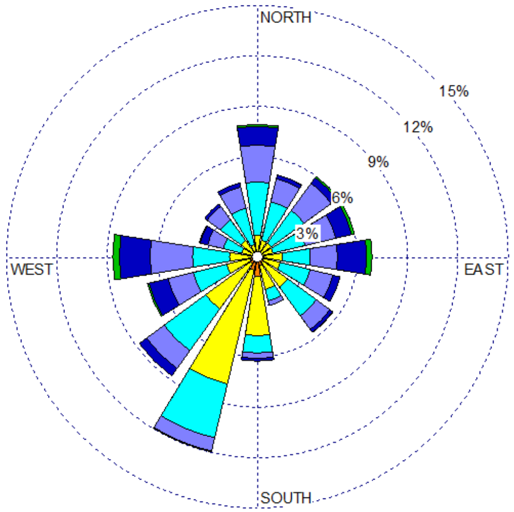
<td>
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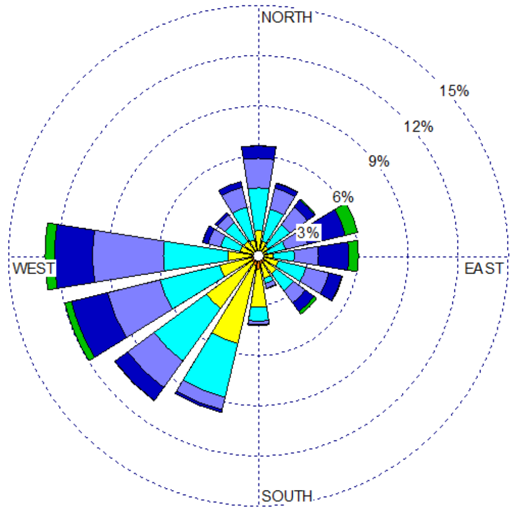
<td>
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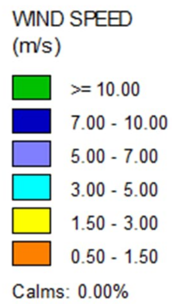
<td>
</td>
</tr>
<tr>
<td>Average windspeed: 3.90 m/s
Calms: 0.25%</td>
<td>Average windspeed: 4.17 m/s
Calms: 0.00%</td>
<td>Average windspeed: 4.58 m/s
Calms: 0.01%</td>
<td></td>
</tr>
</table>

Figure 7-2: Wind roses for Tauranga Airport AQWS (source: Metservice)

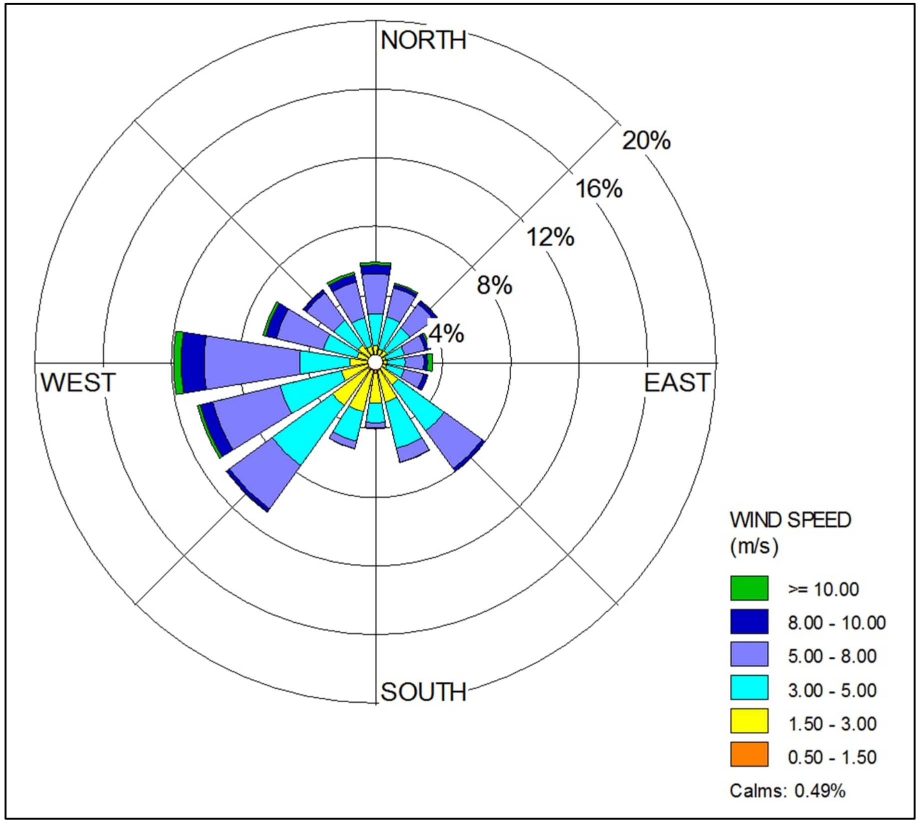


Figure 7-3: CALMET generated wind rose at the Allied site, 2014 to 2016 (Reproduced from Figure 2.5 in Updated AQA)

Attachment Eight: Odour stack emission test data from Marini vertical batch asphalt plants

The value of 38,500 OU/s (rounded to 39,000 OU/s) was adopted in the odour dispersion modelling as representative of the proposed asphalt plant. The average of all scaled emission rates shown in this table is 31,700 OU/s.

Date	**Site**	**Fuel**	**Production rate (tonnes/hour)**	**Actual odour emission rate (OU/s)**	**Scaled emission rate (200 tph) (OU/s)**
11/05/2021	Roseneath Queensland	Diesel (5% RAP)	120	12,800	21,300
12/12/2019	Roseneath Queensland	Diesel	148	28,400	38,400
14/03/2018	Roseneath Queensland	Diesel	130	20,300	31,200
17/12/2021	Narangaba Queensland	Diesel	130	15,100	23,200
09/12/2020	Narangaba Queensland	Diesel	155	14,900	19,200
10/01/2023	Narangaba Queensland	Diesel	138	34,800	50,400
30/09/2022	Laverton, Melbourne	Natural gas	130	25,000	**38,500**