18. AIR QUALITY

Overview

This chapter assesses the actual and potential air quality effects arising from the operation and construction of the Project. Operational effects include the potential for adverse air quality effects from vehicle exhaust pollutants. Studies conclude that adverse effects will be very minor/ negligible.

Construction of the Project has the potential to generate dust, particularly during the large scale earthworks. Construction works could have an adverse effect on air quality for sensitive receptors (mainly residential premises) within close proximity to the proposed earthworks.

Dust emissions will be monitored during construction to assist the control and management of construction dust discharges. The monitoring programme will be based on regular visual monitoring and routine inspections to ensure compliance with conditions relating to dust control. Adherence to dust management measures within the Air Quality Management Plan during construction will minimise the potential for adverse effects.

18.1. Introduction

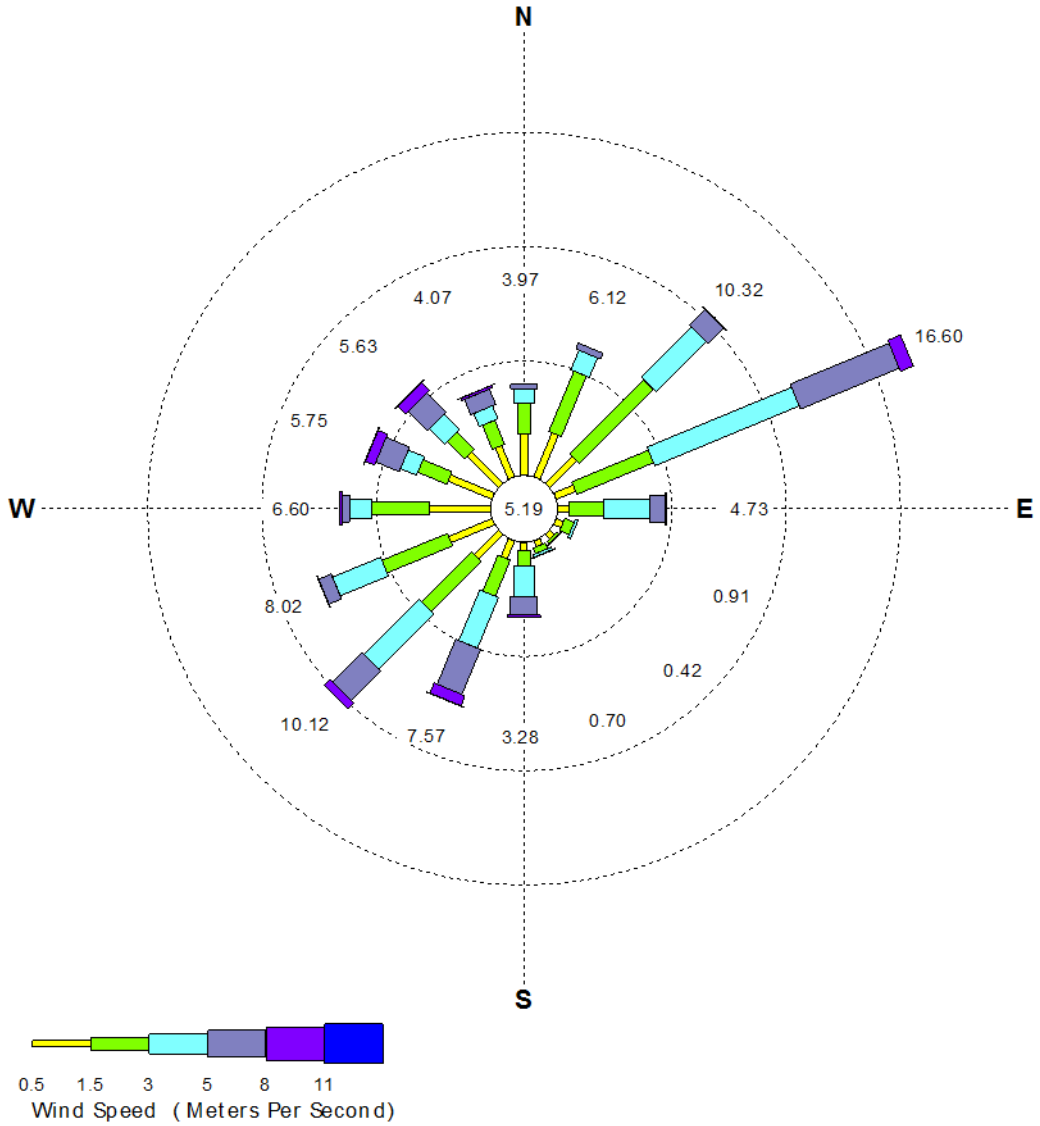
This chapter discusses the actual and potential air quality effects arising from the operation and construction of the Project. Operational effects arise from vehicle emissions from road users, whereas construction effects mainly relate to the generation of dust. The information contained in this chapter is based on Technical Report 10 - Assessment of Air Quality Effects, appended in Volume 3.

18.2. Existing air quality

In order to assess the air quality effects of the Project, information was gathered about existing air quality in the general area of the Project and about the location of potentially sensitive receptors.

Air quality is influenced by the prevailing meteorological conditions of an area, particularly wind speed and direction. Wind directions in the Project area are highly variable, with the predominant wind direction being from the northeast. Figure 50 presents a summary of wind speed and direction that is representative of the Project area and was derived from meteorological data at the Christchurch Airport (where conditions are expected to be comparable to those in the Project area). This information was then used in subsequent dispersion modelling for the Project.

Figure 50: Modelled wind speed and direction for Project area



The easternmost end of CSM2, between Halswell Junction Road and Springs Road, is within Christchurch Clean Air Zone 2 under the NRRP. The main purpose of Christchurch Clean Air Zone 2 is to provide a buffer zone to assist in reducing typical winter concentrations of PM_{10} in the Christchurch Clean Air Zone 1 to below 50 µg/ m^3. Christchurch Clean Air Zone 1, located further towards Christchurch city than the Project area, has been gazetted as an airshed under the National Environmental Standard for Air Quality (NES AQ).

No part of the Project is in any airshed that has been gazetted as an airshed under the NES AQ.

Most of the Project runs through essentially rural areas, with the exception of the southernmost part of MSRFL, which is on the northern edge of Rolleston, immediately adjacent to a residential

area. Therefore, the Lincoln monitoring site is considered to be the most representative of ambient air quality in the Project Area. In contrast, both the Hoon Hay and Hornby monitoring sites are located in established residential areas, within Christchurch Clean Air Zone 1, and are likely to be significantly impacted by emissions from solid-fuelled home heating, as is the Papanui monitoring site.

Table 31 presents a summary of background concentrations of PM_{10}, NO_2 and CO used for this assessment. ECan's Lincoln site was used for PM_{10} concentration and the Papanui site was used for NO_2 and CO, which were not monitored at the Lincoln site. The ambient background concentration of benzene has been assumed to be zero.

Table 31: Summary of background concentrations of PM_{10}, NO_2 and CO

Parameter	Average period	Background concentration	NES threshold
PM_{10}	24 hour	30 µg/ m^3	50 µg/ m^3
NO_2	1 hour	63.5 µg/ m^3	200 µg/ m^3
	24 hour	29.3 µg/ m^3	100 µg/ m^3
CO	1 hour	8.2 mg/m^3	30 mg/m^3
	8 hour	5.4 mg/m^3	10 mg/m^3

18.3. Sensitive receptors

The MfE's Good Practice Guide for Assessing Discharges to Air from Land Transport (2008) recommends assessing the air quality effects of a proposed road on identified sensitive receptors. These are people who are generally regarded to be likely to be more sensitive than the general population to vehicle exhaust emissions. Sensitive individuals are considered to include children and the elderly. Sensitive land use receptors include childcare and early learning facilities, schools, hospitals and residential care homes. In addition, areas of open space or parks used for recreational activities are classified as being receiving environments of high sensitivity.

There no schools, pre-schools, residential healthcare or retirement accommodation) within 200m of any part of the Project, although there are a number of residential dwellings within 100m of several sections of the Project.

All residential premises identified from the rates database within 200m of the Project were considered in this assessment, excluding those located on properties that have been identified for complete purchase by the Crown for this Project, for reasons other than air quality effects. Locations of sensitive receptors in the vicinity of each road section are discussed below, while

maps illustrating the locations of all selected sensitive receptors are included in Technical Report 10:

- Main South Road – 550m north of Rolleston Drive to Weedons Road (interchange):
  - this is the only section of the Project where large numbers of residential receptors are located – residential properties along Marlowe Place and the Living Z zoned land (currently undeveloped) to the northeast of Marlowe Place.
- Main South Road – Weedons Road (interchange) to CSM2:
  - there are a number of sensitive receptors located within 200 m of this section of Main South Road).
- CSM2 – Main South Road to Shands Road interchange:
  - there are a limited number of sensitive receptors located within 200m of this section of CSM2, mainly in the vicinity of Waterholes Road and Blakes Road. The closest of these receptors is located approximately 60m from the edge of the proposed alignment of CSM2. The south eastern corner of the Claremont subdivision is just within 200m of the alignment.
- CSM2 – Shands Road interchange:
  - there are a small number of sensitive receptors located within 200m of this section of CSM2, in the vicinity of Marshs Road and Halswell Junction Road. The closest of these receptors is located on Marshs Road, approximately 30m from the edge of the proposed alignment of CSM2, while a small part of the northern corner of the Aberdeen subdivision is within 100m-200m from the southbound off-ramp.
- CSM2 – Shands Road interchange to Halswell Junction Road:
  - there are a limited number of sensitive receptors located within 200m of the Shands Road Intersection, all in the vicinity of Marshs Road and Shands Road. The closest of these receptors is located on Shands Road, approximately 60m from the edge of the southbound on-ramp.

18.4. Operation of the Project

18.4.1. Dispersion modelling

Dispersion modelling has been undertaken to assess the pollutant levels associated with the operation and changes in the existing road network as a result of Project. The model, which inputs predicted traffic flows from the Project traffic model, predicts future levels of PM_{10}, NO_2, CO and benzene in the Project area for a total of four scenarios– two different scenarios for each of the years 2016 (the assumed year of opening) and 2026, as follows:

- 'Do Minimum' assumes that all other road improvement projects in the surrounding area have been completed except for the Project;
- 'With Project' (CSM2 + MSRFL) assumes that both CSM2 and MSRFL have been completed, along with all other road improvement projects in the surrounding area.

For each of the assessment years, the 'Do Minimum' scenario has been taken to represent the air quality 'baseline' for that year – i.e. ground level concentrations of air pollutants arising from the Project can be compared to predicted ground level concentrations in the absence of the Project, but including the effects of all other roading projects and changes to the vehicle fleet.

18.4.2. Dispersion modelling results

The results of dispersion modelling indicate that only one link within the Project (CSM2 between Shands Road Intersection and Halswell Junction Road) is likely to cause the concentration of air pollutants to exceed any of the MfE Tier 2 significance criteria. This relates to the concentration of PM_{10} at receptors located within 50 m of the centreline of CSM2 which is 2.9 µg/ m^3. This is slightly higher than the MfE Tier 2 significance criteria of 2.5 µg/ m^3. However, it is considerably less than the NES AQ of 50 µg/ m^3. The maximum increase in PM_{10} concentrations at the closest sensitive receptor to this section of the alignment (approximately 60m from the centreline) is 1.4 µg/m^3. In all other locations, the maximum predicted cumulative concentration of PM_{10} at any receptor is less than the MfE Tier 2 significance criterion.

The maximum predicted cumulative PM_{10} concentration is 32.9 µg/ m^3 including background, of which the contribution from the Project is 2.9 µg/ m^3.

While predicted maximum incremental concentrations of NO_2 slightly increase in all of the 'with Project' emission scenarios, at all receptors the concentration will be less than the MfE Tier 2 significance criteria of 20 µg/ m^3 as a 1 hour average and 5 µg/ m^3 as a 24 hour average. Furthermore, NO_2 concentrations at all locations are considerably less than the NES AQ of 200 µg/ m^3.

The maximum predicted increase in 1-hour average CO concentrations at any identified residential receptor is less than the MfE Tier 2 significance criteria of 1 mg/m^3 as an 8-hour average, in all modelled scenarios. Predicted cumulative 1-hour average CO concentrations for each of the modelled emission scenarios are all considerably less than the NZAAQG of 30 mg/m^3, and also less than the 8-hour average NES AQ of 10 mg/m^3.

The results indicate that discharges of air pollutants caused by vehicles using CSM2 and MSRFL will make only minor contributions to concentrations of PM10, NO_2 and CO in the surrounding area. In no case are vehicle exhaust emissions predicted to contribute more than 5.7% of the NES AQ threshold for PM10, 6.9% of the NES AQ threshold for NO_2 the NES AQ, or 2.0% of the NZAAQG for CO.

18.4.3. Regional cumulative effects

Regional scale impacts on the wider airshed will be insignificant, despite a slight increase in vehicle kilometres travelled overall. This is due to improvements in traffic flow through the Project area, combined with the continuing improvements in vehicle emissions generally. The Project will not affect ECan's ability to issue future resource consents within the airshed or to achieve compliance with the NES AQ.

Total heavy commercial vehicle movements within the region are also forecast to increase regardless of whether the Project is built or not (refer Assessment of Traffic and Transportation Effects). Heavy commercial vehicles are higher emitters of pollutants per vehicle kilometre travelled than light vehicles.

18.4.4. Vehicle emissions from traffic on other roads as a result of the operation of the Project

Although vehicle numbers on Shands Road and Marshs Road are predicted to increase significantly for the 'CSM2 only' and 'CSM2 + MSRFL' scenarios (as a consequence of traffic joining and leaving CSM2 at the Shands Road intersection), maximum predicted ground level concentrations of air pollutants at residential receptors located close to these roads will still be well below the relevant health-based assessment criteria.

Changes in traffic volumes on local roads are, including the significant increases in vehicle numbers on some local roads (e.g. Shands Road and Marshs Road) are unlikely to have a significant impact on concentrations of air pollutants at nearby receptors. Where the traffic volumes are expected to decrease on local roads, in consequence there should be a proportionate reduction in in vehicle emissions and reduced exposure to vehicle-related air pollutants for residents in the vicinity of those roads.

18.4.5. Summary of anticipated operational effects

Maximum ground level concentrations of all pollutants are predicted to increase between each of the modelled years (2016, 2026, 2041), as a consequence of increasing vehicle numbers.

Notwithstanding the potential exceedances of the 'acceptable' category in the Canterbury RAAQT, it can be inferred that discharges of air pollutants caused by vehicles using MSRFL and CSM2 are also unlikely to cause more than minor adverse effects on human health or the environment in the surrounding area.

In general, maximum ground level concentrations for any given year are predicted to be highest in the 'CSM2+MSRFL' scenario and lowest in the 'Do Minimum' scenario. This is most probably due to the increased vehicle numbers associated with the 'CSM2+MSRFL' scenario compared to either the 'CSM2 only' or Do Minimum' scenarios.

18.5. Construction of the Project

The following aspects of construction have the potential to cause adverse air quality effects:

- dust from earthworks and road construction; and
- vehicle exhaust emissions.

18.5.1. Dust from earthworks and road construction

The construction of the Project will entail relatively large scale earthworks. Exposed earthworks can be a significant source of dust.

Dust can affect human health and plant life along the edge of the earthworks area, can be a nuisance to the surrounding public, and can contribute to sediment loads by dust depositing in areas without sediment control measures. Sediments deposited on sealed public roads can also result in a dust nuisance. Rainfall, water evaporation and wind speed are meteorological conditions having the greatest effect on dust mobilisation.

Dust discharges from earthworks typically fall into the larger particle sizes, generally referred to as deposited particulates. These generally have minimal physical health impact (particles have only limited penetration into the respiratory tract), but may cause nuisance effects. This includes excessive dust deposits on houses, cars, and washing and excessive dust within houses.

Potential sources of dust which are able to cause nuisance beyond the site boundary during adverse weather conditions if adequate controls and mitigation measures are not adopted include:

- dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions;
- excavation and disturbance of dry material;
- loading and unloading of dusty materials to and from trucks; and
- stockpiling of materials including material placement and removal.

Dust may be generated from dry undisturbed surfaces at wind speeds greater than 5 -10 m/s (10 – 20 knots). Wind can transport dust mobilised from dry surfaces by machinery or truck movements or mechanical disturbance. Dust generation by truck and machinery movements in dry conditions is a function of vehicle speed, number of wheels and vehicle size. Judder bars or humps to reduce vehicle speed are not recommended as they can cause spillage of load and may damage loaded vehicles.

Unpaved roads and yard areas can be very dusty during dry weather. This can be aggravated if surfaces are allowed to get muddy during wet weather, since these eventually dry out and then become ground-up by vehicle movements.

Carrying out extensive earthworks during dry conditions exposes large areas to the effects of wind while being disturbed by machinery. Excavated areas left exposed during dry windy conditions can be significant sources of dust. Stockpiling of topsoil and subsoil and, in particular, dry dusty materials may also be major dust sources during stockpile formation when exposed to strong winds.

18.5.2. Emissions from construction vehicles

Construction vehicles have the potential to cause adverse air quality effects at neighbouring sensitive locations. Excessive smoke and odour from diesel-fuelled heavy vehicles, generators and other machinery is primarily caused by poor engine maintenance.

The CEMP describes measures to be undertaken to control and monitor vehicle emissions, including requirements to maintain vehicles and equipment in accordance with manufacturer specifications and immediately service units discharging excessive exhaust smoke.

Adherence to the CEMP practices for construction vehicles will ensure that all potential adverse effects associated with emissions will be adequately managed.

18.5.3. Summary of anticipated construction effects

The assessment estimates that only premises within approximately 100m of significant dust sources would be considered as potentially impacted by the effects of construction dust. Active management is required to prevent (if possible) or otherwise minimise the effects of dust emissions on these premises. Machinery emissions are expected to be minor.

18.6. Measures to avoid, remedy or mitigate construction dust effects

Mitigation measures will be required to ensure dust effects are not significant. The following measures are recommended in the Technical Report and proposed by the NZTA:

- **Dust suppression** - Dust discharges from activities can be significantly reduced by using water sprinkler systems during dry conditions. Adequate dust suppression is necessary to provide reasonable working conditions as well as minimising impacts upon sensitive receptors beyond the boundary of the site. Water will be applied to haul roads via water trucks and sprinklers in sufficient quantity to suppress dust but to avoid generating muddy conditions or sediment runoff. Appropriate application is uniform at a rate consistent with the evaporation rate. Detergents or hydrocarbon based liquids will not be used for dust suppression;
- **Water sprinklers** - sprinkler systems will be used during dry conditions. Water will be applied to haul roads via water trucks and sprinklers in sufficient quantity to suppress dust but to avoid generating muddy conditions or sediment runoff;
- **Access road and working area base** - Semi-permanent working areas and construction site access roads will be constructed with an appropriate base, kept metalled or sealed if on site for a significant period, and kept damp using watering

trucks or fixed sprinkler systems. Metalled areas will also prevent the creation of mud in winter;

- **Extent of earthworks** – The extent carried out during dry conditions will be limited as far as practicable to a manageable surface area to minimise dust generation while being disturbed by machinery;
- **Excavated** areas left exposed during dry windy conditions and liable to be dusty will be watered as necessary, or preferably stabilised e.g. through metaling, grassing or mulching;
- **Stabilisation of cleared areas** - Cleared areas not required for construction, access or for parking, if liable to cause excessive dust during windy conditions, will be stabilised e.g. through metaling, grassing, mulching or the establishment of vegetative cover;
- **Stockpile dampening and covering** - sand, soil and other materials liable to dry out and generate significant dust during windy conditions will be monitored and options such as dampening, allowing piles crust over, or covering, will be carried out as appropriate. Stockpile margins will be defined to minimise spread onto access areas;
- **Drop heights** – Stockpile drop heights will also be minimised to the extent practicable during stockpiling activities to minimise dust generation;
- **Plant and vehicle maintenance and management** -Vehicles will be appropriately maintained to minimise exhaust smoke and odour, and tailgates will be secure and all loads covered. Material tracked out from the site onto public roads, if significant, will be removed by suction sweeper;
- **Vehicle and tyre wash-down** - Vehicles leaving site from unsealed surfaces will be washed down to remove dust and/or coagulated material where necessary. This can occur at selected site exits either manually or automatically via the use of high pressure water hoses, jets or water assisted brushing. Detergents or hydrocarbon based liquids will not be used for vehicle cleaning;
- **Vehicle speed limits** -The imposition of vehicle speed limits is a practical measure to minimise dust emissions caused by construction traffic. The maximum speed limit on site will be 10 km/h or less;
- **Truck loading and unloading** - Loading and unloading of trucks will be conducted in a manner which minimises the discharge of dust. This includes the minimisation of drop heights during the loading of vehicles to minimise dust generation;
- **Material spills** – Significant spills of materials that may cause dust when dry will be collected, swept, scraped up or hosed down as soon as practicable; and
- **Wind break fencing** – Temporary wind break fencing of suitable length, height, porosity and orientation reduces prevailing wind speed and therefore the impact of dust on surrounding areas.

These mitigation measures will be implemented through an AQMP. A draft AQMP is included in Volume 4. In addition, these measures will be outlined during contractor induction training.

18.7. Monitoring during construction

A dust monitoring programme will be implemented during the construction and earthworks phases of the development, which shall form part of the AQMP, and will include but not be limited to the following:

- visual inspections of land adjacent to the site, construction exits and adjoining roads for the presence of dust deposits.
- checking weather forecasts for strong winds and rainfall.
- visual inspections of all unsealed surfaces (including earthworks sites) for dampness and to ensure that surface exposure is minimised.
- visual inspections of all sealed surfaces to ensure that they are clean and all spillages have been cleared.
- visual inspections of exposed earthworks sites, stockpiles and other dust generating activities to ensure they have been dampened, enclosed, covered, or stabilised. Ensure stockpile height is less than 3 m.
- inspecting watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen all exposed areas.
- inspecting wheel wash equipment to ensure effective operation.

A draft AQMP is included in Volume 4. The recommended method for monitoring deposited dust is visual monitoring. In the instance of strong winds, emissions of dust offsite or following a complaint, additional monitoring may be required.

18.8. Conclusion

Effects on air quality from the operation of the Project have been assessed as very minor, although maximum ground level concentrations of all pollutants predicting to increase between each of the modelled years (2016, 2026), as a consequence of increasing vehicle numbers. It can be inferred that discharges of air pollutants caused by vehicles using MSRFL and CSM2 are unlikely to cause more than minor adverse effects on human health or the environment in the surrounding area. As such, no monitoring or mitigation is proposed.

The assessment estimates that only premises within approximately 100m of significant dust sources would be considered as potentially impacted by the effects of construction dust. Active management will be undertaken to prevent (if possible) or otherwise minimise the effects of dust emissions on these premises. Compliance with proposed mitigation measures set out in section 18.6 and monitoring implemented through the AQMP will mitigate construction effects of the Project to an acceptable level.