APPENDIX H

Air Quality Consulting NZ Air Quality Assessment

AIR QUALITY
CONSULTING NZ

Technical Report

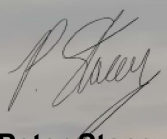
Winstone
Aggregates
Wheatsheaf Quarry
Proposed Expansion

Air Quality Assessment

Prepared for Winstone Aggregates

airqualityconsulting.co.nz

June 2024

Document Title:	**Wheatsheaf Quarry – Assessment of Air Quality Effects**
Document Version:	**Final**
Client:	**Winstone Aggregates**
Project Number:	**11138**
Date of issue:	**26 June 2024**
Prepared by:	 **Jonathan Harland** **Senior Air Quality Consultant**
Approved by:	 **Peter Stacey** **Managing Director**
File Name:	R001 Winstone Wheatsheaf - Air Quality Assessment April 2024 (FINAL)

Air Quality Consulting NZ Limited
9A Cajero Place, Green Bay
Auckland
New Zealand
Telephone: +64 21 614 842
Email: peter@airqualityconsulting.co.nz

Table of Contents

1 Introduction 5

2 Background Information 6

2.1 Site Location 6

2.2 Surrounding Environment 6

2.3 Airshed 7

2.4 Meteorology and Topography 8

2.5 Rainfall 11

2.6 Existing Air Quality 12

2.7 Complaint History 15

2.8 Sensitive Receptors 17

3 Assessment Methodology 19

3.1 Dust Discharges - CARP Requirements 19

4 Description of the Activity 21

5 Discharges to Air 23

5.1 Nuisance Dust 23

5.2 Fine Particulate Matter (PM_{10} and $PM_{2.5}$) 24

5.3 Vehicle Emissions 24

5.4 Respirable Crystalline Silica 25

6 Mitigation Measures 26

6.1 Visual Monitoring 28

6.2 Dust Monitoring 28

6.3 Wind Monitoring 29

6.4 Water Availability 29

7 Assessment of Effects 33

7.1 Frequency 33

7.2 Intensity 34

7.3 Duration 35

7.4 Offensiveness 35

7.5 Location 36

7.6 FIDOL Conclusion 36

7.6.1 Additional Targeted Mitigation 37

7.7 Cumulative Nuisance Dust Effects 37

8 Alternatives **39**

9 Conclusions **40**

10 Limitations **41**

Appendices

Appendix A: Dust Management Plan

Tables

Table 1: Wheatsheaf Quarry - Average Wind Speed Distribution (%) Jan 2020 to 31 Dec 2023 10
Table 2: Air Quality Complaints – Wheatsheaf Quarry 16
Table 3: Sensitive Receptor Locations 17
Table 4: FIDOL factors - Dust 19
Table 5: Mitigation Measures 26
Table 6: Visual Monitoring Requirements 28
Table 7: Summary of Water Consumption 30
Table 8: Frequency of High Wind Speeds in the Direction of Sensitive Receptors 34

Figures

Figure 1: Site location 6
Figure 2: The Site location relative to the airshed boundary 8
Figure 3: Wheatsheaf Quarry - Windrose (01 Jan 2020 to 31 Dec 2023) 9
Figure 4: Wheatsheaf Quarry - Seasonal Wind Roses (01 Jan 2020 to 31 Dec 2023) 10
Figure 5: Percentage of dry days by month 12
Figure 6: Current dust monitoring locations 13
Figure 7: 1-hour average PM_{10} concentrations 14
Figure 8: PM_{10} Polar Plots for the two dust monitoring locations 15
Figure 9: Map showing Site and nearby receptors 18
Figure 10: Daily water consumption based on 4.24 ha 31
Figure 11: 7-day water consumption based on 4.24 ha 31
Figure 12: Annual water consumption based on 4.24 ha 32
Figure 13: Area of potential dust effects from unmitigated dust emissions 38

Glossary of Abbreviations

AEE	Assessment of Environmental Effects
AQCNZ	Air Quality Consulting NZ Limited
AQNES	National Environmental Standards for Air Quality
AWS	Automatic weather station
CARP	Canterbury Air Regional Plan
DMP	Dust Management Plan
E	East
ECan	Environment Canterbury
FIDOL	Frequency, Intensity, Duration, Offensiveness and Location
GPG	Good Practice Guide
GPG Dust	Good Practice Guide for Assessing and Managing Dust
IAQM	Institute of Air Quality Management
km	Unit of distance: kilometre
kph	Unit of speed: kilometres per hour
MfE	Ministry for the Environment
m/s	Unit of speed: metres per second
N	North
NES	National Environmental Standard
NZAAQG	New Zealand Ambient Air Quality Guidelines
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 µm
UTM	Universal Transverse Mercator
US EPA	United States Environmental Protection Agency
RCS	Respirable Crystalline Silica
RMA	Resource Management Act 1991
S	South
SDC	Selwyn District Council
TSP	Total Suspended Particulate
EPA	Victoria Environment Protection Authority
W	West
Winstones	Winstone Aggregates
µg/m³	Unit of Concentration: micrograms per cubic metre
%	Percentage
m	Unit of distance: metre

1 Introduction

Winstone Aggregates (**Winstones**) owns and operates the Wheatsheaf Quarry, located at 50 Selwyn Road, Broadfield, between Prebbleton and Rolleston townships. Quarry activities have been in operation since the 1940s, albeit on a very small scale compared to the current operations. The quarry currently produces a wide variety of aggregates, including basecourse, concrete aggregates and sealing chip which are used in a wide range of uses, but predominately in civil infrastructure projects in Selwyn District, Christchurch and Banks Peninsula.

Based on the remaining resource in the current pit, and as a result of continued high demand for greywacke rock products, Winstones is proposing to expand its current quarry operations by undertaking an expansion into the area known as the Sullivan Block.

It is proposed that the extraction of material from the Sullivan Block will be undertaken in stages, followed by progressive rehabilitation. Material will be transported from the Sullivan Block to the existing Wheatsheaf Quarry processing plant, where processing of the material will take place. This application will not change the already consented operations, with activities such as extraction rate, processing and the stockpile area staying the same.

Air Quality Consulting NZ Limited (**AQCNZ**) has been engaged in relation to the Sullivan Block expansion to assess the air quality aspects, and in particular dust effects, associated with this proposal. AQCNZ has undertaken observations of the current operations at the Wheatsheaf Quarry and prepared a FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) assessment for the Sullivan Block expansion, which is based on observations of the current operations as well as observations and experiences at other similar sites. The purpose of the assessment is to accompany resource consent applications to Environment Canterbury (**ECan**) for an air discharge permit and to Selwyn District Council (**SDC**) for a land use consent.

This report should be read in conjunction with the Assessment of Environmental Effects (**AEE**) Report and resource consent application prepared by Bligh Planning and Engagement Limited.

2 Background Information

2.1 Site Location

The Wheatsheaf Quarry is located at 50 Selwyn Road, Broadfield, approximately 4 km west southwest of Prebbleton and 6 km east of Rolleston. The coordinates for the centre of the Site are approximately Universal Transverse Mercator (**UTM**) 618,138 m E, 5,172,422 m N, Zone 59. The Site's location relative to the surrounding area is shown in Figure 1.

Figure 1: Site location

2.2 Surrounding Environment

The Site and the surrounding area are zoned General Rural (GRUZ) under the partially operative Selwyn District Plan – Appeals Version (POSDP). The surrounding land is predominantly used for livestock grazing but includes other rural activities such as intensive poultry operations and a plant nursery.

There are nine existing residences (excluding properties owned by Winstones) within 250 m of the proposed Sullivan Block pit expansion, with the closest dwelling being approximately 115 m to the south of the proposed Sullivan Block.

As discussed in further detail in Section 5 of this report, the primary air pollutant that has the potential to be discharged from the Sullivan Block is nuisance dust. AQCNZ has reviewed surrounding activities and identified the following which have the potential for discharges and therefore potentially contribute to nuisance dust effects:

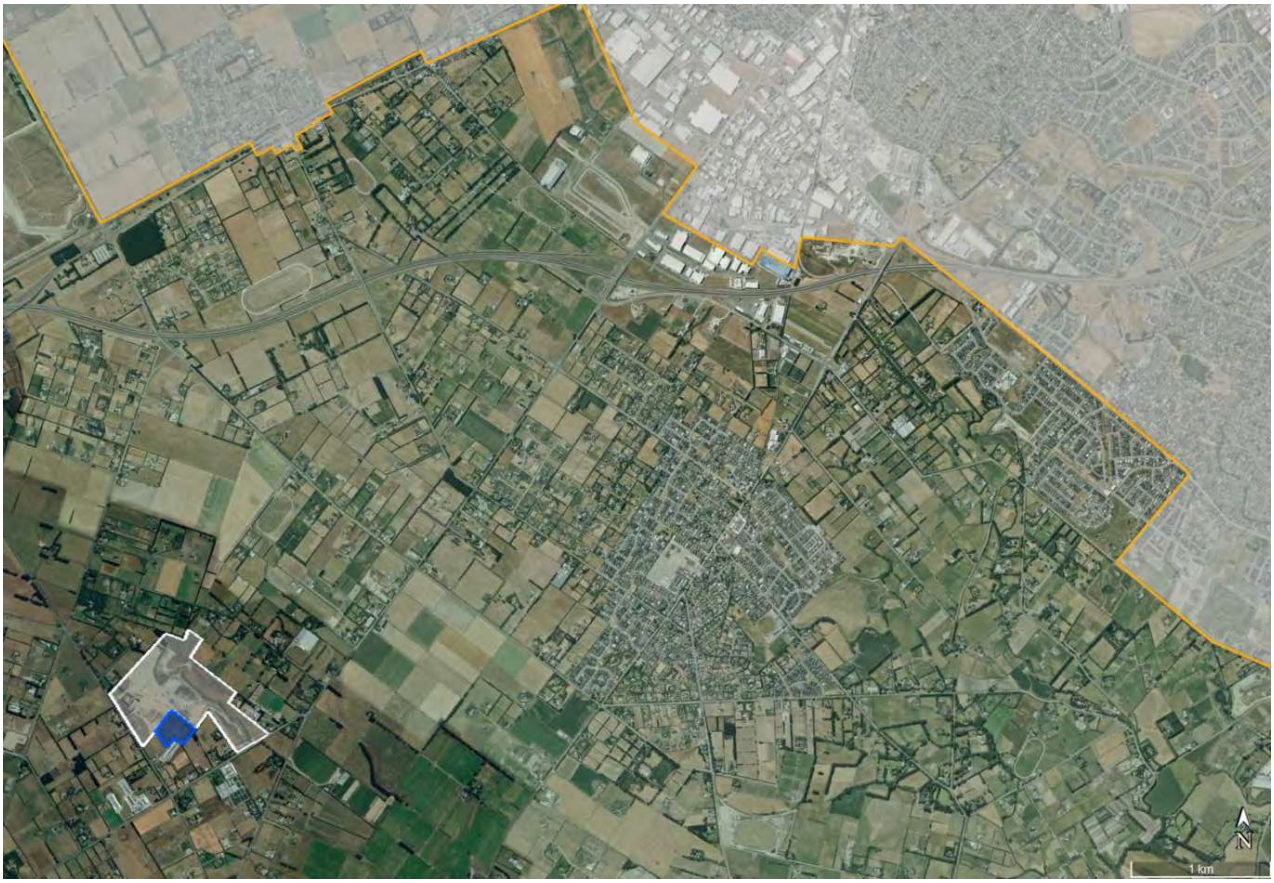
- There is a consented (CRC231512) intensive poultry farming operation approximately 400 m to the southwest of the proposed Sullivan Block.
- There is a second intensive poultry farming operation that borders the southeastern corner of the proposed Sullivan Block.
- Agriculture operations such as working of the land i.e. plowing and cultivation.

2.3 Airshed

The Wheatsheaf Quarry is not within an airshed with the closest airshed being the Christchurch Airshed approximately 5 km from the site. This airshed is deemed polluted based on historic monitoring that shows numerous PM_{10} (particles less than 10 µm in diameter) exceedances of the National Environmental Standard for Air Quality Regulations, 2004 (**AQNES**)[1]. As shown in Figure 2, at this distance it is very unlikely the Wheatsheaf Quarry will have any impact on this polluted airshed and therefore Regulation 17 of the AQNES is not applicable.

[1] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality), Regulations 2004

Figure 2: The Site location relative to the airshed boundary



2.4 Meteorology and Topography

Wind can have a significant impact on the potential for air quality effects; however, generally speaking, strong, dry winds intensify dust emissions. It is, therefore, important to understand the local meteorology to assess the potential for air quality effects to arise.

The topography in the region consists of low-lying, flat plains (Canterbury Plains), which spans 180 km along the eastern coast. The prevailing winds on the Canterbury Plains are north-easterly or south-westerly winds which are typical along the eastern coast of the South Island. The Canterbury region is also influenced by the Southern Alps Mountain Range, which is located to the west of the region. The most notable effect that the range has on the region is that of the strong, dry north-westerly winds.

The area around the Site is relatively flat without any significant terrain features. The nearest significant terrain features are the Port Hills, approximately 10 km to the east, and the Canterbury foothills, approximately 40 km to the northwest. These terrain features will have a limited effect on localised wind flows; however, they significantly influence regional weather patterns.

Winstones operates its own Automatic Weather Station (**AWS**) recording wind speed and direction at the site. Data from this station for the period January 2020 to December 2023 has

been analysed and the distribution of hourly average wind speeds and directions recorded at the site is presented in Figure 3, and a seasonal breakdown of the data is presented in Figure 4. The distribution frequency of wind speed is presented in Table 1.

AQCNZ has also reviewed the closest publicly available wind data from the Lincoln Broadfield Meteorological station, which is operated by NIWA, approximately 4 km south of the quarry. The data collected at Wheatsheaf Quarry closely resembles corresponding wind data from Lincoln and therefore AQCNZ considers using the on-site data to be appropriate.

Figure 3: Wheatsheaf Quarry - Windrose (01 Jan 2020 to 31 Dec 2023)

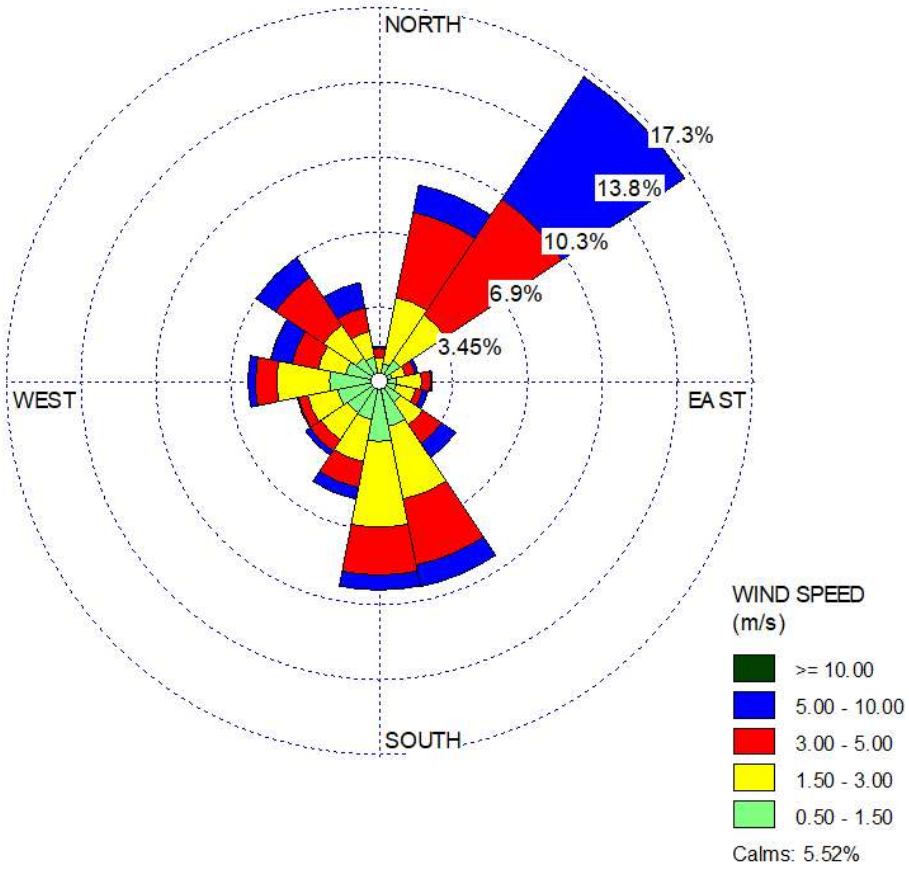


Figure 4: Wheatsheaf Quarry - Seasonal Wind Roses (01 Jan 2020 to 31 Dec 2023)

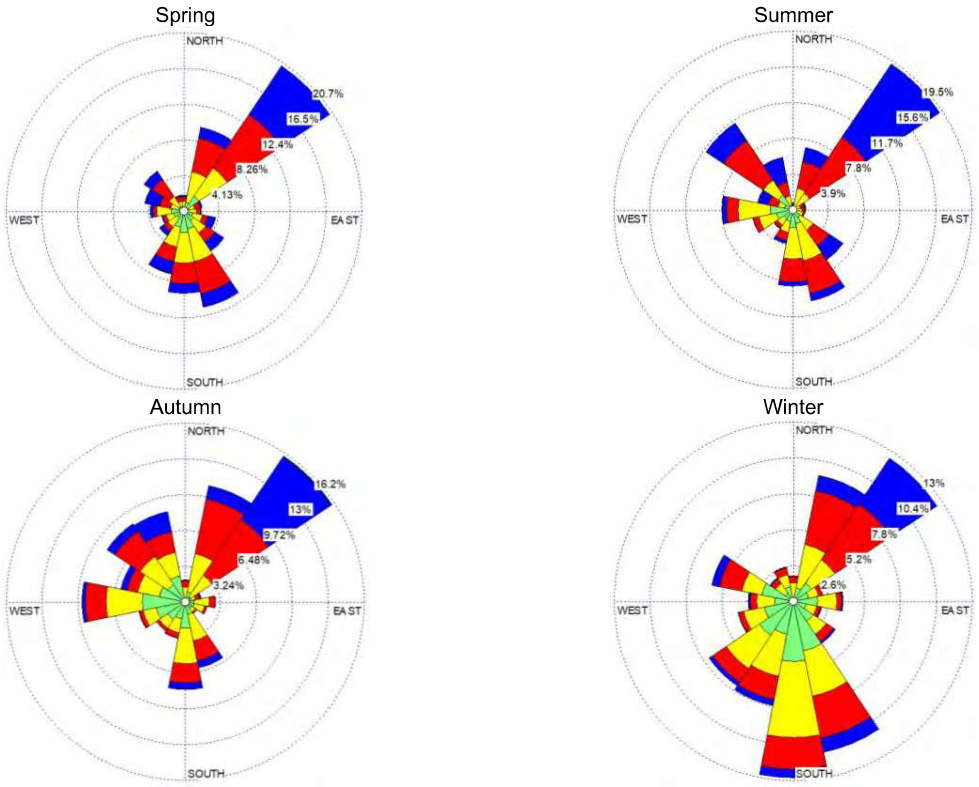


Table 1: Wheatsheaf Quarry - Average Wind Speed Distribution (%) Jan 2020 to 31 Dec 2023

Wind Direction	Wind Classes (m/s)					
	0.5 -1.5	1.5 – 3.0	3.0 – 5.0	5.0 – 10	>10	Total (%)
N	0.3	0.8	0.4	0.1	0.0	1.7
NNE	0.9	3.1	4.0	1.3	0.0	9.2
NE	1.2	2.5	6.4	6.8	0.0	16.9
ENE	0.7	0.6	0.4	0.1	0.0	1.9
E	0.9	1.1	0.4	0.1	0.0	2.5
ESE	0.9	0.9	0.3	0.3	0.0	2.3
SE	1.2	1.2	1.0	0.8	0.0	4.3
SSE	2.2	3.4	3.1	1.0	0.0	9.7
S	2.8	3.9	2.2	0.7	0.0	9.6
SSW	1.9	2.0	1.2	0.5	0.0	5.6
SW	1.8	1.5	0.6	0.2	0.0	4.1
WSW	2.0	1.4	0.4	0.1	0.0	3.9
W	2.3	2.4	1.0	0.3	0.0	6.1
WNW	1.6	1.3	1.2	1.0	0.0	5.2
NW	1.4	1.8	2.7	1.1	0.0	6.9
NNW	1.2	1.2	1.1	1.2	0.0	4.7
Sub-Total	23.2	29.2	26.5	15.5	0.1	94.5
Calms						5.5
Total						100

Based on the data from Wheatsheaf Quarry, it is apparent that there are variations between the spring/summer and autumn/winter wind patterns. The spring/summer months experience more northeast/east-northeast winds, while the autumn/winter months typically experience winds from the south and northeast. In general, the area is dominated by low wind speeds (< 5 m/s) caused by stable weather conditions, particularly during winter. However, during summer, there is a relatively high frequency of winds from the northeast and east-northeast. Strong winds (>5 m/s), which can exacerbate dust emissions, show a similar pattern with winds being predominately from the northeast and to a lesser extent from the south and northwest. Strong winds also occur from the northwest albeit at a lower frequency. Winds from the east to southeast are very infrequent.

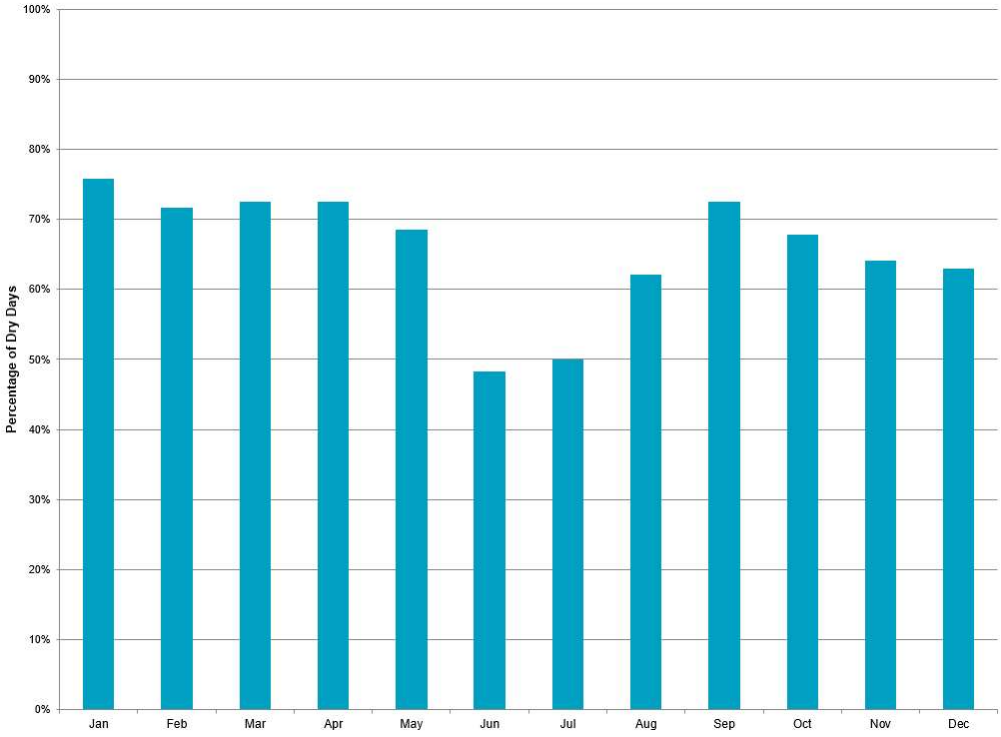
2.5 Rainfall

Rainfall acts as a natural dust suppressant and therefore reduces the potential for dust generation. Therefore, a key consideration in assessing the potential for dust emissions is identifying when the ground surface is likely to be wet or dry, i.e. when the evaporation rate exceeds the rainfall rate.

The percentage of dry days[2] by month has been calculated based on the nearby Lincoln monitoring site for the years 2020 to 2023 and is presented in Figure 5. The driest months of the year are generally late summer to earlier autumn, therefore greater emphasis on the management of dust should be given during these drier months. Over the four-year period, the number of days where there was no rainfall over a 24-hour period (or 'dry days') was 960 days, which corresponds to 66 percent of the time.

[2] Days without any measurable rainfall.

Figure 5: Percentage of dry days by month



2.6 Existing Air Quality

The predominant pollutant generated from the Wheatsheaf Quarry is dust, and in particular nuisance dust (coarse particulate 30 – 100 micrometers (µm) in diameter). While a proportion of dust will include finer particulates (PM_{10}) which can cause health effects, PM_{10} from quarrying operations are generally low. Given the rural nature of the surrounding area, it is unlikely for there to be high concentrations of PM_{10} except for the occasional discharge from agricultural type activities such as burn-offs. Therefore, it is not expected that background concentrations exceed the PM_{10} 24-hour average standard set under the AQNES of 50 µg/m³.

The site currently operates two continuous PM_{10} dust monitors. Monitoring has been undertaken at the site since January 2019 in response to directives from ECan for quarry operations to undertake dust monitoring. The purpose of the monitoring is to provide warnings of potential dust events through the real-time measurement of PM_{10} and comparison against a dust trigger criterion of 150 µg/m³ as an hourly average as set out in the Ministry for the Environment (MfE) Good Practice Guide for Dust[3] (**GPG Dust**). This criterion is explicitly for managing nuisance impacts and is not a health-based criterion.

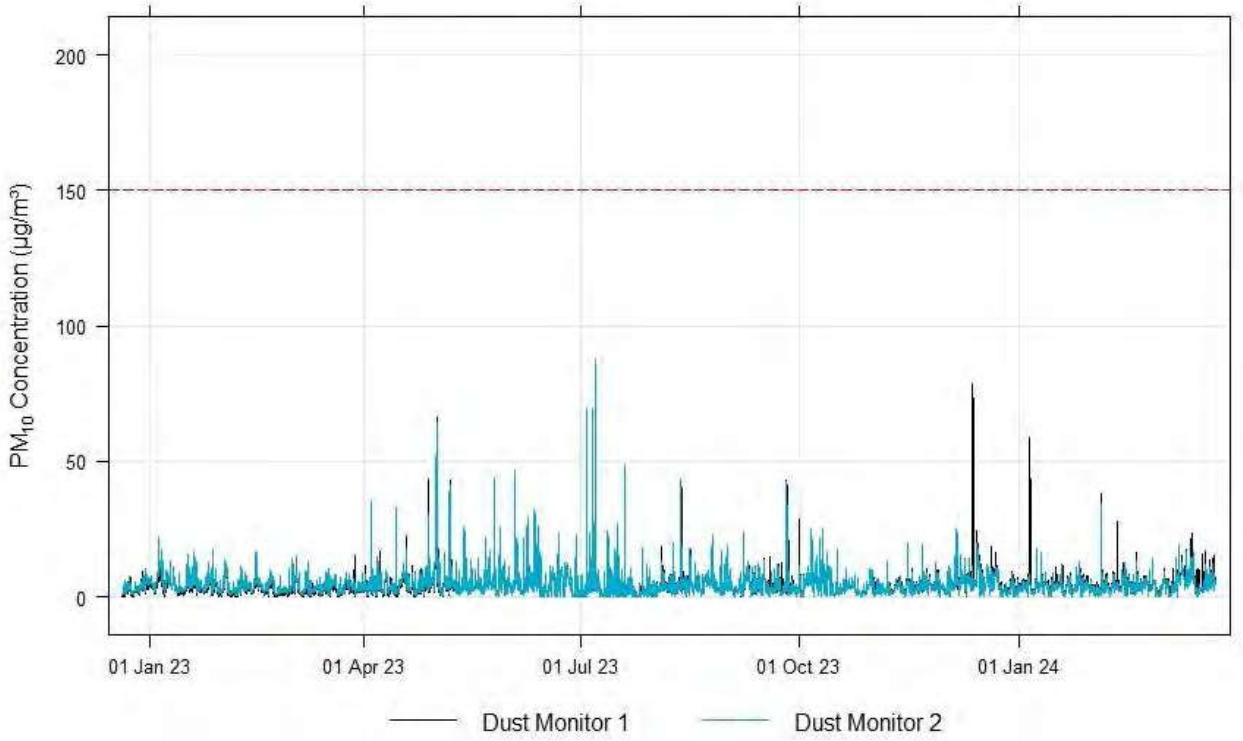
While monitoring has been undertaken since 2019, as part of the last expansion project, the dust monitoring locations were moved in December 2022 to the locations shown in Figure 6. AQCNZ

[3] Ministry for the Environment. 2016. *Good Practice Guide for Assessing and Managing Dust*. Wellington: Ministry for the Environment.

considers that the current monitoring locations best represent potential dust discharge from the Sullivan Block, especially Dust Monitor 1, therefore has presented the data collected at both these locations. The hourly average PM_{10} concentration measured between 20 December 2022 and 24 March 2024 is presented in Figure 7. Both Dust Monitor 1 and 2 recorded similar average concentrations of 4.1 and 4.4 µg/m³ respectively over the monitoring period. Dust Monitor 2 recorded a slightly higher 1-hour maximum concentration of 87.9 µg/m³ compared to 78.9 µg/m³ recorded by Dust Monitor 1. However, both monitors during this period recorded values lower than the MfE nuisance dust criteria of 150 µg/m³.

Figure 6: Current dust monitoring locations

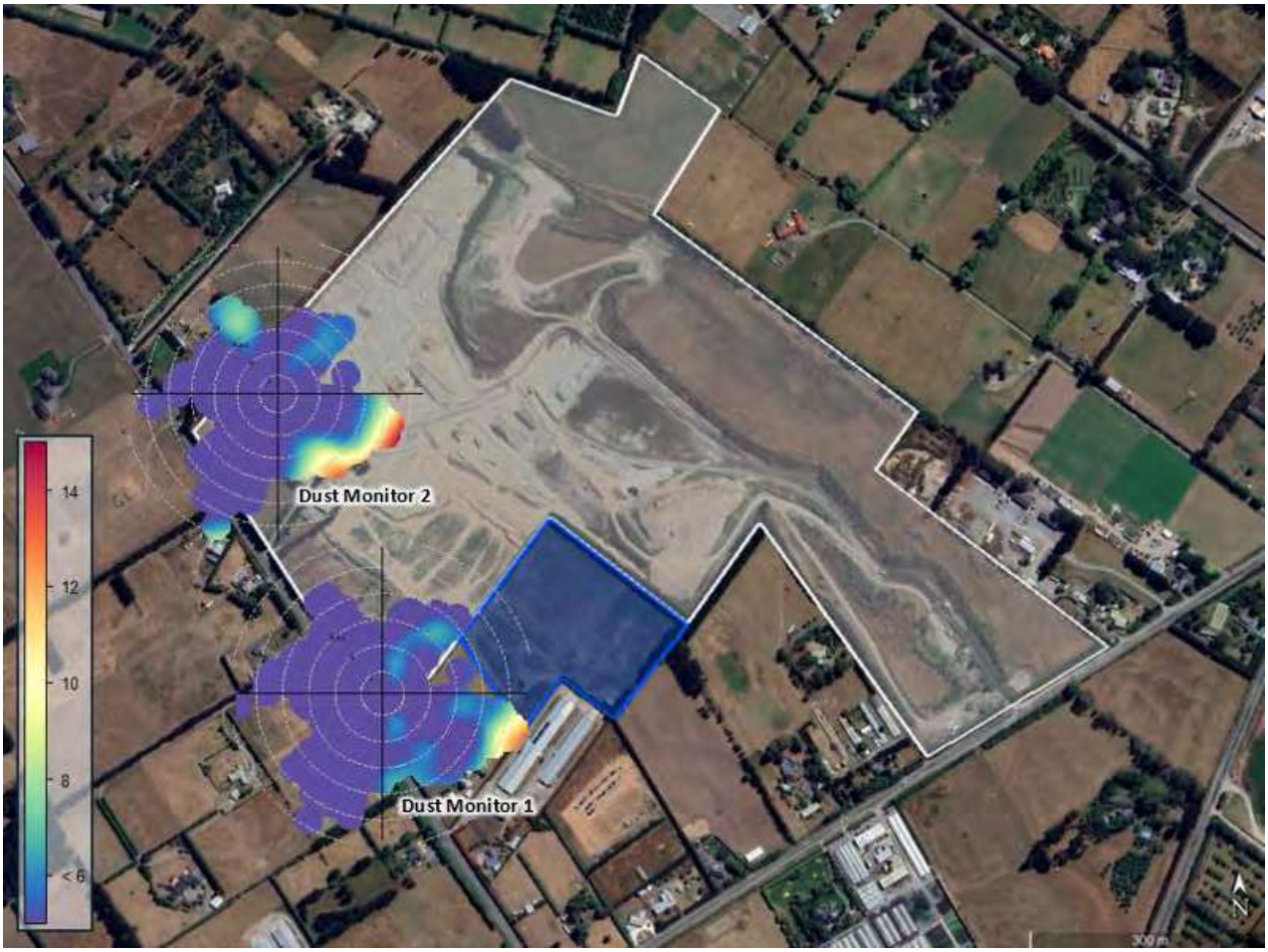
Figure 7: 1-hour average PM_{10} concentrations



To help understand the potential sources of dust currently generated on-site, Figure 8 presents a polar plot of the data for the two dust monitors. A polar plot shows three variables in one representation, wind speed, wind direction and 1-hour average PM_{10} concentration (µg/m³). A coloured dot is placed over the grid for each possible wind direction and speed. The colour of the dot represents the "maximum" concentration (in µg/m³) of PM_{10} measured at the monitoring site during the wind conditions at the spot i.e. for the plots below, the higher PM_{10} concentrations are indicated by red and the lower concentrations by purple. Presenting the three variables (concentration, windspeed and wind direction) in one figure makes it easier to understand the potential source of the dust.

Based on Figure 8, for Dust Monitor 1, the main source of PM_{10} appears to be coming from off-site and to the east of the dust monitor, with very little influence from the quarry. Whereas for Dust Monitor 2, the main source appears to be the quarry when wind speeds exceed 7 m/s.

Figure 8: PM_{10} Polar Plots for the two dust monitoring locations



2.7 Complaint History

AQCNZ has reviewed ECan's complaints records for the Wheatsheaf Quarry[4] to understand the effectiveness of dust control measures used at the Quarry and the sensitivity of the surrounding area.

In total, three complaints have been received since 2019 in relation to air discharges. The date and description of the complaint noted in the complaint logs are provided in Table 2.

The complaints can be summarised as follows:

- Two complaints relate to visible dust being observed discharged beyond the Site boundary. The other complaint also relates to visible dust but does not mention if it is occurring beyond the boundary.

[4] LGOIMA request received 12 April 2024.

- Two complaints appear to be related to periods of high wind, and two complaints mention easterly winds.
- The time of day that the complaints were made was varied.
- One of the complaints identified topsoil as the cause of the dust.
- None of the complaints were noted as being verified by an ECan compliance officer.

Given the size of the existing quarry and the scale of activities, AQCNZ considers the number of complaints received over the five-year period to be low (no more than 1 per year). While complaints are not always a good indicator of whether an adverse effect is occurring, as people may not choose to complain for various reasons, it suggests that, for the most part, dust control measures at Wheatsheaf Quarry are effective at controlling dust and minimising its effects on the surrounding environment. Consequently, adopting similar dust control measures for the Sullivan Block extension is considered appropriate.

Table 2: Air Quality Complaints – Wheatsheaf Quarry

No.	Date	Description of Complaint
1	**06/03/2019**	*"Dust blowing onto his property, with easterly blowing".*
2	**06/03/2020**	*"Caller reported dust currently coming from the Winstone Quarry at 50 Selwyn Road, Broadfield. Just noticed at Robinsons Road. Strong Easterly wind and caller can't tell if they are doing anything to control the dust."*
3	**19/12/2023**	*"Caller noted there is piles of topsoil in the quarry, that when the wind gets up blows an excessive amount of dust through to Robinsons road. There does not seem to be any planting or mitigation occurring to reduce this. The dust is impacting on the callers property and home around the corner too. It is currently happening now and has been occurring since they have been expanding the quarry."*

2.8 Sensitive Receptors

A sensitive receptor/activity is defined in the Canterbury Air Regional Plan (**CARP**) as follows:

a) the area within 20m of the façade of an occupied dwelling; or
b) a residential area or zone as defined in a district plan; or
c) a public amenity area, including those parts of any building and associated outdoor areas normally available for use by the general public, excluding any areas used for services or access areas; or
d) a place, outside of the Coastal Marine Area, of public assembly for recreation, education, worship, culture or deliberation purposes.

Based on this definition, AQCNZ has identified the location of a number of sensitive receptors within 250 m of the Sullivan Block and these are summarised in Table 3. The 250 m distance is based on the guidance provided in the draft separation distance guideline published by the Victoria Environment Protection Authority[5] (**EPA**). This document recommends a 250 m buffer for a *"Mine for other minerals"* (covering activities such as crushing, stockpiling and conveying of other minerals). Figure 3 presents the location of these receptors along with a red buffer based on recommended distances of 250 m from the site boundary for dust.

Table 3: Sensitive Receptor Locations

Receptor ID	Receptor Name	Distance to Receptor from Sullivan Block	Direction Relative to the Sullivan Block	Receptor Type
SR1	58 Selwyn Road	160 m	East southeast	Residential
SR2	74 Selwyn Road	210 m	Southeast	Residential
SR3	90 Selwyn Road	220 m	South southeast	Residential
SR4	104 Selwyn Road	240 m	South	Residential
SR5	666 Robinsons Road	150 m	South southwest	Residential
SR6	668 Robinsons Road	115 m	Southwest	Residential
SR7	663 Robinsons Road	190 m	South southwest	Residential
SR8	679 Robinsons Road	175 m	Southwest	Residential
SR9	701 Robinsons Road	230 m	West	Residential

[5] Victoria Environmental Authority, Separation distance guideline/ Publication/ December 2022.

Figure 9: Map showing Site and nearby receptors

3 Assessment Methodology

The primary concern with dust is its ability to cause an effect that could be considered 'offensive' or 'objectionable'. In order to assess whether a dust event has the potential to be offensive or objectionable, the MfE GPG Dust recommends the FIDOL (frequency, intensity, duration, offensiveness and location) assessment tool. The FIDOL factors concerning dust are summarised in Table 4.

Table 4: FIDOL factors - Dust

FIDOL Factor	Description
Frequency	The frequency of dust discharges is how often an individual is exposed.
Intensity	Intensity relates to the concentration of dust impacts at receptor locations. Intensity is primarily characterised by the distance from the dust source, with dust intensity effects reducing with increasing distance.
Duration	The duration relates to the length of time that receptors are exposed to a potential dust event. Duration depends on wind conditions blowing dust from The Site to the receptor.
Offensiveness	Offensiveness relates to dust from the Site activities will have a character similar to naturally occurring dust in the area.
Location	The sensitivity of locations in the receiving environment is characterised by land uses surrounding the Site.

3.1 Dust Discharges - CARP Requirements

Schedule 2 of the CARP provides ECan's criteria for assessing offensive or objectionable dust. ECan will consider the FIDOL factors as detailed in Section 0 and *"some or all of the following: (It will not be necessary to consider all the listed matters in items 1 to 9 in every case).*

1. *Other validated dust complaints or events relating to discharges from the same Site, including previous validated complaints from one location.*
2. *Collection of dust samples and analysis to identify source (where necessary and appropriate).*
3. *Weather conditions at the time of the dust event, notably wind speed, wind direction and rainfall.*
4. *Information regarding operational conditions that may have caused the complaint. The effectiveness of dust control measures at the Site will be taken into account.*
5. *A complaints register is held at the Site. The CRC may require the discharger to keep such a register and identify any cause of an alleged dust effect, including remedial action taken.*
6. *Dust monitoring both within and beyond the Site boundary. This includes both deposited dust and suspended particulate monitoring. Regard should be had to the Ministry for the Environment's Good Practice Guide for Assessing and Managing the Environmental*

Effects of Dust Emissions (January, 2001) when designing a dust monitoring programme and selecting the method of measurement.

7. *Results of dispersion modelling carried out as part of an assessment of effects to predict suspended particulate concentrations and dust deposition. These results may be compared to the trigger levels recommended in the Ministry for the Environment's Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions (January, 2001). Note that this method will have limited application to dispersed area sources or small scale discharges. Its primary value lies in the prediction of the effects of point source dust discharges, such as stacks.*
8. *Contents of dust diaries held by people living and working in the affected area. People may be requested to keep such a diary. The diaries would record details of any dust event, including the date and time of the event, weather conditions (wind speed and direction, rainfall) at that time, a description of the type and amount of the dust detected, and the duration of the dust event.*
9. *Results of a public survey or field investigation commissioned by the CRC or the person responsible for the discharge. In this case it is critical that the survey or investigation is professionally designed to ensure that credible and reliable information is gathered".*

This report will use the FIDOL assessment tool to determine the potential for dust discharges to be considered ‘offensive or objectionable’.

4 Description of the Activity

To meet continued demand for aggregate and to allow for the continued operation of the quarry, Winstones is proposing to expand the Wheatsheaf Quarry into the 4 ha area known as the Sullivan Block which is located to the south of the existing pit. The extraction activities proposed will follow on from quarry activities that have occurred through the most recent extension of the quarry approved in 2022.

Extraction activities are proposed to be undertaken in the Sullivan Block in stages. Prior to quarrying, topsoil and subsoil overburden material will be removed from each stage of the extension area. Topsoil removal will be undertaken at ground level using an excavator and dump trucks, in combination with a loader. Topsoil and overburden material removed through the first stage of site preparation will be used to form bunds along the southern and eastern boundary of the site (external boundaries). Generally, these site preparation works will be completed within a four-week window and typically avoid the height of summer and the middle of winter, in accordance with past practice at the site.

Following site preparation within a stage, extraction of aggregate is undertaken using standard quarrying machinery typically involving a loader which loads dump trucks, although other machinery may be used from time to time to enable the efficient extraction of the aggregate resource. Extraction of the aggregate resource itself will occur by working from the existing quarry areas so quarrying can commence at the level of the existing quarry floor, minimising dust effects.

Aggregate will not be stockpiled within the Sullivan Block but rather extracted and loaded by the loader into the truck as it arrives within the extension. Once loaded, these trucks will exit the extension and travel via internal haul roads to the existing processing plant where the material will be processed, stockpiled, and sold.

Based on the estimated volume of material and the current production rates, it is anticipated that the quarry will be worked out within approximately three years, with a further two years proposed both as a buffer for additional extraction, but primarily to enable the completion of cleanfilling and site rehabilitation.

If cleanfilling does occur, it is proposed to use worked-out areas for cleanfilling once an area that does not impede on the extraction operation becomes available, and/or for reinstating final batter slopes. This will allow for progressive rehabilitation whereby extraction activities are closely followed by cleanfilling and site rehabilitation.

All material to be used in the backfilling and rehabilitation of the site is to be cleanfill material meeting the definition of cleanfill under the LWRP and will be in accordance with a Cleanfill Management Plan (**CMP**) prepared for the site.

Cleanfill material brought to the site will pass over the Winstone Aggregates quarry weighbridge and be unloaded at a cleanfill ‘tip head’ and spread across the working cleanfill area. Visual inspections of the quality of the cleanfill coming in will assist in ensuring that the material meets the definition of cleanfill, with any unacceptable loads being turned away from the site. Should an unacceptable load reach the tip head and be unloaded.

Once the site has been backfilled, final rehabilitation will be undertaken, primarily by re-spreading and contouring of overburden and stored or imported topsoil materials, stabilisation of quarry

faces and grassing of completed and restored extraction areas to create a free draining and stable landform.

There will be no change to the processing plant, weigh station, office area, workshop, staff rooms and parking as a result of this proposed expansion.

The current mineral extraction is being undertaken in the areas known as B-Block and C-Block, with C-Block bordering the Sullivan Block to the northwest. Extracted material is extracted from the pit face and transported to the processing and stockpile area in the centre of the site. No change to these processing activities is being sought with this application.

5 Discharges to Air

The following section of this report describes the activities that have the potential to generate air discharges from the extraction of aggregate from the Sullivan Block.

AQCNZ has reviewed the proposed onsite activities and considers there is the potential for the following air pollutants to be discharged.

- Nuisance Dust;
- Fine Particulate Matter (PM_{10} and $PM_{2.5}$);
- Vehicle Emissions;
- Respirable Crystalline Silica;

A range of mitigation measures will be used to minimise discharges. These mitigation measures are set out in the Dust Management Plan (**DMP**) attached in Appendix A and summarised in Section 6.

5.1 Nuisance Dust

The principal air pollutant associated with any quarrying operation is dust, primarily in the coarse size fraction that can generate nuisance effects.

Nuisance dust generally consists of larger particle sizes (generally greater than 30 µm in diameter) which are otherwise known as total suspended particulate (**TSP**).

Individual particles typically become visible at approximately 50 µm, and particulate discharges in this size range (greater than 50 µm) are generally associated with nuisance effects rather than health effects.

Nuisance dust effects often relate to dust clouds obscuring visibility and soiling of clean surfaces such as cars, washing and buildings/windows, etc.

There is also the potential for nuisance dust to lead to the contamination of rainwater collection systems and increased dust deposition inside houses. These effects can lead to additional cleaning requirements, reduced ability to enjoy outdoor living areas, and overall reduced amenity values.

Excessive dust emission can also have adverse effects on plant life due to reduced photosynthesis, increased incidence of plant pests and disease, reduced effectiveness of pesticide sprays, and crop soiling effects can also lead to rejection or downgrading of the quality of some types of horticultural crops.

Generally speaking, TSP does not travel further than 250 m from the source of dust during periods where the wind is less than 10 m/s.

AQCNZ considers that dust could be generated from the following sources/activities:

- Removal of overburden and construction of the bund.
- Extraction of aggregate.
- Vehicles operating within the Sullivan Block.
- Wind erosion of the working area.

- Rehabilitation and cleanfilling operations.

5.2 Fine Particulate Matter (PM_{10} and $PM_{2.5}$)

The potential for health effects associated with dust emissions is determined by a number of factors including particulate size, concentration, and chemical composition.

PM_{10} have the ability to enter the alveoli in the lungs and cause respiratory health effects. There is significant evidence of the effects of short-term exposure to PM_{10} on respiratory health; however, elevated particulates with an aerodynamic diameter less than 2.5 µm (**$PM_{2.5}$**) concentrations have a higher risk factor for long-term exposure and mortality rates.

PM_{10} and $PM_{2.5}$ discharges are normally associated with combustion activities, such as vehicle emissions and domestic home heating, however these size fractions have also been found to be associated with quarrying activities, primarily vehicles travelling on haul roads (through the grinding and pulverising of material as vehicles travel along these surface) and the crushing and screening of aggregates. There will be no new haul roads established as part of the Sullivan Block and no aggregate processing will occur in this area, therefore, PM_{10} and $PM_{2.5}$ emissions from this source will be minimal. Furthermore, materials will be retained in a wet state, minimising any potential for any dust emissions (TSP or PM_{10}/$PM_{2.5}$).

Overall, AQCNZ considers the potential for PM_{10} and $PM_{2.5}$ discharges from the proposed Sullivan Block expansion to be very low to negligible, providing that the proposed mitigation measures are implemented. Furthermore, off-site concentrations of these air pollutants are likely to be well below the relevant air quality standards and guidelines, namely, the AQNES, MfE Ambient Air Quality Guidelines (**NZAAQG**)[6] and the World Health Organisation air quality guidelines[7].

Consequently, PM_{10} and $PM_{2.5}$ discharges are not considered any further in this assessment.

5.3 Vehicle Emissions

Vehicles (dozers, excavators and dump trucks) operating within the Sullivan Block will generate combustion-related pollutants such as oxides of nitrogen, carbon monoxide and fine particulate matter (PM_{10} and $PM_{2.5}$). These will primarily occur from the engine exhaust pipe(s) and brake and tyre wear.

Discharges from vehicles will be minimised by ensuring that vehicles are appropriately maintained, travel at the posted quarry speed limits (20 kph), and the surface on which they travel is well maintained and watered.

Overall, AQCNZ considers that emissions from vehicles operating within the Sullivan Block will have a negligible effect on local air quality, given the rural environment will already have low background contributions and assuming that the above mitigation measures are appropriately implemented. Consequently, these discharges are not considered any further in this assessment. Additionally, given that the Sullivan Block will be a gradual progression of the existing quarry

[6] Ministry for the Environment, Ambient Air Quality Guidelines (2002 update)
[7] WHO 2006. Air Quality Guidelines Global Update 2005, Particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Copenhagen: WHO Regional Office for Europe. World Health Organisation Regional Office for Europe.

operation, no additional vehicles are required to undertake this expansion, therefore vehicle related emissions will be at the same intensity.

5.4 Respirable Crystalline Silica

Respirable Crystalline Silica (**RCS**) can also be present in the dust generated by quarrying operations, however the risk associated with overburden (soil and weathered rock) removal and aggregate extraction is much lower compared to freshly crushed rock. Given that there will be no crushing undertaken on the Sullivan Block, the risk of RCS exposure will be low. AQCNZ also notes that any mitigation used to control dust will also control RCS emissions.

To help understand the potential risk of RCS, AQCNZ has reviewed the monitoring data from Yaldhurst[8] which was commissioned by ECan between 22 December 2017 and 21 April 2018. When comparing the results of this study, out of 20 samples collected for RCS only two samples detected RCS (within 50 m of the quarry), and these were well below the recommended guidelines.

The Yaldhurst Quarry zone represents a large area (approximately 230 ha) containing multiple quarries and numerous large aggregate processing plants. The potential for RCS emissions from the Sullivan Block, on its own or cumulatively with the balance of the Wheatsheaf operation, will be much lower. Consequently, RCS discharges have not been considered any further in this assessment.

[8] Yaldhurst Air Quality Monitoring – Summary Report: 22 December – 21 April 2018. Prepared by Mote Ltd, 19 June 2018.

6 Mitigation Measures

The Wheatsheaf Quarry is already subject to extensive dust suppression controls, and as such, Winstone's staff are well educated and trained in dust management. These mitigation measures are detailed in the DMP for the Site and have been adopted for the Sullivan Block. The DMP is updated on an annual basis to reflect improvements in dust mitigation and to ensure continual improvement in reducing dust nuisance across the site.

Table 5 summarises all the measures described in DMP to control air discharges from the proposed Sullivan Block which are largely based on the proven measures adopted by the existing operations. The table also describes the purpose of each mitigation measure.

Table 5: Mitigation Measures

Potential Dust-Generating Activity	Mitigation
Site Access Road	Sealed road surfaces are generally installed in high risks areas as the potential for dust generation from this source is much lower than unsealed roads. In the case of Wheatsheaf Quarry, the first 100 m of the site access road is sealed. This is regularly vacuum swept to minimise dust from vehicles travelling along this road.
Vehicle Movements	Vehicle movement across unconsolidated surfaces has the potential to result in significant dust emissions. Winstones' controls dust emission from these sources with following: • Applying water through the use of sprinklers and a watercart. Water is applied at the start of each day and then throughout the day to maintain a continually damp surface. • Using bio-degradable dust suppressants during prolonged dry conditions and water restrictions. • Limiting speed of vehicles to no more than 20 km/hr. • Maintaining the surface of roads and applying fresh road metal as required.
Exposed areas not frequently trafficked	Exposed areas that are not frequently trafficked will be covered with pea gravel during periods of dry weather to minimise dust entrainment during strong dry winds. Alternatively, approved bio-degradable soil binding agents can be used to the same effect.
Overburden Removal and Placement	Overburden removal and bund formation will be scheduled to avoid the dry summer months. If this is unavoidable or the ground is dry, the following mitigation measure will be implemented: • Watering the surface prior disturbing it during dry conditions. • Minimising the amount of material removed to a practical level. • Limiting vehicle speeds to 20 km/hr on exposed surfaces.

	• Mulching or grassing of newly formed bunds as soon as practicable. • Overburden removal and bund formation shall not be undertaken when hourly average winds are greater than 7 m/s unless it is raining.
Aggregate Extraction	Extraction of the resource will be undertaken using an excavator or front-end loaders by removing material from the toe of the quarry face. The extraction will advance from the current pit floor to the outside of the site, meaning there is always a quarry face between the works and receptors. Other mitigation measures that will be implemented include: • Extraction of material takes place below the surrounding ground level. With the construction of the bund will provide additionally barrier to reduce the dust emissions. • Aggregates are generally damp, but if required material can be dampened down prior to extraction. • Extraction is limited to a maximum of 700,000 tonnes per annum (tpa) and a maximum of 4,000 tonnes per day (tpd), however, current market conditions are seeing the quarry operate at approximately half this volume.
Aggregate Processing	Winstones have carefully considered the location of the processing plant to provide adequate separation distance between this activity and nearby receptors. Additionally the processing plant is located approximately 10 m below the current ground level which means any dust emission will most likely be contained within the pit itself. In addition to the location of the processing plant, all crushers will be fitted with water fogging systems to suppress dust emissions. The crushers will be operated with the water fogging systems working, except during rainfall
Stockpiles	Stockpiles are located near the centre of the site and the height of the piles will be below the height of the surrounding bunds.
Material Handing	During the handling of material, the drop height from loaders and excavators into trucks or hoppers will be minimised to the lowest practicable height for the task.
Clean filling	During dry weather, clean-fill operations will only occur within 250 m of a neighbouring residence where the hourly average wind speed is less than 7 m/s.

6.1 Visual Monitoring

Table 6 outlines the visual dust monitoring programme that will be implemented while the Site is operating.

Table 6: Visual Monitoring Requirements

Frequency	Visual Monitoring Activities
Daily	Check weather forecasts for strong winds and rainfall to plan appropriate dust management responses.
Daily	Inspect land adjacent to the Site and adjoining roads for the presence of dust deposits from Site operations.
Daily and as conditions change	Inspect all surfaces for dampness and ensure that surface exposure is minimised.
Daily and as conditions change	Inspect stockpiles to ensure enclosure, covering, stabilisation or dampness.
Daily and as new activities are commenced	Inspect dust-generating activities to ensure dust emissions are effectively controlled.
Weekly	Inspect watering systems to ensure equipment is maintained and functioning to effectively dampen exposed areas.
In winds over 7 m/s	Additional monitoring of dust-generating activities and water application.

6.2 Dust Monitoring

Winstones undertakes continuous dust monitoring with telemetry at a number of locations around the Wheatsheaf Quarry and the current locations are shown in Figure 6. The monitors are able to measure PM_{10} concentrations and send data in 'real time' and as such are set up to send alarms if dust concentration exceeds a threshold value. Winstones has adopted a tiered approach which is common amongst most quarry operations, to provide an early warning of potential dust effects. Below sets out these triggers, however AQCNZ notes that these values are more conservative than the 150 µg/m³ recommended by the MfE.

Trigger Level 1 – (60 µg/m³ as a 1-hour average) – To identify that dust concentrations have reached a point where dust nuisance is likely to occur if action is not taken to implement mitigation measures. It would not be expected that dust concentrations would reach this level unless there are adverse weather conditions in conjunction with a failure of mitigation.

Trigger Level 2 – (70 µg/m³ as a 1-hour average) – All activities that have the potential to generate dust on site, apart from dust mitigation, must cease until such time as dust concentrations drop below Trigger Level 1.

6.3 Wind Monitoring

Like with dust monitoring, Wheatsheaf Quarry also undertakes continuous wind speed and wind direction monitoring with telemetry which is capable of sending out alarms. The site currently has adopted a trigger alarm that when quarrying or cleanflling occurs within 250 m of a notional boundary of a nearby receptor will cease during strong dry winds that blow from the site in the direction of a nearby receptor.

AQCNZ notes a wind speed of 5 m/s has been conservatively used in this assessment to assess the potential for dust effects, however for mitigation purposes the site adopts a wind speed trigger level of 7 m/s.

When wind speeds reach 5 m/s dust pickup starts to occur, however it isn't until wind speeds reach 7 m/s, there is a higher risk of dust been transported off-site. Consequently, a wind speed threshold of 7 m/s has been adopted for management of dust effects.

6.4 Water Availability

As water will be the primary mitigation tool that Winstones will implement to control dust at Wheatsheaf Quarry, it is important to understand that there is sufficient volume of water available. Wheatsheaf Quarry has a water take consent (CRC212834) that allows the following extraction of water:

- Extraction of water from Bore M36/20476 at a rate not exceeding 8 L/s (equivalent to 691.2 m³/day);
- A volume not exceeding 5,439 m³ in 7-day period; and
- A volume not exceeding 41,728 m³ between 1 July and the following 30 June.

Given that both the current aggregate extraction blocks (B-Block and C-Block) are each approximately the same size as the proposed Sullivan Block (~4 ha) and these operations will cease prior to the commencement of the Sullivan Block, no additional water is required. However, to determine whether there is adequate water within the limits of the current water allocation, an analysis of rainfall and evapotranspiration data from January 2020 to December 2023 was conducted. This meteorological data was obtained from NIWA's Lincoln monitoring site, which is the closest location to the proposed Sullivan Block. The analysis was based on the following criteria:

- Dust suppression is not necessary on days when rainfall is equal to or greater than evapotranspiration.
- When rainfall exceeds evapotranspiration on a particular day, the excess rainfall is carried over to the next day's calculation (for one day only). This allows some residual surface moisture from the rainfall event to be accounted for the following day, but not for subsequent days.
- On days without rainfall, the amount of water required for dust suppression is calculated to offset the evaporation for that day.

Based on the above, water consumption has been calculated based on 4.24 ha active working area for both the proposed extraction and rehabilitation activities at the Sullivan Block and the current cleanfill working face and stockpile area within Wheatsheaf quarry. Of this 4.24 ha, it has been estimated that the proposed Sullivan Block will have 2 ha of active working area at any one time. This is considered a conservative approach given that the Sullivan Block will be extracted in small stages and all other non-active areas of the site will either be vegetated, covered with washed aggregates or stabilised therefore limiting the amount of water required for dust suppression. Figure 10, Figure 11 and Figure 12 present the water consumption on a daily, weekly (7-day rolling average) and yearly (July to June), respectively for the entire site including the proposed Sullivan Block extension. In addition to the water needed for dust suppression, Winstones is proposing to establish plants around the bund which will also require water for irrigation. Based on 1000 m² of plantings and 30 mm of water per week to develop and maintain healthy plants, an additional 30 m³ of water is required per week at the proposed Sullivan Block on top of the water required for dust suppression.

Table 7 presents the maximum, 99th percentiles and 95th percentiles on a daily and weekly basis for both the Sullivan Block and the entire site. In addition to the water needed for dust suppression, Winstones is proposing to establish plants around the bund which will also require water for irrigation. Based on 1000 m² of plantings and 30 mm of water per week to develop and maintain healthy plants, an additional 30 m³ of water is required per week at the proposed Sullivan Block on top of the water required for dust suppression.

Table 7 also presents the maximum annual water consumption for the Sullivan Block and the entire site, like with the daily and weekly calculations, the predicted water consumption below the current consented allowance for Wheatsheaf Quarry.

Alternatively, the site could be operated with a mix of water and dust suppressants.

In addition to the water needed for dust suppression, Winstones is proposing to establish plants around the bund which will also require water for irrigation. Based on 1000 m² of plantings and 30 mm of water per week to develop and maintain healthy plants, an additional 30 m³ of water is required per week at the proposed Sullivan Block on top of the water required for dust suppression.

Table 7: Summary of Water Consumption

	Daily Water Consumption (m³/day)		Weekly Water Consumption (m³/7 day)		Annual Water Consumption (m³/year)	
	Sullivan Block (2 ha)	Entire Site (4.24 ha)	Sullivan Block (2 ha)	Entire Site (4.24 ha)	Sullivan Block (2 ha)	Entire Site (4.24 ha)
Maximum	170	360	910	1,929	16,752	35,514
99th Percentile	142	301	798	1,692	-	-
95th Percentile	116	246	719	1,523	-	-
Current Consented Allowance	**691.2**		**5,439**		**41,728**	

Figure 10: Daily water consumption based on 4.24 ha

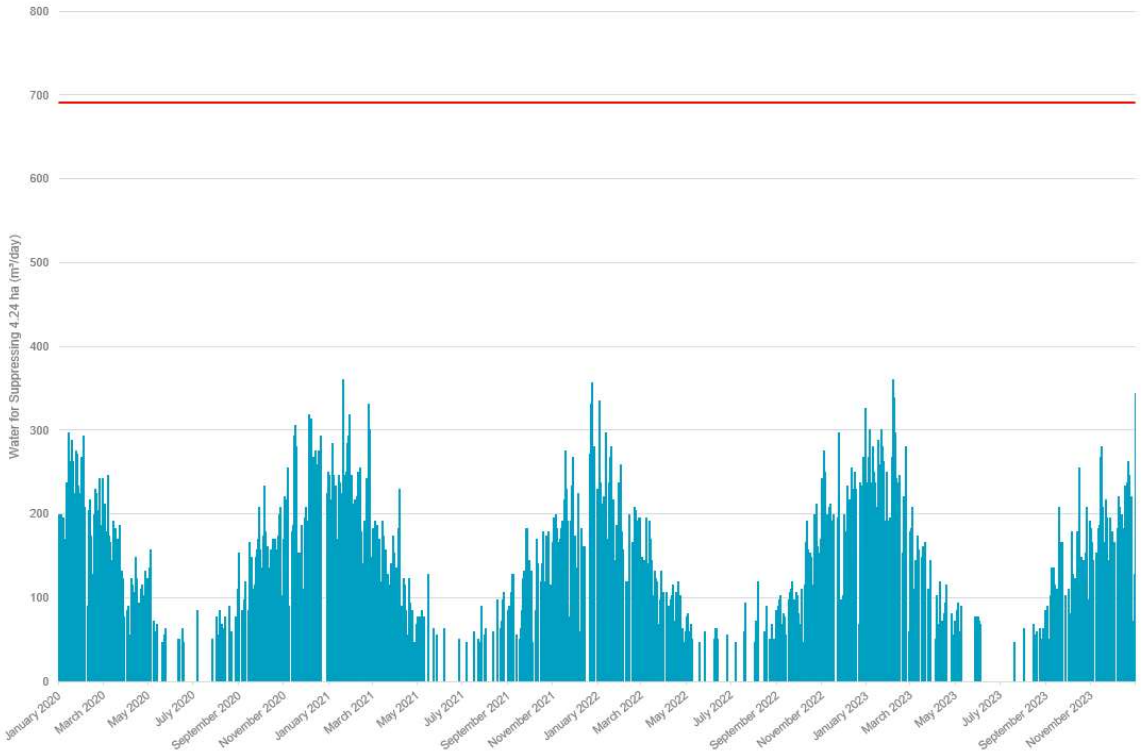


Figure 11: 7-day water consumption based on 4.24 ha

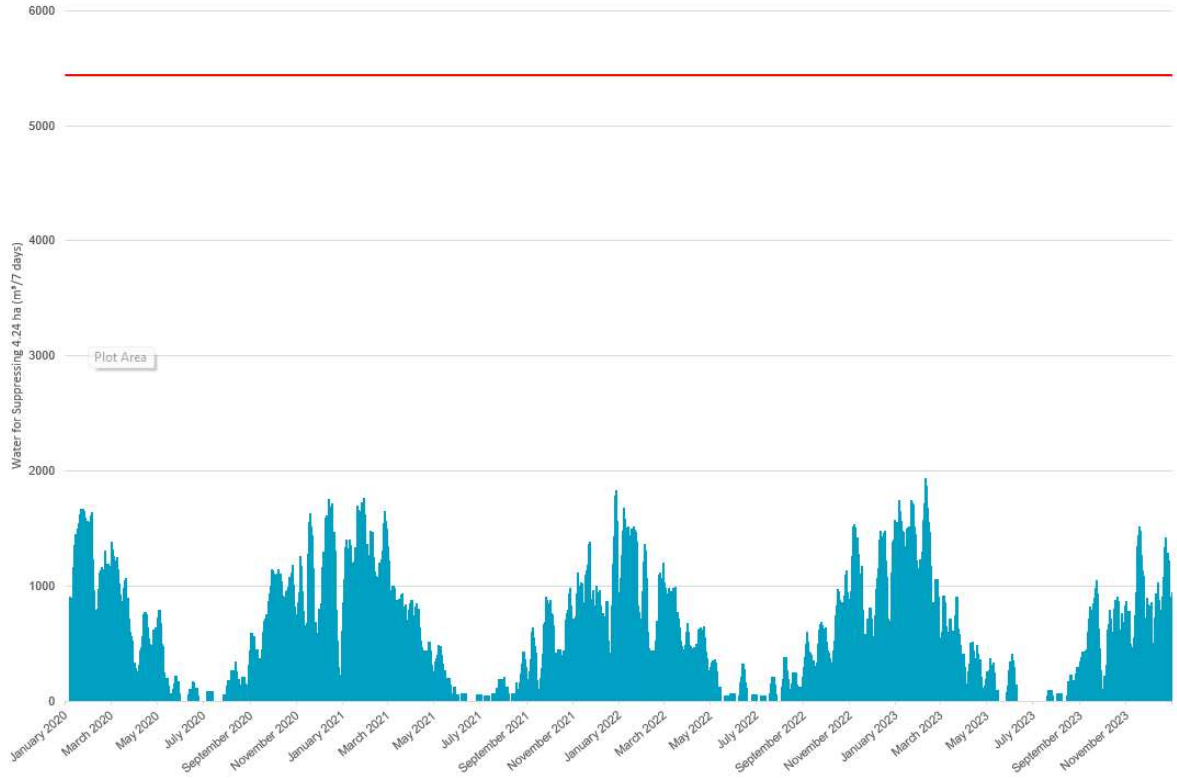
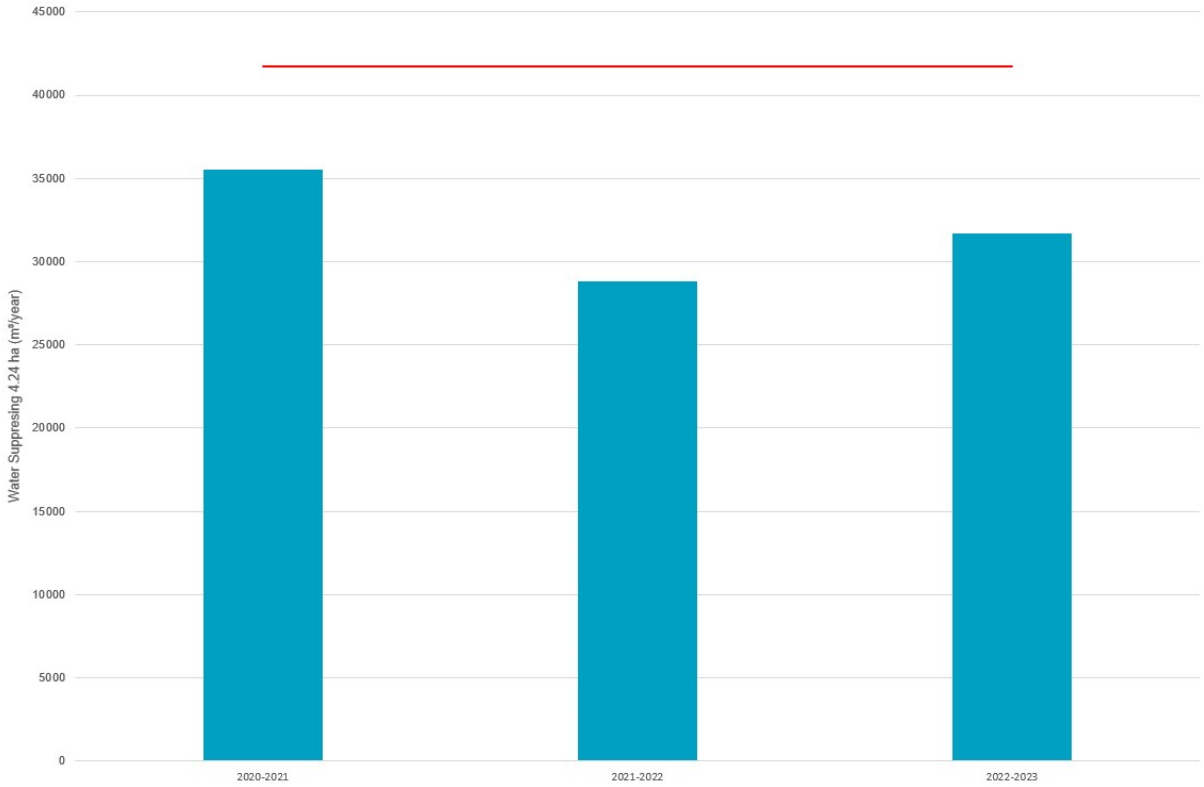


Figure 12: Annual water consumption based on 4.24 ha



7 Assessment of Effects

The following assessment is based on the control measures presented in Section 6 and therefore represents the residual effects of air discharges. AQCNZ has undertaken a FIDOL assessment, as described in Section 0, to assess the potential for dust nuisance effects. This assessment is presented in the following sections.

7.1 Frequency

Frequency relates to how often dust discharges affect sensitive receptors. This is influenced by the frequency of dust discharges and when suitable meteorological conditions exist. MfE GPG Dust states, *"Dust pickup by wind is usually only significant at wind speeds above 5 metres per second."* Based on this information, AQCNZ has adopted for this assessment that when wind speeds are greater than 5 m/s there is a greater potential for dust discharges to result in off-site effects.

Given the information provided in Table 1, the predicted frequency of wind speeds greater than 5 m/s occurs 15.6 percent of the time from all directions. Table 8 presents the frequency of high wind speeds in the direction of the nearby receptors. The data indicates that high wind speeds blowing in the direction of all receptors are infrequent, with the exception of receptors SR5 to SR8, which will experience moderately frequent strong wind speeds. Frequency categories have been adopted from the Institute of Air Quality Management's (**IAQM**) Guidance on the Assessment of Mineral Dust Impacts for Planning[9].

To cause a dust nuisance, activities that generate dust must coincide with dry conditions and winds capable of carrying the dust towards a sensitive receptor. When considering the mitigation measures and monitoring, the frequency of any adverse effects associated with the site's operations will be much lower.

[9] IAQM, 2016. *Guidance on the Assessment of Mineral Dust Impacts for Planning.*

Table 8: Frequency of High Wind Speeds in the Direction of Sensitive Receptors

Receptor ID	Downwind Direction	Percentage of wind above 5 m/s	Frequency of Wind
SR1	East northeast to East	0.4	Infrequent
SR2	East southeast to Southeast	2.1	Infrequent
SR3	South southeast	1.2	Infrequent
SR4	South	0.1	Infrequent
SR5	South to Southwest	8.2	Moderately Frequent
SR6	South to Southwest	8.2	Moderately Frequent
SR7	South southwest to Southwest	8.1	Moderately Frequent
SR8	Southwest to West	7.0	Moderately Frequent
SR9	West	0.1	Infrequent

7.2 Intensity

Intensity relates to the concentration of dust that is likely to be experienced at any potential receptor. Dust concentration correlates with distance, with dust concentration decreasing with increasing distance from the source. Larger particles will deposit on surfaces close to the source and finer suspended dust will disperse and dilute with increasing distance from the emission source. Therefore, the intensity at which dust might be experienced is a combination of the mitigation used to manage concentration at the source, location of the dust source relative to the receptors, windspeed and the pathway between the source and the receptor.

All of the identified nearby receptors are within 250 metres of a dust source, which means without any mitigation in places all these receptors could experience dust nuisance. Based on guidance from the IAQM, no receptor is considered 'Close' (within 100 m of the site activities). Receptors SR1, SR5, SR6, SR7 and SR8 are considered to be at an 'Intermediate' distance (between 100 and 200 m) and receptors SR2, SR3, SR4 and SR9 are considered 'Distant'. Therefore, AQCNZ considers that receptors within 100 m of dust sources are more sensitive to dust than those beyond 100 m. Additionally, based on the separation distance, the majority of coarser dust will have already fallen out of suspension, therefore leaving only finer dust at a much-reduced intensity. Given that Winstones undertakes a range of mitigation measures including real-time monitoring that informs staff of the potential for elevated dust events to occur, the potential for elevated dust intensity is much lower.

In addition to distance, the pathway in which dust must travel between the source and receptor will also affect dust intensity. Initial works such as overburden stripping and bund formation will

occur at the same ground level relative to the surrounding receptors. However, once the 3 m high bund is established, the pathway for the dust is not directly open and therefore, the bund will help to reduce dust intensity in certain metrological conditions. Secondly, extraction will work from the current pit floor outwards from the toe of the pit, this means there will always be a pit wall between the activity and the receptors and the pit wall will have the same effect on the dust pathway, which should result in containing most dust effects.

When considering the distance of all the nearby receptors from the site are greater than 100 m from a dust source and that number are beyond 200 m (a distance defined by IAQM as "Distant"), the dust pathway and the level of mitigation, dust intensity at nearby receptors should be low.

7.3 Duration

Dust issues are exacerbated under dry, windy conditions. Based on the data presented in Figure 3, wind conditions in the area of the Site are dominated by low to moderate wind speeds with the exception of northeast winds. Nonetheless, based on AQCNZ's experience, it is primarily the response time of operation staff to significant dust events which has the greatest impact on the duration of off-site dust emissions. In the occurrence of visible dust events, the mitigation measures will be increased (i.e. applying water to roads or watering of stockpiles). Additionally, with the use of continuous monitoring of dust and wind conditions using the alerts discussed in Sections 6.2 and6.3, the duration of any event will remain short and intermittent, typically less than 1 hour.

On a larger time scale, the proposed overburden removal and aggregate extraction will only take up to three years to complete. Quarrying operations will not be near receptors for the entire period, due to the quarrying sequence. For example, when quarrying activities are undertaken in the northern section of the site, work is at a distance in which no receptors should be affected by dust. Therefore the duration of works that could affect nearby receptors will be limited in its duration.

7.4 Offensiveness

Dust can lead to issues such as visual amenity (dust clouds) and dust deposition on property, including vehicles, washing lines and rooftops. While these events can lead to nuisance over extended and frequent exposure, the nature of a standalone event is not considered highly offensive. Given the mitigation techniques used to minimise dust effects, it is expected that the offensive nature of dust will remain at acceptable levels for the zone. This is further confirmed by the dust monitoring data which indicated that concentrations measured near the site boundary are below MfE guidelines for nuisance dust.

In addition, based on the compliance history for Wheatsheaf Quarry there have only been three air quality related complaints received in the last 5 years. Given that the activities and mitigation at the Sullivan Block will be the same, AQCNZ considers that a good level of compliance will continue to occur at the Sullivan Block and therefore proposed activities will not result in nuisance off-site dust effects.

7.5 Location

The location of dust discharges is within a rural environment, which is a mix of lifestyle blocks and farming activities. These locations would be considered to have a moderate sensitivity to dust discharges of this nature. Given the level of mitigation that is undertaken, it is expected the dust emissions will be controlled to an acceptable level for a moderately sensitive location.

7.6 FIDOL Conclusion

Having assessed the site activities that have the potential to cause dust discharges against the FIDOL factors, AQCNZ considers that it is unlikely that dust from onsite activities will cause dust nuisance effects at sensitive receptor locations. This is based on the following findings:

- Based on the meteorological data for the area, nearby receptors are only downwind of the proposed Sullivan Block during high risk wind speeds at a frequency that is considered “infrequent” or “moderately frequent”. As the dust emission rates from works could be quite varied, there is an even lower probability of high emissions rates coinciding with high-speed wind conditions that could carry dust towards receptor locations.

- No receptor is considered close as all the receptors are at least 100 m from the site, with many more being much further (>150 m) away. At these distances dust effects are expected to be minimal. When considering the pathway in which the dust must travel, the bund and additional planting will also help reduce dust effects.

- Winstones will use a range of proven best practice dust mitigation measures.

- Winstones will also undertake visual monitoring alongside continuous monitoring of dust and wind conditions. Monitors are configured to send out alerts if values exceed predefined trigger values. Given these measures, if a dust event was to occur it is expected to be short in duration, being only the time to recognise that dust emissions are occurring and to implement any additional mitigation that might be required.

- The site has a good compliance history in terms of nuisance dust effects.

7.6.1 Additional Targeted Mitigation

Based on the findings of this assessment and to provide further certainty for nearby receptors, given that receptors SR5, SR6, SR7 and SR8 are within an intermediate distance from the source (100 to 200 m) and they are downwind at a frequency considered “moderately frequent”, additional targeted mitigation has been adopted to further reduce any residual dust effects that might occur.

Therefore, for the Sullivan Block Winstones will adopt the following stop work trigger.

Quarry activities (except dust suppression measures) within 250 metres of a sensitive receptor location must not be undertaken when:

1) Wind speed reaches or exceeds 7 m/s (1 hour average); and
2) Quarry activities would be directly upwind of a sensitive receptor (wind direction is from 280° through to 40°); and
3) Less than 1 mm of rain has fallen during the preceding 12 hours.

7.7 Cumulative Nuisance Dust Effects

For acute cumulative dust effects to occur on any given sensitive receptor, the receptor needs to be downwind of more than one emitter, emissions need to coincide, wind speeds need to be elevated, and the intensity of the emissions needs to be sufficiently great for the dust to reach that receptor.

Therefore, for a receptor to be affected by cumulative dust effects from the existing quarry operations and proposed Sullivan Block, the receptor must be downwind of both sources at the same time dust emissions are occurring.

Chronic cumulative nuisance dust effects can occur where a receptor is exposed more frequently or for longer durations to dust as a result of dust emissions from multiple dust emitters. However, this is unlikely for the proposed Sullivan Block given the small number of sources and the relatively short duration of the proposed activities.

Figure 13 shows the maximum distance of potential dust effects from both the existing quarry and the proposed Sullivan Block if no mitigation is undertaken. These areas are shown on Figure 13 as red shaded area polygons with the overlapping areas indicated areas where there is the potential for cumulative effects. For the most part, most receptors will not be downwind and within 250 m of both the existing operations and the proposed Sullivan Block. For the receptors that are potentially downwind and within 250 m of both sources, the area in which they are downwind is relatively small. When considering the frequency of high winds speeds together with the relatively small area in which dust generating areas will be upwind of a receptor, there is a low probability of dust from each source coinciding. Additionally, given the proposed mitigation measures and the low probability of various conditions coinciding that could cause cumulative effects, AQCNZ considers that there will be minimal/negligible effects on the nearest neighbours. Therefore, it is considered that the proposed Sullivan Block will not result in nuisance cumulative effects.

Figure 13: Area of potential dust effects from unmitigated dust emissions

8 Alternatives

Consideration of alternative methods of discharge, including discharging into any other receiving environment, is required under section 105 of the RMA for applications seeking to discharge contaminants.

In terms of alternative methods of discharge, this mainly relates to methods used to control emissions and minimise their effects.

The mitigation and monitoring methods set out in the DMP and summarised in Section 6 are considered appropriate to ensure that potential off-site dust effects will not be offensive or objectionable and to meet the requirements of the NESAQ.

Notwithstanding the above, in some quarries, where the processing plant is significantly distant from the working face, aggregate conveyor systems are employed to transport materials. These systems help reduce dust emissions compared to haul trucks that would otherwise be used. However, in this case, conveyor systems are not being proposed due to the following reasons:

- The relatively short timeframe of the aggregate extraction;
- The distance between the Sullivan Block and the processing area is relatively short;
- The material being handled is primarily in a damp condition with a low potential to result in dust discharges;
- The use of extensive best industry practice dust control measures, as set out in Section 6;
- The Sullivan Block has sufficient buffers surrounding it, which will help minimise the effect of any residual dust discharges from the site, and,
- Winstones has a proven track record of controlling dust emissions from the site using the proposed mitigation measures.

9 Conclusions

Winstones has engaged AQCNZ to undertake an air quality assessment to understand the potential for effects from air discharges from a new aggregate extraction area known as the Sullivan Block at Wheatsheaf Quarry.

The assessment determined that Site activities can generate the following types of air contaminants:

- Nuisance Dust;
- Fine Particulate Matter (PM_{10} and $PM_{2.5}$);
- Emissions from vehicles; and,
- Respirable crystalline silica.

To control these air discharges, a range of mitigation measures have been proposed, including applying water, control vehicle speeds, adopting extractions techniques (extraction from the pit floor, working towards the receptors, limiting drop heights etc.), restricting activities that have a high risk of generating discharges during adverse meteorological conditions and real-time dust monitoring to assess and monitor the effectiveness of mitigation. All these measures are captured in a comprehensive DMP.

AQCNZ identified that the nearest sensitive receptors are at least 115 m from the Sullivan Block and at a sufficient distance and considering the low frequency that dust could cause nuisance effects. Provided the proposed mitigation measures are appropriately implemented, there will be limited potential for adverse effects.

Overall, based on the results of AQCNZ's assessment, air discharges from the operation of the Sullivan Block are unlikely to result in any adverse environmental effects beyond the Site boundary and the effects are therefore considered to be less than minor.

10 Limitations

Air Quality Consulting NZ Limited has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Winstone Aggregates, and only those third parties who have been authorised in writing by Air Quality Consulting NZ Limited to rely on this report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where this report indicates that information has been provided to Air Quality Consulting NZ Limited by third parties, Air Quality Consulting NZ Limited has made no independent verification of this information except as expressly stated in the report.

Air Quality Consulting NZ Limited assumes no liability for any inaccuracies in or omissions to that information.

This report was prepared between April to June 2024 and is based on the conditions encountered and information reviewed at the time of preparation. Air Quality Consulting NZ Limited disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A: Wheatsheaf Quarry Dust Management Plan

Wheatsheaf Quarry
Draft Dust Management Plan

JUNE 2024

Revision Record:

Date	Revision	Details/Comments
Dec 2020	V1	Draft
July 2022	V2	Post Consent
June 2024	V3	Pre-Sullivan Block Consent

TABLE OF CONTENTS

1 PURPOSE 4
2 SITE CONTEXT 4
2.1 SENSITIVE RECEPTORS 4
2.2 CLIMATE 4
2.3 STAFF CONTACT DETAILS 5
2.4 STAFF TRAINING 5
3 SITE ACTIVITIES 6
3.1 SULLIVAN BLOCK SITE PREPARATION – STRIPPING AND BUND CONSTRUCTION 6
3.2 EXTRACTION 6
3.3 CLEANFILL OPERATION/REHABILITATION 6
4 MONITORING 7
4.1 WIND MONITORING EQUIPMENT 7
5 COMPLAINTS 8
5.2 RECORDING AND INVESTIGATING CAUSES 8

1 PURPOSE

The purpose of this Draft Dust Management Plan (DMP) is to provide a framework for managing the existing dust emissions at the Wheatsheaf Quarry and those attributed to the proposed expansion into the Sullivan Block so that potential adverse dust effects are avoided or mitigated. To achieve this, the DMP includes the following:

- Site information, including a description of sensitive receptors and local climatic conditions relevant in terms of dust generation;
- A summary of site activities;
- How dust will be monitored, mitigated and location of the monitoring equipment;
- The requirements of the consent conditions, the trigger limits and the actions required;
- Staff training and site contact details; and
- Recording of data and any complaints.

2 SITE CONTEXT

2.1 SENSITIVE RECEPTORS

Sensitive receptors (dwellings within 250m) to the quarry expansion have been identified below –

2.2 CLIMATE

Rainfall can suppress dust emissions from quarry operations. Damp exposed ground will not generate dust emissions, and wet aggregate will produce little dust when processed or handled. Conversely, the highest risk for dust emissions is during the summer and autumn months.

As expected, Wheatsheaf Quarry has a predominately dry period from December to February and is at its wettest in June and July.

In terms of wind, the summer months have the greatest risk of dust emissions and monitoring data (from the existing quarry) indicates the following –
the following:

- Winds during the daytime are typically stronger than those in evening, which in turn are stronger than those in the early morning;
- Winds prevail from the northeast direction, and carry the greatest strength, especially during the day and evening – this means sensitive locations to the southwest of dust emissions sources will be the most exposed;
- Winds from the south also occur frequently;
- North-northeast winds prevail at night-time (early morning); and
- The summer season (December to January) experiences the highest frequency of strong winds, with strong winds mainly occurring from the northeast.

2.3 STAFF CONTACT DETAILS

Site management is the responsibility of the Wheatsheaf Quarry Manager. The Manager's responsibilities include:

- Ensuring compliance with the conditions of all resource consents pertaining to the site.
- Managing quarry operations – extraction, manufacturing of aggregates and controlling dust.
- Ensuring all resource consent requirements are clearly communicated to staff, contractors and training is provided to all regarding dust management.
- Recording and responding to any complaints and reporting where required.

The Quarry Manager's contact details are:

Jake Richardson
Phone: 027 567 044
Email: Jake.Richardson@winstoneaggregates.co.nz

For all Environmental queries, contact:

Ian Wallace
Environmental Manager
Phone: 021 673 430
Email: Ian.Wallace@winstoneaggregates.co.nz

2.4 STAFF TRAINING

Successful dust management depends on appropriate actions by site personnel in day to day operations. Training will be provided to staff and contractors during site inductions and regular environmental meetings will provide a forum to discuss:

- On site practices relating to minimising dust emissions; and
- Procedures for reporting and dealing with dust emissions as they arise.

Records of staff training are kept at the site office and updated regularly as training proceeds. Winstone personnel and all contractors operating on site will be made aware of all potential adverse effects of dust emissions and shall be proactive in identifying actual and potential dust sources. Job descriptions and annual training reviews will identify individual staff training requirements in aspects of dust control. The Quarry Manager will oversee training and ensure that it is appropriate. A record of staff training will be maintained and kept at the site office.

The Quarry Manager will ensure that any training provided by contractors to their own staff also meets the requirements with respect to dust control.

3 SITE ACTIVITIES

3.1 SULLIVAN BLOCK SITE PREPARATION – STRIPPING AND BUND CONSTRUCTION

Overburden needs to be stripped back to access the aggregate. This is achieved using a bulldozer and/or diggers as well as a dumptruck and loader. The stripped soil is used to form the bunds surrounding the external boundary of the proposed quarry area. Once formed, the bunds will be immediately stabilised with mulch or another suitable product to minimise dust. Then the bunds will be grassed.

Stripping of overburden occurs throughout the year in advance of quarrying. Progressive stripping helps to minimise the open area of the quarry at any given time and therefore the risk of dust entrainment by strong, dry winds.

Bund construction and stripping shall mainly be planned to occur during the winter months. If stripping is planned outside these months, the watercart will be utilised to saturate the area prior to stripping.

No stripping shall be undertaken when wind speeds are above 7m/s (10 minute average).

3.2 EXTRACTION

Extraction will proceed in accordance with the details in the QMP. Extraction will be undertaken using loaders or excavators, which load aggregate into dumptrucks for transport through the site to the processing plant.

Extraction will be no closer than 108m from the notional boundary of the closest house, which is 668 Robinsons Rd.

3.3 CLEANFILL OPERATION/REHABILITATION

Quarried areas will be rehabilitated with cleanfill, which will progressively follow the footprint of the adjacent consented C-Block. Cleanfilling will be an integral part of rehabilitation, with the final landform shape being dependent on the future availability of cleanfill in the Canterbury region.

In terms of dust generation, cleanfill is a relatively low impact activity involving deposition of the material at a tiphead and then that material being pushed into the excavation area by bulldozer. All areas are regularly watered and open area minimised. Once the final height is achieved, the ground will be topsoiled and grassed.

3.4 DUST MANAGEMENT CONTROLS

The quarry employs the following dust suppression techniques –

- The watercart and uses this to dampen the haul roads and entrance/exit areas. It is also deployed to the cleanfill tiphead to prevent dust nuisance. Should the watercart breakdown, a replacement cart will be hired from Porter Hire (Harewood or Moorhouse), who have a range of different sized carts available
- One of the mobile crushing plants is fitted with a spray nozzle. This is the crusher which produces crusher dust and therefore suppression is required. A fogger will be installed on the second crushing plant.
- Speeds are minimised within the quarry and limited to 20kmh
- Bio-degradable dust suppression agents will be used during periods of prolonged dry weather and water restrictions
- Where possible, overburden removal and bund formation will occur following a rainfall event
- Bunds will be covered in vegetation (such as grass) as soon as practicable and maintained to ensure complete cover. If prolonged dry weather prevents vegetation cover, then approved bio-degradable soil binding agents are to be used until such time that a vegetation cover can be established
- Product stockpiles will be located within the quarry floor and their height will not exceed the height of bunds to minimise exposure to strong winds.

4 MONITORING

Site inspections of visible dust emissions will be carried out throughout the day. Observations are to be recorded in a daily log. Visible site observations are used to assess the effectiveness of dust control measures. They also help identify dust emission events and investigating and responding to any received complaints.

Dust emissions can increase during dry, windy conditions due to surfaces rapidly drying and wind erosion of dusty material from exposed surfaces. Dust can also occur after hours and on weekends. In these instances, the Quarry Manager is alerted via text if there is a trigger and an appropriate action will be undertaken after the trigger has been investigated (*several triggers over the years on weekends have been caused by neighbouring fires*).

4.1 WIND MONITORING EQUIPMENT

Winds speed, direction, humidity and temperature is monitored by the existing meteorological station which is located high above the existing pit floor in the middle of the existing quarry site (see below) –

The existing station will continue to be operated, maintained and data from it recorded and used for alerting site operators of the wind trigger conditions. The equipment is to be routinely checked (at least weekly) to ensure it is functioning correctly, and regularly calibrated as per the equipment specification.

4.2 DUST MONITORING EQUIPMENT

The existing quarry operates two nephelometer particulate matter monitors. These monitors are maintained and managed by Mote and are configured to continuously measure PM_{10} in general accordance with AS/NZ 3580.12.1:2015. The monitors are referred to as 'Wheatsheaf 1' and 'Wheatsheaf 2', and their locations in relation to the existing quarry site are shown below.

5 COMPLAINTS

Although the measures outlined in this DMP are aimed at preventing dust emissions from activities on site, there may be occasion where an incident occurs and a complaint from a member of the public is received. Any complaint made must be promptly investigated to resolve the source of the dust emissions and implement appropriate actions to mitigate the effects.

5.1 RECEIVING A COMPLAINT

The following outlines the quarry's process for receiving and keeping records of any complaints made –

- A complaint can be received from a member of the public or from SDC/CRC
- The correct information must be collected by the person receiving the complaint to help investigate the cause and identify any corrective action that has been or needs to be undertaken
- Advise the complainant that an investigation will be taken out to identify the likely cause of their concern, and that appropriate mitigating actions are being undertaken or will be undertaken promptly
- Record details reported by the complainant highlighted in Section 5.2 below
- Investigate the likely cause of the complaint including immediate investigation of observed dust emissions noting any process considerations and meteorological conditions, including if there are any abnormalities
- Take corrective actions as soon as practicable; and
- After completion of the investigation, follow up with the complainant to ensure that their concerns have been addressed.

5.2 RECORDING AND INVESTIGATING CAUSES

A record is to be kept of all dust related complaints received relating to site activities. Those details shall be recorded in the onsite daily log and must be available to CRC staff when requested. The complaint investigation must record the following information:

- Name and contact details of the complainant, and location/address of when the dust was detected;
- Date and time of the dust detection, and any further information of the event described by the complainant;
- Details of who received the complaint, and how the complaint was made;
- Weather conditions when the dust was detected, including wind speed and direction measured at the site;
- Details of any observed dust emissions from the site made by responsible person investigating the complaint;
- Identification of the possible cause of the dust event/complaint following an investigation;
- Detail any corrective action taken at the time to resolve the incident, and any mitigation methods in place during the time of dust event; and
- Details of any preventative measures or actions put in place to prevent events such as this occurring in the future.

An investigation of the dust complaint will require the site manager or delegated responsible person to walk around site to make observations of activities being undertaken and any visible dust emissions. It may also include visiting the location of the complaint which may be located off site.

The investigation should be carried out promptly following the receipt of the complaint and at least ideally within 30 minutes of the complaint being made.

6 REVIEW

The DMP will be updated to reflect any changes to on-site activities, equipment or location of activities. Additional modifications may need to be made to manage risks if additional management and mitigation measures are required to minimise dust.

Management will undertake an annual review of the DMP. This review will be organised by the Environmental Manager. The review will consider:

- Audit findings and recommendations;
- Environmental monitoring records;
- Any environmental complaints, incidents or emergencies, including details of corrective and/or preventative actions taken;
- Changes to organisational structure to include responsible persons;
- Ongoing compliance with conditions and targets;
- Possible changes to legislation and standards; and
- Improvements to site and any developments of industry codes of practices.

The review process will include looking at environmental controls and procedures to ensure that they are apply to activities being undertaken on site. Reasons for any changes to the DMP will be documented and stored with a copy of the original version marked as obsolete. Each new/updated version of the DMP will be issued with a version number and date to avoid obsolete documentation being used.

Winstone Aggregates will ensure that CRC and SDC are provided with the most up to date version of the DMP.