BEFORE THE HEARINGS PANEL
FOR THE WELLINGTON CITY COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Proposed Plan Change 83 to the Wellington City District Plan

---

STATEMENT OF EVIDENCE OF JOHN WILLIAM DOUGLAS BODDY

23 November 2018

---

1 SUMMARY OF EVIDENCE

1.1 I have assessed the potential air quality effects associated with during the continued operation of the quarry including the expansion into the south face of the quarry as provided for under Proposed Plan Change 83 (the 'Plan Change' or the 'southern extension').

1.2 The potential effects, which are primarily associated with nuisance dust, were assessed qualitatively. The term 'dust' refers to solid particles that are suspended in air, or have settled out onto a surface after having been suspended in air.

1.3 My assessment considered the potential dust-generating activities, the location of the Kiwi Point Quarry site (the 'Site of the Plan Change') and sensitive receptors, the local meteorology, and also the range of commonly used mitigation measures that could be implemented to control dust emissions.

1.4 I am satisfied that the potential dust nuisance effects can be effectively controlled through the requirement to implement a Quarry Management Plan and a Dust Management Plan. Condition 28 of resource consent 34514[1] requires a Dust Management Plan to be prepared and adhered to prior to undertaking dust generating activities associated with cleanfilling. The mitigation measures recommended in paragraphs 6.19 to 6.23 below should be incorporated into the Dust Management Plan.

1.5 Consequently, I am confident that the Plan Change can be implemented without causing dust nuisance effects, or adverse effects on human health or the environment at or beyond the boundary of the site.

2 INTRODUCTION

2.1 My full name is John William Douglas Boddy. I am a Senior Air Quality Scientist at Pattle Delamore Partners Limited ('PDP'). I have been in this position since November 2017. I held a similar position at MWH New Zealand Limited ('MWH'), now part of Stantec, between

[1] Resource Consent for Discharges to Air (Number 34514), 'Discharge Permit to Discharge Contaminates (Dust) to Air in Association with the Operation of a Cleanfill', date granted 7 August 2017, file reference 'WGN170175', Greater Wellington Regional Council. This resource consent is due to expire on 7 August 2042.

September 2014 and July 2017. I hold a PhD in Environmental Engineering (Air Quality) from the University of Leeds with a thesis on the dispersion of road traffic pollutants in urban streets. I also hold a BSc (Hons) in Geography from the University of St Andrews in the UK.

2.2 I am a member and Treasurer of the Clean Air Society of Australia and New Zealand and I am a Certified Air Quality Professional. I am a member of the Institute of Air Quality Management ('IAQM') and the Institution of Environmental Sciences, and I am a Chartered Scientist, registered with the Science Council in the UK. I am a member of the Project Management Institute and I am a certified Project Management Professional.

2.3 I have over 16 years' experience working in the air quality sector, the majority of which has been in multi-disciplinary environmental consultancies in New Zealand, Australia and the UK. I am experienced in undertaking air quality and environmental impact assessments for a wide range of industries and sectors, including mineral extraction sites. I have prepared a number of air quality assessments involving dust emissions from quarries and construction sites, many of which have involved undertaking dust monitoring and investigations, preparing environmental impact assessments and management plans, and recommending mitigation measures. I have been engaged by regional councils on several occasions to review resource consent applications and to undertake environmental compliance inspections relating to the discharge of contaminants to air from a wide range of emission sources.

2.4 In July 2016 I prepared a report for Wellington City Council ('WCC') entitled 'Kiwi Point Quarry Air Quality Assessment' (MWH report dated 12 July 2016) ('Air Quality Assessment'). This report presented the results of a qualitative assessment of the potential air quality effects that may arise as a result of the Plan Change, which would allow for the proposed expansion into the south face of the quarry.

2.5 In November 2016 I prepared another report for WCC entitled 'Kiwi Point Quarry Plan Change – Assessment of Options: Air Quality' (MWH report dated 25 November 2016) ('Air Quality Options Assessment'). This report presented the results of an assessment of

the potential air quality effects that may arise as a result of four different options associated with the Plan Change and quarry expansion.

2.6 In July, August and November 2018 I reviewed the submissions regarding the Plan Change.

2.7 In preparing my Air Quality Assessment and evidence I have visited the Site of the Plan Change on the following days:

(a) 31 October 2016; and,
(b) 28 June 2018.

2.8 While I understand that the present hearing is not a matter to which the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (2014) applies, I confirm that I have approached the preparation of this evidence in the same manner as I would for Environment Court proceedings and have complied with the requirements of the Code. I confirm that the issues addressed in this evidence are within my area of expertise and the opinions I have expressed are my own except where I have stated that I have relied on the evidence of other people. I have not omitted material facts known to me that might alter or detract from my evidence.

3 SCOPE OF EVIDENCE

3.1 I have been asked by WCC to prepare evidence on its behalf as proponent of Proposed Plan Change 83, which was publicly notified on 13 April 2018.

3.2 The evidence I was asked to prepare specifically relates to the proposed discharges to air at the Site of the Plan Change, which is predominantly dust.

3.3 My evidence will address the following points:

(a) Receiving environment;
(b) Methodology;
(c) Assessment of effects;
(d) Dust deposition monitoring;

(e) Response to submitters; and,

(f) Comments on the Officer's report.

3.4 The key documents and information that I have referred to and relied on in preparing my evidence include:

(a) Section 32 Report relating to the Plan Change (Incite report dated 5 February 2018);

(b) Air Quality Assessment (MWH report dated 12 July 2016);

(c) Air Quality Options Assessment (MWH report dated 25 November 2016); and,

(d) Dust Deposition Monitoring Results for October 2016 to July 2018 (Holcim, the quarry operator).

4 RECEIVING ENVIRONMENT

4.1 In the context of the Air Quality Assessment, the term 'sensitive receptor' included any persons, locations, or systems that may be susceptible to changes in the existing (or baseline) ambient air quality as a consequence of discharges to air arising from the proposed expansion into the south face of the quarry. It is important to note that in my assessment I have also considered the potential dust effects associated with the continued extraction and processing activities (including cleanfilling) within the existing (northern) part of the quarry. However, it is anticipated that extraction of rock within the existing (northern) part of the quarry will cease in 2020 once extraction has begun into the south face.

4.2 As outlined in the Ministry for the Environment ('MfE')'s 'Good Practice Guide for Assessing and Managing Dust' (2016), typical locations for sensitive receptors include residential properties, retirement villages, hospitals or medical centres, schools, marae, libraries, and public outdoor locations (e.g. parks and sports fields).

4.3 Sensitive receptors do not include indoor locations (e.g. within residences), inside vehicles, within indoor workplace environments, or within outdoor workplace environments where members of the public are not typically exposed to airborne contaminants.

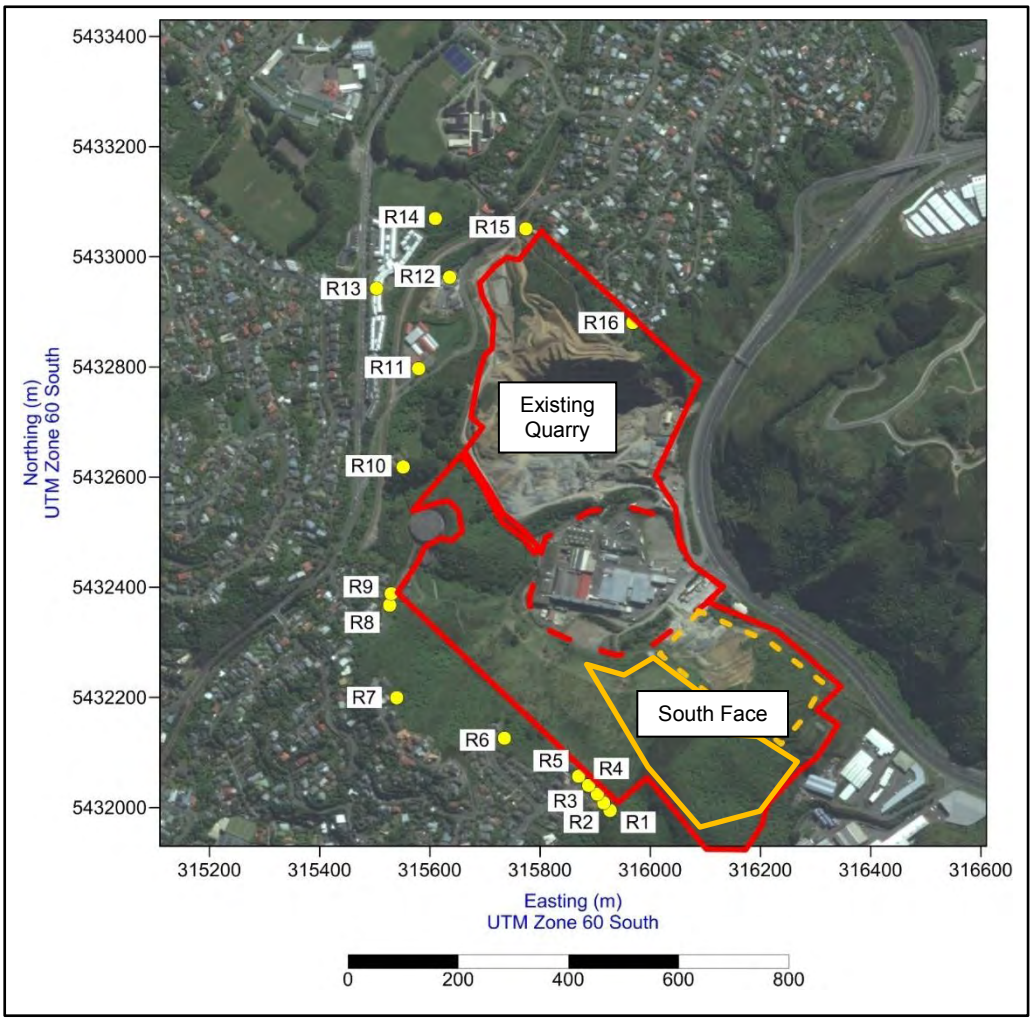
4.4 Sixteen sensitive receptors were identified in the Air Quality Assessment. These receptors are all situated within 1 kilometer of the boundary of the quarry. Whilst there are considerably more sensitive receptors located within this distance of the quarry boundary, these receptors are some of the closest and are therefore considered to have the greatest potential to be affected by the Plan Change. The majority of these sensitive receptor locations are residential properties, with the remainder being a retirement village, a business and a park.

4.5 Table 1 and Figure 1 show the sixteen sensitive receptor locations (referred to as receptors 'R1' to 'R16').

Table 1: Sensitive Receptor Locations

Ref.	Address	Receptor Type	Distance (m) and Direction from Site Boundary
R1	42 Gurkha Crescent	Residential	0 / SW
R2	44 Gurkha Crescent	Residential	0 / SW
R3	46 Gurkha Crescent	Residential	0 / SW
R4	39 Gurkha Crescent	Residential	0 / SW
R5	37 Gurkha Crescent	Residential	0 / SW
R6	18 Shastri Terrace	Residential	40 / SW
R7	26 Imran Terrace	Residential	120 / SW
R8	7 Maldive Street	Residential	10 / W
R9	94 Burma Road	Residential	20 / NW
R10	175 Fraser Avenue	Residential	50 / NW
R11	170 Fraser Avenue	Residential	80 / NW
R12	130 Fraser Avenue	Business	30 / NW
R13	134 Burma Road	Retirement Village	160 / WNW
R14	159 Burma Road	Park	110 / NW
R15	113 Fraser Avenue	Residential	0 / NE
R16	9 Plumer Street	Residential	0 / NE

Figure 1: Sensitive Receptor Locations



4.6 The existing businesses located on Tyers Road to the south-east of the quarry site boundary (and shown in Figure 1) were not included as sensitive receptors in the Air Quality Assessment. However, the report assessed the potential risk at these properties as a result of dust emissions generated during the proposed south face expansion works.

4.7 I consider that the receptors that are residential properties and the retirement village are of 'high' sensitivity to potential dust emissions at Kiwi Point Quarry, for the reasons outlined below:

(a) The location of a person(s) who could reasonably be expected to enjoy a high level of amenity; or

(b) The appearance, aesthetics or value of a person's property could be diminished by soiling; and the people or property could reasonably be expected to be present continuously, or

at least regularly for extended periods, as part of the normal pattern of use of the land.

4.8 I consider that receptor R11 (a former school and now an approved multi-unit residential development) is of 'high' sensitivity to potential dust emissions at Kiwi Point Quarry. As a school, I would have considered this location to be of 'moderate' sensitivity to potential dust emissions.

4.9 I consider that receptor R12 (business) is of 'moderate' sensitivity, and that Receptor R14 (park) is of 'low' sensitivity to potential dust emissions at Kiwi Point Quarry. This is based on the principle that users would expect to enjoy a reasonable level of amenity but would not be reasonably expected to enjoy the same level of amenity as they would in their home.

5 METHODOLOGY

5.1 A qualitative (risk-based) assessment of the potential air quality effects that may arise as a result of the Plan Change was undertaken in general accordance with the MfE's 'Good Practice Guide for Assessing and Managing Dust' (2016)[2] and the UK's IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning' (2016).[3]

5.2 The assessment draws parallels with the FIDOL[4] method and is based on the source-pathway-receptor (S-P-R) concept which represents the hypothetical relationship between the dust emission source (S), the pathway (P) by which nuisance or exposure might occur and the receptor (R) that could be adversely affected (i.e. receptors R1 to R16).

5.3 The potential for dust to be emitted at the Kiwi Point Quarry will be directly influenced by the nature of the activities taking place onsite. The principal dust-generating activities are likely to comprise the following:

(a) Site preparation and restoration;

[2] MfE, 2016. 'Good Practice Guide for Assessing and Managing Dust', Ministry for the Environment (MfE), November 2016.
[3] IAQM, 2016. 'Guidance on the Assessment of Mineral Dust Impacts for Planning', Institute of Air Quality Management (IAQM), May 2016.
[4] The Frequency (F), Intensity (I), Duration (D), Offensiveness (O) and Location (L) of the dust effect (nuisance).

(b) Mineral extraction, including drilling and blasting;

(c) Materials handling and processing, including crushing and screening of aggregate and stockpiling of material; and,

(d) Vehicle movements on unsealed roads and yard surfaces.

5.4 Emissions are likely to vary substantially from day to day, depending on the level of activity, the specific operations being undertaken, the weather conditions and the location of the activity.

6 ASSESSMENT OF EFFECTS

6.1 The existing and proposed quarrying and processing activities undertaken at the Kiwi Point Quarry are permitted under Rule 10 of the operative Wellington Regional Air Quality Management Plan ('RAQMP' or the 'Regional Plan') provided that there are no *"noxious, dangerous, offensive or objectionable"* effects associated with the discharges to air from the site at or beyond the site boundary.

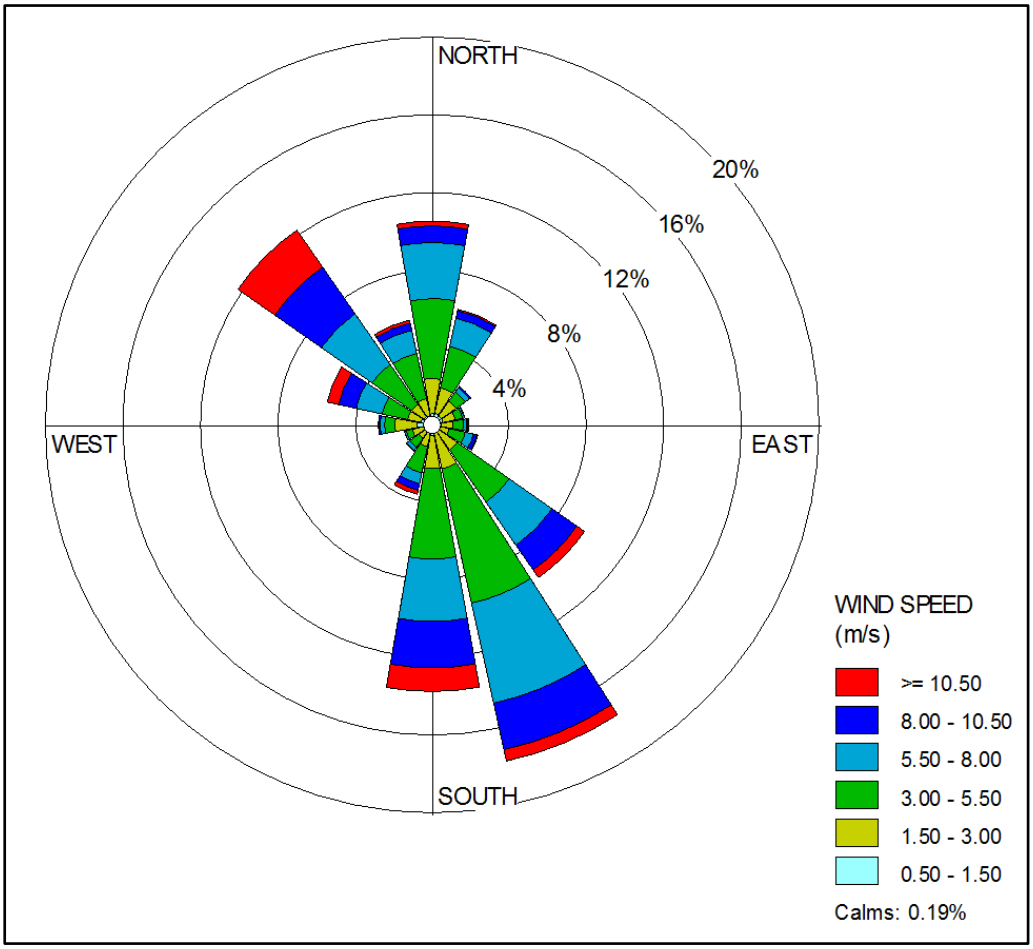
6.2 Rule R27 of the Proposed Natural Resources Plan for the Wellington Region ('PNRP' or the 'Proposed Regional Plan') provides for the handling of aggregate and is very similar to Rule 10 of the operative RAQMP. In other words, the existing and proposed quarrying and processing activities undertaken at the quarry are permitted under Rule R27 of the PNRP provided that there are no *"noxious, dangerous, offensive or objectionable"* effects associated with the discharges to air from the site at or beyond the site boundary.

6.3 In the absence of site-specific meteorological monitoring data, I have analysed hourly wind speed and wind direction data from the Kelburn Automatic Weather Station (Kelburn AWS) which is listed on the National Climate Database ('CliFlo') and is situated 5.5 kilometers south-west of the quarry site boundary. In my opinion, and in the absence of site-specific data, the Kelburn AWS meteorological data are likely to be a good representation of the meteorological conditions at the quarry.

6.4 Hourly wind speed and direction data for the period 1 January 2008 to 31 December 2012 (i.e. a 5 year period) were analysed. The data availability over this period was excellent at 99.7%. The data indicates that winds from all directions are likely to be experienced at the Kiwi

Point Quarry. However, the predominant winds (63.8% in total) measured at the Kelburn AWS were from the south-south-east (SSE, 17.7%), south (S, 13.7%), north-west (NW, 12.2%), north (N, 10.5%) and south-east (SE, 9.6%), as shown in the wind rose presented in Figure 2.

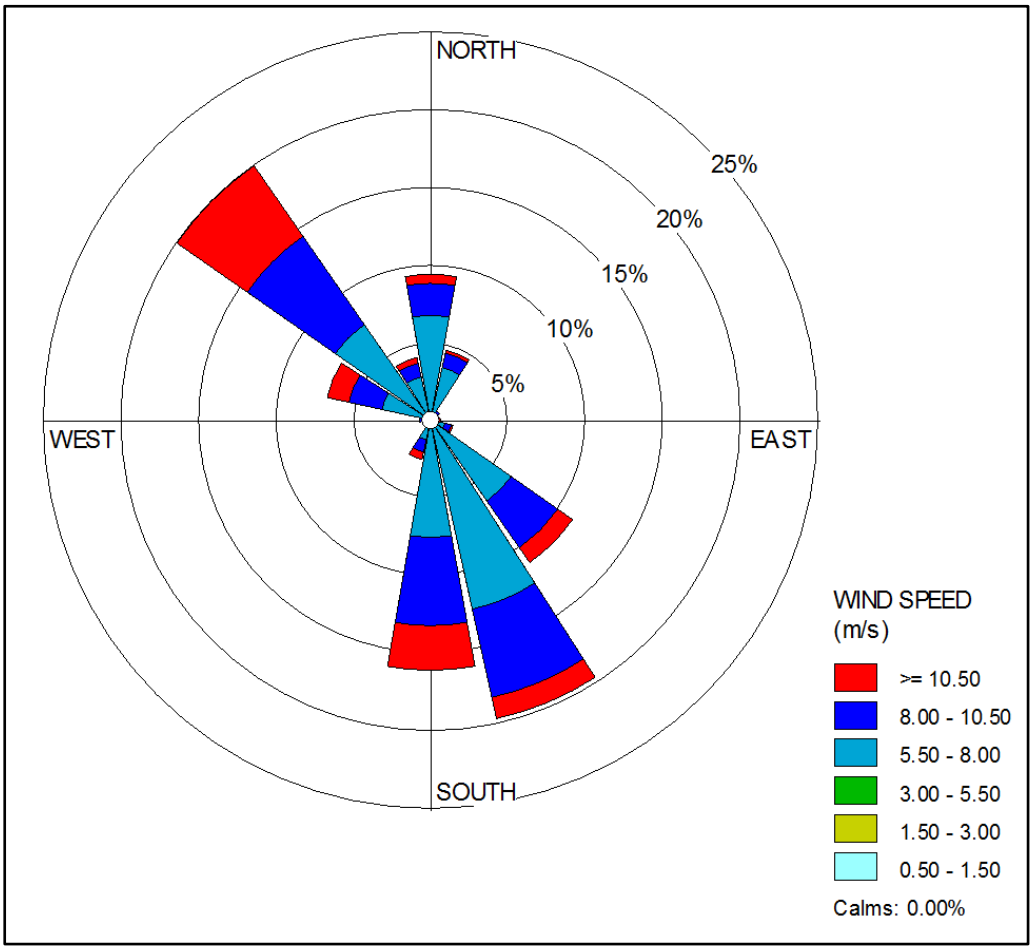
Figure 2: Wind Rose for Kelburn AWS for 2008 to 2012



6.5 The hourly mean wind speed frequency distribution for Kelburn AWS indicates that 42% of the mean wind speeds were above 5.5 metres per second (m/s), which is significant as I adopted this value in my assessment as the threshold above which there is the potential for the propagation of dust in dry conditions, based on IAQM (2016). A 5.5 m/s mean wind speed corresponds to 19.8 km/hr or 'moderate breeze' (Beaufort 4) or 'moderate' winds, as defined by the MetService. I then undertook further analysis of the data to determine the percentage frequency that sensitive receptors are likely to be situated downwind of potentially dusty winds (those greater than 5.5 m/s) blowing over the quarry.

6.6 Figure 3 shows the wind rose for wind speeds measured above 5.5 m/s at the Kelburn AWS. The predominant winds were from the NW (8.4%), SSE (8.3%), S (6.8%), SE (4.7%) and N (4%), which corresponds to 32.2% of the total winds above 5.5 m/s.

Figure 3: Wind Rose for Kelburn AWS for 2008 to 2012 for Winds above 5.5 m/s



6.7 In accordance with IAQM (2016), I estimated the effectiveness of the pathway to each sensitive receptor location by considering the distance and direction of each receptor relative to the prevailing wind directions (based on 5 years' wind speed and direction data for Kelburn AWS), and the criteria used in my assessment are summarised in Table 2 and Table 3. However, the criteria shown in the tables do not consider the change in elevation between the dust emission source and receptor, and this limitation has the potential to lead to an over-prediction (more conservative assessment) of the potential impacts.

6.8 I then determined the pathway effectiveness based on the outputs from Table 2 and Table 3, and using Table 4.

Table 2: Categorisation of Frequency of Potentially Dusty Winds (IAQM, 2016)

Frequency Category	Criteria*
Infrequent	Frequency of winds (>5.5 m/s) from the direction of the dust source on all days are less than 5%
Moderately frequent	Frequency of winds (>5.5 m/s) from the direction of the dust source on dry days are between 5% and 12%
Frequent	Frequency of winds (>5.5 m/s) from the direction of the dust source on dry days are between 12% and 20%
Very frequent	Frequency of winds (>5.5 m/s) from the direction of the dust source on dry days are greater than 20%

N.B. * For a worst-case assessment, include all days.

Table 3: Categorisation of Receptor Distance from Source (IAQM, 2016)

Frequency Category	Criteria*
Distant	Receptor is between 200 m and 400 m from dust source
Intermediate	Receptor is between 100 m and 200 m from dust source
Close	Receptor is less than 100 m from the dust source

N.B. * For a worst-case assessment, do not take into account changes in terrain elevations or the influence of vegetation cover and buildings.

Table 4: Pathway Effectiveness (IAQM, 2016)

Receptor Distance	Frequency of Potentially Dusty Winds			
	Infrequent	Moderately Frequent	Frequent	Very Frequent
Close	Ineffective	Moderately Effective	Highly Effective	Highly Effective
Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
Distant	Ineffective	Ineffective	Moderately Effective	Moderately Effective

6.9 The residual dust emission magnitudes were based on the scale of the anticipated works and were classified as 'imperceptible', 'small', 'medium', or 'large' after the 'designed-in' mitigation measures have been taken into account. For the purposes of my assessment, I assumed that the 'designed-in' mitigation measures were the existing mitigation measures employed onsite by the existing quarry operator

(Holcim) as opposed to the additional measures recommended in paragraphs 6.19 to 6.23).

6.10 The third step in my assessment was to combine the residual source emissions and the pathway effectiveness to predict the dust impact risk for each dust-generating activity (and/or phase) and receptor, as shown in Table 5.

Table 5: Dust Impact Risk Assessment Criteria (IAQM, 2016)

Pathway Effectiveness	Residual Source Emissions		
	Small	Medium	Large
Highly Effective Pathway	Low Risk	Medium Risk	High Risk
Moderately Effective Pathway	Negligible Risk	Low Risk	Medium Risk
Ineffective Pathway	Negligible Risk	Negligible Risk	Low Risk

6.11 In the final step of the assessment I determined the magnitude (scale) of the potential dust impact risks predicted at each receptor location. The criteria used in my assessment are shown in Table 6.

Table 6: Dust Impact Magnitude Criteria

Dust Impact Risk	Receptor Sensitivity		
	Low	Medium	High
High Risk	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
Medium Risk	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
Low Risk	Negligible Effect	Negligible Effect	Slight Adverse Effect
Negligible Risk	Negligible Effect	Negligible Effect	Negligible Effect

6.12 In my assessment I assumed that 'negligible' and 'slight adverse' effects would equate to 'less than minor' and 'no more than minor' effects, respectively, while 'moderate adverse' and 'substantial adverse' effects are 'minor' and 'more than minor' effects, respectively.

6.13 Existing dust mitigation measures implemented onsite include:

(a) Visual inspection (monitoring) for dust: quarry staff undertake regular visual inspections for dust emissions on the site, and implement control measures (e.g. sprinklers, water cart) as required;

(b) Mineral processing and materials handling: the crushing and screening plant and aggregate product stockpiles are located within a low-lying part of the site (the quarry floor or void) which reduces the potential for propagation by wind erosion and weathering. In addition, overburden extracted on site has been used to construct noise/visual bunds around the perimeter of the site (along the boundary with Fraser Avenue). There is the potential for these bunds to be planted with native vegetation which, in addition to existing vegetation and terrain elevations, will provide shelter from the wind and will reduce the potential for dust to be picked and carried by the wind from the sources located on the quarry floor; and,

(c) Dampening surfaces and stockpiles using water or a chemical dust suppressant: the unsealed haul roads are sprayed with water or a dust suppressant called Vital Bon-Matt Stonewall using a water truck, and the stockpiles area is also sprayed in order to control dust emissions. The sealed road has a sprinkler system for dust suppression.

6.14 I have estimated the potential residual dust emission magnitudes for the proposed activities to be undertaken on at the quarry as a result of the Plan Change. The residual dust emission magnitudes and the predicted dust impacts at each receptor are shown in Table 7, where 'southern extension works' relate to the Plan Change activities (i.e. the proposed quarry expansion into the south face of the quarry).

6.15 Overall, I consider that the proposed activities undertaken at the quarry as a result of the Plan Change will have a 'slight adverse' effect within the surrounding community. These potential effects are considered to be 'no more than minor' and are based on a consideration of the different magnitude of effects at individual receptor locations, and the sensitivity and type of receptor that would potentially experience these effects.

Table 7: Summary of Predicted Dust Impacts

ID	Nearest Dust Source	Residual Source Emiss-ions	Pathway Effective-ness	Dust Impact Risk	Receptor Sensit-ivity	Magnitude of Dust Effect
R1	Southern Extension Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R2	Southern Extension Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R3	Southern Extension Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R4	Southern Extension Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R5	Southern Extension Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R6	Southern Extension Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R7	Existing Quarry Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R8	Existing Quarry Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R9	Existing Quarry Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R10	Existing Quarry Works	Medium	Ineffective	Negligible Risk	High	Negligible Effect
R11	Existing Quarry Works	Medium	Moderately Effective	Low Risk	High	Slight Adverse Effect
R12	Existing Quarry Works	Small	Highly Effective	Low Risk	Medium	Negligible Effect
R13	Existing Quarry Works	Medium	Moderately Effective	Low Risk	High	Slight Adverse Effect
R14	Existing Quarry Works	Small	Highly Effective	Low Risk	Low	Negligible Effect
R15	Existing Quarry Works	Small	Highly Effective	Low Risk	High	Slight Adverse Effect
R16	Existing Quarry Works	Medium	Moderately Effective	Low Risk	High	Slight Adverse Effect

6.16 The results of my assessment indicate that there are unlikely to be any dust nuisance effects beyond the Kiwi Point Quarry site boundary as a result of the Plan Change. Furthermore, I determined from my assessment that the Tyers Road businesses (located south-east of the quarry boundary) are of 'low' risk to potential dust emissions generated as a result of the Plan Change and I predict that the potential effects at this location will be 'negligible' or 'less than minor'.

6.17 Based on the results of my assessment, I also consider that it is unlikely that there will be any exceedances of the 24-hour mean National Environment Standard for particles less than 10 micrometers (μm) in diameter (PM_{10}) beyond the quarry site boundary or at any sensitive receptor location as a result of PM_{10} emissions at the quarry.

6.18 Whilst the results of my assessment indicate that the designed-in (existing) operational mitigation measures are considered appropriate to mitigate the potential effects on the surrounding area, I have recommended a number of additional mitigation measures in paragraphs 6.19 to 6.23, which take into account current best practice.

6.19 Recommended 'design' mitigation measures to control potential dust emissions arising as a result of the Plan Change include:

(a) Locating all dust-generating activities as far away from sensitive receptor locations as possible. Dust-generating activities should, where possible, be located where maximum protection can be obtained from topography, trees and vegetation cover or other sheltering features;

(b) Stockpiles, haul roads, tips and mounds, and exposed areas should be located as far away as possible from sensitive receptors. Where practicable, they should not be located directly upwind of sensitive receptors with respect to the potentially dusty wind directions determined in the Air Quality Assessment;

(c) For longer periods of activity, perimeter screening bunds (ideally vegetated) or semi-permeable fences, and over shorter periods netting screens may be effective at reducing the propagation of dust beyond the site boundary;

(d) Consideration should be given to the installation of a wheel or vehicle washing facility, where feasible, and the construction of a sealed (paved) road after the vehicle washing facility in order to reduce trackout beyond the site boundary and onto the Centennial Highway. The term 'trackout' refers to the transport of dust and dirt from the site onto the public road network, where it may be deposited and then re-suspended by vehicles travelling on the road.

6.20 Recommended 'operational' mitigation measures to control potential dust emissions arising as a result of the Plan Change include:

(a) A Dust Management Plan (DMP) should be produced and adhered to. The DMP could be incorporated into the existing Quarry Management Plan and should contain details as to how the quarry operator will control dust emissions;

(b) Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;

(c) Provide training to the site personnel on dust mitigation and visual inspections for dust, including dust deposition monitoring or, if applicable, ambient air quality monitoring;

(d) Undertake daily onsite and offsite inspections and audit the monitoring programme. Carry out regular site inspections to monitor compliance with the DMP and adjust the frequency of site inspections according to dust risk (higher frequency in dry and windy conditions);

(e) Some activities should ideally be planned only during favourable weather conditions. Where possible, particularly dusty activities should be avoided during extended periods of dry and windy conditions. Blasting may be avoided if appropriate alternatives can be employed, for example modern hydraulic excavators and breakers. Equipment used for abrasive blasting should be fitted with dust extraction systems;

(f) Wherever practicable, crushing and screening should take place within fully enclosed structures, or where this is not possible (e.g. in the case of mobile plant) mineral processing should take place within a sheltered part of the quarry, away from boundaries with offsite sensitive receptors. Dampen

material (e.g. wetting down of stockpiles prior to crushing operation). Protect equipment (e.g. conveyors and process plant) by partial or complete enclosure within housing and use crushing and screening plant within its design capacity and maintain good standards of all plant and equipment;

(g) Enclose transfer points and conveyor discharges where visible dust emissions occur.

6.21 I also recommend that an automatic weather station is established in a suitable location on the site to measure, as a minimum, the onsite wind speed and direction. Other parameters which could also be measured at little additional cost include: ambient temperature, relative humidity, atmospheric pressure and rainfall.

6.22 The weather station should be positioned as far away from buildings and trees as possible, as these structures affect wind flow. The onsite meteorological data may be used for the following reasons:

(a) To manage the occasions when the propagation of dust occurs at the site. For example, it may be necessary to avoid undertaking drilling, blasting, quarrying (extraction) and processing (crushing and screening) activities under moderate to strong winds blowing towards the nearest sensitive receptors as these conditions may, in the absence of adequate mitigation, cause dust complaints;

(b) To corroborate (or contradict) any dust nuisance complaints that may arise during the continued operation of the quarry.

6.23 A regular monitoring programme should be undertaken by the quarry operator for dust emissions during the proposed expansion of the south face of the quarry, and a description of the monitoring programme should be included in the DMP. This could range from visual inspections for visible dust plumes and dust deposition/flux monitoring (existing monitoring measures), but could also include real-time PM_{10} continuous monitoring (e.g. near the site boundary with Gurkha Crescent). The monitoring data could be used as a management tool to implement dust mitigation (suppression) measures, as required, particularly during dry conditions and under moderate to high wind speeds (>5.5 m/s) blowing from the NE (i.e. towards Gurkha Crescent).

7 DUST DEPOSITION MONITORING

7.1 The existing quarry operator, Holcim, has undertaken dust deposition monitoring at Kiwi Point Quarry since October 2016, and this monitoring is still ongoing. The monitoring is being undertaken in accordance with Draft International Standard ISO/DIS 4222.2, which is a recommended method in the MfE's 'Good Practice Guide for Assessing and Managing Dust' (2016) and is widely used in New Zealand. This method involves collecting deposited dust or matter that settles out of the air (mass) per unit area per unit time, which is usually grams per square metre per 30 days (or 'g/m^2/30 days').

7.2 Measurements are undertaken at three locations onsite by means of deposition gauges. The locations of the deposition gauges are shown in Figure 4 and are situated around the main dust-generating activities and are referred to in my evidence as locations 'L1', 'L2' and 'L3' or 'entrance', 'haul road' and 'top yard', respectively.

Figure 4: Existing Dust Deposition Monitoring Locations (L1 to L3)

7.3 A photo of the deposition gauge located at the site entrance (location 'L1') is shown in Figure 5. The photo was taken on 28 June 2018 and is looking south-west towards Taylor Preston Limited's abattoir and meat works (centre) and the houses on Shastri Terrace and Gurkha Crescent (along the ridgeline in the distance).

Figure 5: Dust Deposition Gauge Located at the Site Entrance (L1)

7.4 As outlined in the MfE's 'Good Practice Guide for Assessing and Managing Dust' (2016), the current recommended trigger level (or control limit) for deposited dust (insoluble matter) is 4 g/m^2/30 days (above the background deposition rate). The MfE's Good Practice Guide for Dust recommends that this trigger level should only be considered in conjunction with the results of other assessments, including complaints surveys and community consultation and that a trigger level of 2 g/m^2/30 days (above the background deposition rate) may be more appropriate in more sensitive locations (e.g. residential areas).

7.5 I have reviewed the Greater Wellington Regional Council's complaints database, as provided to me by WCC, and there have only been three dust nuisance complaints relating to activities undertaken at the Kiwi

Point Quarry. These complaints occurred on 14 January 2009, 18 December 2009 and 20 December 2011 and correspond to the following residential property locations: 407 Burma Road, 134 Burma Road and 105 Fraser Avenue, respectively. The Burma Road locations correspond to the retirement village (approximately 200 m west-north-west of the quarry site boundary), while the Fraser Avenue address is a private residential property (approximately 60 m north of the quarry site boundary). Given that these complaints occurred between 6.5 and 9.5 years ago, it is difficult to relate these complaints to actual activities that were undertaken at the quarry at the time. However, it is possible, given that the complaints occurred in the summer, that dry and windy conditions coupled with dust-generating activities taking place on the northern part of the quarry (near Fraser Avenue) may have been the cause of the incidents.

7.6 I understand that a complaint relating to dust emissions from the 'top yard' (near Fraser Avenue) was received by Holcim on 5 December 2017, which was before Holcim started using the dust suppressant (Vital Bon-Matt Stonewall). The complainant is a resident living on Fraser Avenue.

7.7 Having considered the above complaints record and based on my observations during my two site visits I believe that a dust deposition trigger level of 4 g/m^2/30 days (above the background deposition rate) is appropriate for the site. It is important to stress, however, that I do not consider this trigger level to be the threshold above which deposited dust will cause an adverse effect at or beyond the boundary of the site (e.g. annoyance, nuisance or disamenity), which is in agreement with IAQM (2016), which states that "this is largely due to the difficulty in accurately determining human response to dust accumulation and soiling." Whilst a degree of caution is needed when interpreting dust deposition monitoring results, they often provide a useful indication as to the relative amount of dust deposition (e.g. for comparison with other monitoring sites over time).

7.8 The dust deposition monitoring results for October 2016 to July 2018 (i.e. over a period of 22 months) are shown in Table 8. Exceedances of the dust deposition trigger level of 4 g/m^2/30 days are shown in bold text.

Table 8: Dust Deposition Monitoring Results for October 2016 to July 2018

Date	Dust Deposition Rates at Each Monitoring Location (g/m^2/30 days)		
	L1 Entrance	L2 Haul Road	L3 Top Yard
October 2016	1.9	2.9	1.6
November 2016	0.3	**11.5**	**9.2**
December 2016	**6.1**	1.8	1.4
January 2017	3.4	**22.4**	0.5
February 2017	**5.5**	3.0	1.3
March 2017	0.2	1.1	<0.1
April 2017	**4.2**	0.7	1.5
May 2017	1.2	1.3	**5.3**
June 2017	3.6	**6.2**	0.9
July 2017	**6.2**	2.4	0.7
August 2017	2.7	3.2	1.4
September 2017	**83.8**	2.3	**67.2**
October 2017	**6.6**	**14.2**	**5.0**
November 2017	**4.3**	**26.8**	**16.0**
December 2017	**8.3**	**22.3**	**8.3**
January 2018	**10.9**	1.7	**4.4**
February 2018	2.5	**5.4**	3.9
March 2018	**6.5**	2.5	**4.2**
April 2018	2.4	**6.8**	0.7
May 2018	2.0	3.9	1.3
June 2018	1.7	3.3	2.2
July 2018	2.9	1.0	1.8

7.9 The dust deposition monitoring rates shown in Table 8 indicate that there have been a number of recorded incidents in exceedance of the trigger level of 4 g/m^2/30 days, and that, as expected, the highest dust

deposition rates generally occurred during the drier months of the year (spring and summer).

7.10 The dust deposition monitoring rates shown in Table 8 are fairly typical of monitoring locations at quarry sites, particularly those situated in close proximity to dust emission sources, such as unsealed haul roads and yard surfaces, as locations L1 to L3 all are. It is stated in IAQM (2016) that it is commonly accepted that the greatest dust impacts are likely to occur within 100 m of a dust emission source, and that this can include both large dust particles (greater than 30 µm in size) and small dust particles (less than 10 µm in size or PM_{10}). IAQM (2016) also states that intermediate-sized particles (10 µm to 30 µm in size) may theoretically travel up to 400 m, with occasional elevated dust deposition and PM_{10} concentrations being possible, in the absence of adequate dust mitigation (suppression). IAQM (2016) also states that particles less than 10 µm in size (or PM_{10}), again in the absence of adequate dust mitigation, have the potential to travel beyond 400 m but with minimal significance due to dispersion and deposition. In other words, larger particles, which may make up the majority of the dust released at the quarry (e.g. 95% of total dust emissions), would be expected to be deposited within 100 m of the dust emission source.

7.11 In view of the foregoing, the dust deposition rates at or beyond the boundary of the site (including sensitive receptor locations) are likely to be lower than those measured at locations L1 to L3 due to dispersion and deposition.

8 RESPONSE TO ISSUES RAISED IN SUBMISSIONS

8.1 The key submissions relating to discharges to air during the continued operation of the quarry including the expansion into the south face as provided for under the proposed Plan Change are as follows:

(a) Mr Suisted[5] is a commercial photographer and lives at 16 Kitchener Terrace and is concerned that dust from the quarry could damage his “expensive delicate equipment” and cause long term effects “from breathing this airborne particulate matter over a long period.” He mentioned that his

[5] Submitter 2.

home “gets coated with a fine brown dust” and seeks stringent controls on quarrying activities relating to dust emissions, including undertaking dust and meteorological monitoring onsite.

(b) Mr Austin[6] lives at 12 Nagpur Terrace and is concerned that the Plan Change will cause “significant human health (dust, noise) and amenity (noise, visual) impacts on residents with consequential impacts on property values for which no compensation is proposed.”

(c) Mr Norton[7] lives at 14 Plumer Street and is concerned about the “ability of the quarry to contain dust and noise impacts within their boundary.”

(d) Ms Brydges-Jones[8] lives at 6 Birla Terrace and is concerned about “pollution – thick smoke” allegedly from the quarry.

(e) Ms Mundell[9] lives at 92 Burma Road and raised concerns that the quarry is “dusty, so dusty with the rock-crushing machinery grinding away that we have to wash our cars and homes regularly to get rid of the grit and grime that attracts paint destroying mould.” She also seeks the quarry to “stop its offensive air and noise contamination that regularly exceeds beyond its boundaries.”

(f) Mr and Mrs Dawe[10] live at 313/134 Burma Road (the retirement village) and support the Plan Change but commented that “more effective dust control, than currently, would be helpful.”

(g) Mr Stapleton and Mrs McQuellin[11] live at 14 Nagpur Terrace and raised concerns about “general malaise and ill health for elderly” and those “vulnerable to depressed immune systems”, in addition to “uncertainty around long term health effects [of dust exposure]”. They also refer to “smoke emissions” and the “smoke belching quarry.”

(h) Mr and Mrs Young[12] live at 37B Gurkha Crescent and are concerned about “significant environmental impacts in discharge of contaminants and air pollution.”

---

6 Submitter 4.
7 Submitter 7.
8 Submitter 8.
9 Submitter 13.
10 Submitter 16.
11 Submitter 18.
12 Submitter 20.

(i) Mr Peel[13] lives at 12 Plumer Street and is concerned that it "will not be possible for the quarry to contain dust impacts within their boundary (our property is already coated inside and out with a fine brown dust."

(j) Mr Mainwaring[14] lives at 92 Kanpur Road and is concerned that dust and airborne particulates "create a clear health risk to the community." He goes on to say that "they are already an issue and expanding quarry will increase this greatly."

(k) Mr Brodie[15] lives at 5 Hindipur Terrace and raises similar concerns to Submitter 18, such as childhood asthma, general malaise, ill health of elderly and depressed immune systems. He is concerned that "so many children at playtime will ingest dust from the increased blasting" and also mentions "smoke emissions."

(l) Ms Pennell[16] lives at 42 Rajkot Terrace and is concerned about the "negative environmental impact on houses, schools and businesses in the surrounding areas" and goes on to say that "the quarry already generates noise and dust pollution." She refers to the "adverse impact on retirement home" and a "health risk to children and the elderly." She also raises concerns about the potential impact on the water supply due to blasting.

(m) Ms Rudzki and Mr Savage[17] live at 37A Gurkha Crescent and opposes the Plan Change due to the "reduction of real estate value of homes close to the quarry, noise, dust, light and air pollution …"

(n) Ms McFaull[18] is President of the Onslow Residents Community Association (ORCA) and refers to the residents living adjacent to the quarry who are "constantly cleaning up dirt and dust that arrives on their property from quarrying operations. The mitigations promised in the quarrying management plan will not be enough to halt the dust when Wellington turns on her gale force winds." She also seeks that "dust levels are monitored regularly by council officials and methods of dust minimisation such as the use of water

[13] Submitter 22.
[14] Submitter 23.
[15] Submitter 24.
[16] Submitter 26.
[17] Submitter 29.
[18] Submitter 32.

and 'Vitabond' Matt Sonewall [sic, Vital Bon-Matt Stonewall] are used to reduce the dust nuisance beyond the quarry. Costs should not be a consideration in this respect." She also seeks that if dust in residents' homes is "more than should be expected for someone to have to clean up, Council will pay for the dust to be removed/cleaned from their homes." She also seeks "a gap of at least 70 m is maintained between residential boundaries and the first batter area" although she goes on to say that ORCA would prefer a separation distance of at least 100 m.

(o) Ms Rivera-Jiminez[19] lives at 11 Birla Terrace and is concerned about a "health threat" to residents, school children and the retirement village. She mentioned that she already has "plenty of dust in our home in Broadmeadows." She is also concerned about the "negative impact on the value of surrounding properties." She goes on to say that "we recently bought our first home, currently investing to make our home weather proof and we see the expansion as a decreasing factor on the value of our property." She seeks the Council "to consider the negative impacts for the surrounding residents (specially health risks) over the financial benefits for outsiders."

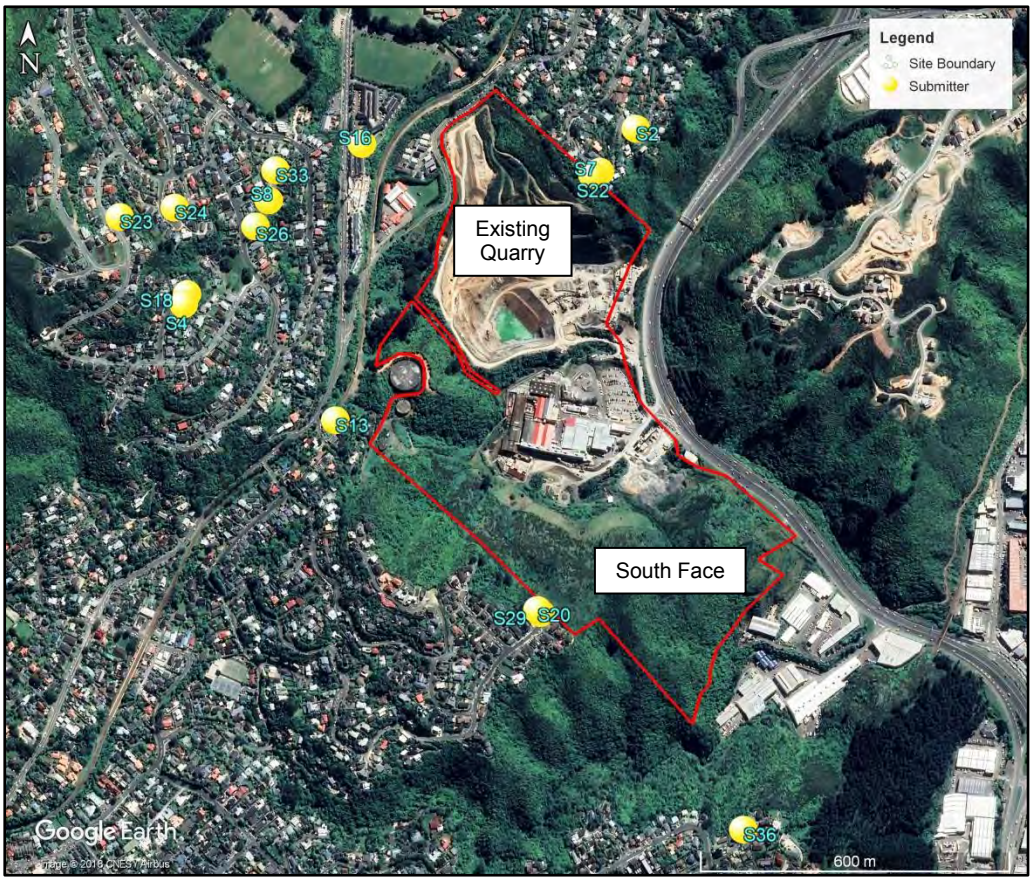
(p) Ms Garty[20] lives at 138 Homebush Road, Khandallah and is concerned that dust from the quarrying operations will adversely affect her property despite the dust control measures in place.

8.2 The location of the submitters' properties are shown in Figure 6. The submitter numbers are abbreviated by the letter 'S' followed by the submitter number (e.g. the location of Submitter 2 is shown as 'S2').

8.3 Figure 6 indicates that the closest submitters to the south face are Submitters 20 and 29 (numbers S20 and S29 on the figure). Both of these properties are located on Gurkha Crescent and are approximately 70 m south-west of the nearest dust-generating activities to be undertaken at the south face (e.g. soil stripping and overburden removal associated with the uppermost bench).

[19] Submitter 33.
[20] Submitter 36.

Figure 6: Submitter Property Locations Relating to Discharges to Air



8.4 Provided that the dust mitigation measures are implemented, it is anticipated that there will be no significant adverse air quality effects during the continued operation of the quarry including the expansion into the south face at any sensitive receptor location, including the submitters' properties.

8.5 The smoke emissions referred to by Submitters 8 and 18 are unlikely to be from any quarry-related activities. It is more likely that these emissions were from the asphalt plant situated adjacent to the quarry (on the eastern boundary of the quarry).

8.6 As I noted in paragraph 6.23, in the unlikely event that visible dust plumes are observed or that dust nuisance (soiling) effects arise beyond the boundary of the site, real-time, continuous monitoring for PM_{10}, wind speed and wind direction should be undertaken at a fenceline (site boundary) location as a dust management tool (e.g. near the boundary with Gurkha Crescent). All dust-generating

activities should cease in the event that a trigger level (or site action level) has been exceeded (e.g. 150 micrograms per cubic metre ($\mu g/m^3$) for PM_{10} as a 1-hour mean concentration and 250 $\mu g/m^3$ for PM_{10} as a 15-minute mean concentration) to allow the dust emission source to be identified and to implement appropriate mitigation measures.

8.7 It may also be useful for WCC and Holcim to consider increasing the number of dust deposition monitoring locations and to undertake composition analysis of the particulate matter (in addition to gravimetric analysis) using, for example, scanning electron microscopy with energy dispersive x-ray spectrometry (SEM/EDS). I have indicated three potential additional dust deposition monitoring locations in Figure 7 (locations shown as 'P1', 'P2' and 'P3'). By increasing the number of the dust deposition monitoring locations and the scope of the analysis (to include SEM/EDS), WCC and Holcim will likely gain a better indication as to the amount and composition of dust deposited at the monitoring locations (e.g. for annual and seasonal trend analysis) and therefore of the effectiveness of dust control measures implemented onsite.

8.8 Proposed locations 'P1' (near Maldive Street) and 'P2' (near Plumer Street) are close to the boundary of the site and are relatively close to submitter's who have commented that dust soiling events have occurred in the past at their properties. Whereas proposed location 'P3' is located close to the asphalt plant, which is another potential source of dust and particulate matter (and other contaminants such as hazardous air pollutants and smoke).

Figure 7: Additional Dust Deposition Gauge Monitoring Locations (P1 to P3)

9 COMMENTS ON THE OFFICER'S REPORT

9.1 At page 35 of the Officer's report (the section 42A report dated 19 November 2018), the Council Officer has recommended an amendment to the Quarry Management Plan information requirements set out under Policy 32.2.2.7 of the Operative District Plan. Note that this appears to be a typo and the correct policy number is Policy 33.2.2.7. The proposed amendment introduces "procedures for monitoring the effectiveness of management plan measures and for improving effectiveness over time where needed."

9.2 The Officer considers that the proposed amendment will make the Quarry Management Plan more effective at achieving Policy 33.2.2.7 (and other general policies) and that "existing and proposed district and regional plan requirements are sufficient to manage adverse nuisance and health effects from dust such that no further amendments are necessary." I agree with this statement providing that a DMP and the mitigation measures recommended in paragraphs 6.19 to 6.23 are adhered to at all times by the quarry operator.

10 CONCLUSION

10.1 I have undertaken an air quality assessment of the potential effects during the continued operation of the quarry including the expansion into the south face as provided for under the proposed Plan Change.

10.2 With the implementation of a DMP and the mitigation measures recommended in paragraphs 6.19 to 6.23, potential dust emissions will be effectively controlled and the potential for dust nuisance events will be appropriately managed in accordance with standard quarry management techniques.

10.3 Consequently, I am confident that the proposed Plan Change will not result in any dust nuisance effects or any adverse effects on human health or the environment at or beyond the boundary of the quarry.

John William Douglas Boddy

23 November 2018