

Before the Hearing Panel

Under the Resource Management Act 1991

In the matter of an application by Cromwell Certified Concrete to replace Discharge Permit - RM16.108.02 (ORC), Water Permit RM16.108.01 (ORC) and Land use consent - RC150052 (CODC) and seek resource consent for the discharge of contaminants to air to authorise the operation and expansion of the Amisfield Quarry

Statement of Evidence of Peter Stacey

For the Hayden Little Family Trust, Nicola and Bryson Clark, and Amisfield Orchard Limited

8th December 2021

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**anderson
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Qualifications and experience

- 1 My full name is Peter Warwick Stacey. My qualifications are: a Bachelor of Science from The University of Auckland and a Graduate Diploma in Business from Auckland University of Technology.
- 2 I am a Member of Clean Air Society of Australia and New Zealand and a Certified Air Quality Professional.
- 3 I am a Technical Director at GHD Limited (GHD) based in their Auckland office. I have over 18 years' experience in the field of air quality.
- 4 I have extensive experience with the assessment of dust from a variety of activities. My work experience relevant to this application includes:
 - i. Expert witness for Agrifeeds, Glencore and ADM NZ Limited (s127 parties) as part of an Environment Court appeal of Bay of Plenty Regional Council's Plan Change 13. As part of this project, I undertook an independent assessment of the effects from bulk handling of stockfood material for both Port side and warehouse operations, including PM₁₀ exceedance investigations and identification of likely sources. This information was then presented as evidence before the Court. (2020-2021).
 - ii. Expert witness for Northland Waste for the proposed construction and operation of a Refuse Transfer Station. This project involved an assessment of odour and dust associated with the facilities construction and operation.
 - iii. Air quality delivery work plans for various stages of the City Rail Link works including the design and implementation of a monitoring programme to determine whether works are causing significant nuisance dust effects (2018-2020).
 - iv. Air quality assessment of emissions from Ballance Agri-Nutrients fertiliser manufacturing plant in Mount Maunganui. This project required a detailed study of emissions using atmospheric dispersion modelling and empirical analysis of monitoring results (2015-2019).
 - v. Air quality assessment for Wellington International Airports, Runway Extension Project and development of appropriate dust mitigation measures (2017).
 - vi. Air quality assessment to support the application to expand the Brookby Quarry where fugitive dust emissions were the primary pollutant of concern (2013-2014).

- vii. Air quality assessment for Winstone Aggregates, Dry Creek Replacement Cleanfill (November 2012). This project also involved the assessment of fugitive dust.
 - viii. Expert witness for Doug's Opuia Boatyard, presenting evidence before the Environment Court as part of an appeal against Northland Regional Council's decision to decline an air discharge consent. As part of this work, I assessed dust emissions from boatyard activities and determined effects on the adjacent reserve, public walkway and nearby residential properties.
- 5 I am skilled in the use of a range of atmospheric dispersion models (for example, CALPUFF/CALMET, TAPM, AERMOD, GRAL, CALROADS, LandGEM and AUSPLUME) and have applied these skills to air quality assessments for a broad range of clients.
- 6 I have also supported various ambient air quality monitoring projects during my career in relation to the following quarries or aggregate processing facilities:
- i. Winstone Aggregates Three Kings Quarry, Auckland
 - ii. Winstone Aggregates Hunua Quarry, Auckland
 - iii. Winstone Aggregates Belmont Quarry, Wellington
 - iv. Brookby Quarry, Auckland
 - v. Rock and Rubble, Rosebank Road, Auckland
- 7 Over the past twelve years I have been responsible for obtaining air discharge consents for a large number of different activities within New Zealand (2010-2021).

Code of Conduct for Expert Witnesses

- 8 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014. This evidence has been prepared in accordance with that Code and I agree to comply with it. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Scope of evidence

- 9 I was engaged by Hayden Little Family Trust (HLFT), Amisfield Orchards Limited (AOL) and BD & NJ Clark Trust (Clark) (herein collectively referred to as the submitters) during November 2021 to provide independent air quality advice in relation to Cromwell Certified Concrete Limited's (CCCL) proposed expansion of its Amisfield Quarry.
- 10 Specifically, I have undertaken a review of the applicant's air quality assessment, in its various guises and assessed the potential effects of the proposal on the properties owned by the submitters, both in terms of the potential for health and nuisance impacts.
- 11 I have identified various areas where I disagree with the information presented in the application and the evidence of Mr Cudmore and have therefore made a number of my own recommendations regarding mitigation measures/consent conditions that could be implemented. In my opinion these will provide a greater level of comfort that air discharges from the proposal can be appropriately managed and not cause adverse effects.
- 12 In preparing this evidence I have reviewed the following reports and statements:
 - i. Beca Report: Amisfield Quarry – Technical Assessment of Potential Effects of Dust Discharges. Dated 22 October 2020 (herein referred to as the Beca Report or assessment)
 - ii. NZ, Air Preliminary technical air quality review of the proposed Cromwell Certified Concrete Quarry air discharge consent application, dated 12 January 2021
 - iii. Beca Letter: RM20.360.03 Amisfield Quarry Response to Request for Further Information. dated 1 March 2021.
 - iv. NZ Air, Technical air quality review of the Cromwell Certified Concrete Quarry Section 92 response. RM20.360.03, dated 12 March 2021.
 - v. PDP Memorandum, Amisfield Quarry Expansion – Review of effects on Air Quality, dated 17 March 2021
 - vi. Submissions prepared by Hayden Little Family Trust (HLFT), Amisfield Orchards Limited (AOL) and Clark, Nicola and Bryson (BD & NJ Clark Trust)
 - vii. Golder Letter: Review of Dust Effects Assessment – Amisfield Quarry, dated 11 November 2021.

- viii. Golder Draft Dust Management Plan – Amisfield Quarry. Dated November 2021.
 - ix. Central Otago Regional Council s42a Report, dated 23 November 2021
 - x. Central Otago District Council s42a Report, dated 23 November 2021
 - xi. Brief of Evidence of Mr Van Kekem, prepared on behalf of Otago Regional Council, dated 23 November 2021.
 - xii. Brief of Evidence of Ms Ryan, prepared on behalf of Central Otago District Council, dated 23 November 2021.
 - xiii. Brief of Evidence of Mr Cudmore, prepared on behalf of CCCL, dated 30 November 2021.
- 13 At the time of preparing this brief of evidence I have been unable to undertake a site visit due COVID 19 travel restrictions. However, I am proposing to arrange a visit prior to, or during the Hearing, subject to the lifting of Auckland’s travel restrictions. I therefore reserve the right to change the opinions that I have provided in my evidence, if I identify any areas where I may have not had a complete understanding of the nature of the proposed activities and/or surrounding environment.
- 14 My evidence will address the following matters:
- i. General Overview of the Application
 - ii. Review of Submissions and other supporting evidence of dust effects
 - iii. Evidence of Mr Cudmore
 - iv. Review of proposed consent conditions/dust mitigation measures
 - v. Comment on CODC and ORC air quality evidence
 - vi. Comment on the s42A reports
 - vii. Summary and Conclusion

General Overview of the Application

- 15 While reviewing the assessment undertaken by Beca and the additional information provided by Mr Cudmore, I was surprised that the applicant had not decided to undertake any site-specific air quality monitoring to provide a better understanding of the existing environment and the level of effect from the existing quarry operation.
- 16 Given the proximity to a number of sensitive receptors¹, I consider that it would have been necessary to have collected at least a year of meteorological data at the site, in addition to some form of ambient dust monitoring at the boundary of the site, downwind of the significant dust generating sources. In my view this would have represented best practice for an activity where limited accurate information is available on the existing environment and where the existing activity is already causing an adverse effect.
- 17 The dust monitoring could have also been an opportunity to collect information on the effectiveness of the proposed mitigation measures, justify the small setback distances that have been proposed and validate the modelling that Mr Cudmore has undertaken. Furthermore, it would have also helped to address some of the submitters' concerns, regarding exposure to particulate matter with an aerodynamic diameter less than 10 micrometres (PM₁₀) and respirable crystalline silica (RCS), which I also share, particularly if mobile crushing is allowed near locations where people can reside.
- 18 While in many instances time is limited to collect the appropriate amount of information, at least a year has passed since the application was lodged, a timeframe that I would consider to be sufficient to collect the required amount of information, not even considering that there must have been a sizeable amount of time available as part of preparing and lodging the application. Instead, Mr Cudmore has had to rely on a combination of modelled data and monitoring studies around other quarries to support his assessment, which by its very nature is subject to a greater level of uncertainty, when compared with actual site-specific information.

¹ A location that may be affected by dust emissions. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust.

- 19 In terms of meteorology, Mr Cudmore has relied on synthetic data derived from CALMET, in combination with other meteorological data sources, I consider there is a degree of uncertainty relying on this information, something that could have been mitigated with the use of site-specific data.
- 20 Given this uncertainty, I have limited confidence that the data can be relied on for the purposes of establishing the frequency and duration that off-site receptors could be affected by adverse dust nuisance and health effects from quarry operations, particularly given some of the issues that I have noted in the way the information has been used.
- 21 Mr Cudmore has used a variety of methods to understand the air quality effects from the proposal, however fundamentally we have to rely on the proposition that the quarry will implement, what I consider 'above and beyond' industry best practice dust mitigation measures and that these be effectively and rigorously undertaken at all times, something that the existing quarry has clearly not been able to manage, based on recent complaint information, various submissions and the photographs and videos that I have observed of dust being generated by the site.
- 22 In my view it is not practicable to mitigate dust effects from the proposed expansion to a less than minor effect without a sufficient buffer around the proposed operational areas, as despite the best endeavours from the applicant, there will always be periods of time where the effective use of mitigation measures will lapse or be insufficient. By way of example, it is likely to be impractical to manage dust discharges outside operational hours during extremely dry and windy periods, not to mention times where through human error or the breakdown of equipment, mitigation isn't implemented as required.
- 23 For this reason, I have recommended that there should be at least a 150 m buffer between sensitive receptors and dust generating activities, along with additional mitigation measures and consent conditions, if the proposal is to be granted consent. Even with these measures in place I am not certain that there will be no more than minor effects on the adjacent landowners. My justification for these additional controls is set out in my evidence further below.

Review of Submissions and other supporting evidence of dust effects

- 24 As part of reviewing the three submissions, I have reproduced the map that was appended to the AOL submission, which shows the various dwellings, consented building platforms and sensitive crops. In addition to identifying these various locations, I have also added other relevant pieces of information, such as site boundary locations, areas where the quarry has

encroached on HLFT property² and the location of a proposed seasonal worker's camp for the HILF orchard. In my view this figure provides a more complete picture of the specific locations on the submitters property that people are likely to reside, than when compared to the figure provided in Attachment F, Figure 1 of Mr Cudmore's evidence. I have appended this map to my evidence in **Appendix A**, as **Figure 1**.

- 25 The submissions made by HLFT, AOL and Clark cite a variety of concerns regarding air discharges. These include:
- i. potential health effects from PM₁₀ and RCS.
 - ii. dust depositing on cherry tree rain covers and sprinklers.
 - iii. nuisance effects on the Clark dwellings (house and sleepout) from excavation activities and exposed areas associated with the expansion block.
 - iv. reductions in photosynthesis from deposits on leaves and soiled fabric and the potential impact on tree health and crop yields.
 - v. Dust deposition on flowers affecting pollination and a reduction in the effectiveness of pest and disease sprays.
 - vi. Effect on dust on grazing livestock.
- 26 The submitters are concerned that given they are already experiencing air quality impacts from the quarry, the proposed expansion will only exacerbate these effects as the intensity of onsite activities increases and extraction areas move closer to their properties.
- 27 One of their most pressing concerns is the potential for health effects on the occupants of the dwellings which are essentially on the boundary of the site, including the Clark residence and associated sleep out, consented building platforms and seasonal workers camps. They have asked me

² I understand that CCCL has accidentally quarried approximately 35 m into the HLFT property along a section of the southern site boundary. To date the applicant has not come to an agreement with the affected party to satisfactorily compensate and rehabilitate this area and return it to HLFT. HLFT has advised that significant dust nuisance is observed from this area.

specifically about exposure to RCS and PM₁₀, noting that there is no known defined safe limit³ for these contaminants.

- 28 Their secondary concern is the potential loss of income from the soiling of the cherry orchards and associated infrastructure with dust and general dust nuisance effects.
- 29 To help me understand the level of effect from existing quarry operations, the submitters have provided me with a number of photographs showing what appears to be visible dust discharges originating from the quarry at various time throughout the year. In addition to these photos, AOL and Clark have provided me with short videos showing visible dust discharges, which also appear to originate from quarry operational areas. I have attached a number of these images and videos to my evidence in **Appendix B, C and D**.
- 30 For each image/video, I have attempted to identify the location that it was taken and the direction the camera was pointing (refer to the lower right-hand corner of the image). I have subsequently confirmed this information with the respective submitters. I have also noted in my summary below, the wind direction and wind speed recorded by the Cromwell automatic weather station (AWS) at the time the image/recording was taken.
- 31 As I do not have access to the Fulton Hogan Parkburn station data, I have had to rely on the Cromwell AWS wind data and while I do not consider it appropriate to rely on this data for the purposes of undertaking an assessment of the likely air quality effects for the site / the proposal, it is likely to provide a general indication of the wind direction and speed at the time of the dust event.

A summary of my observations for each figure is provide below:

- i. **Appendix B, Figure 1:** Photograph taken on 18 March 2020 at 15:20, showing visible dust being generated by a source in the vicinity of the quarry. The wind direction was from the north and the windspeed was high at 8 m/s.
- ii. **Appendix B, Figure 2:** Photograph taken on 31 August 2020 at approximately 16:00. The photograph shows visible dust being generated from the general direction of the southwestern corner of

³ World Health Organisation, Review of evidence on health aspects of air pollution – REVIHAAP Project. Technical Report. Copenhagen: WHO Regional Office for Europe, 2013

the existing quarry. The wind direction was from the north and the wind speed recorded by the Cromwell AWS was low at 3 m/s. However, based on the movement of the trees in the accompanying video the windspeed looks to be well above 10 m/s.

- iii. **Appendix B, Figure 3:** Screenshot from a video showing visible dust originating from the direction of the quarry, with the video taken at the same time as the photograph in Figure 2 (31 August 2020 at 16:00). Wind direction and speed noted above. The accompanying video of this incident is provided in Appendix C.
 - iv. **Appendix B, Figure 4:** Screenshot from video taken from the Clark property (Video appended to Ms Clark's evidence – Appendix C) showing visible dust being generated by a source within the quarry. The video was taken on 27 November 2020 at 16:00. The video was taken from the Clark property facing southwest. The wind direction was from the south and the windspeed was ~ 9 m/s.
 - v. **Appendix B, Figure 5:** Screenshot from video taken from the Clark property (Video appended to Ms Clark's evidence – Appendix E), showing visible dust being generated by a source within the quarry. The video was taken on 4 April 2021 at 08:11. The video was taken from the road between the storage business and quarry, facing south. The wind direction was from the south and the windspeed was high >7 m/s.
 - vi. **Appendix B, Figure 6:** Image taken from the HLFT property on 05 May 2021 at 15:16, showing dust discharge from material excavation. The wind direction was from the north and the windspeed was reported to be low at 1 m/s. However, based on the movement of the trees in the video the windspeed looks to be well above 10 m/s. The accompanying video of this incident is provided in Appendix D.
 - vii. **Appendix B, Figure 7:** Screenshot from video taken on the edge of the quarry, showing visible dust being generated by a quarry stockpile. The video was taken on 5 June 2021 at 13:47. The wind direction was from the northeast and the windspeed was high >7 m/s.
- 32 While it is difficult to categorically ascertain that the quarry is the source of dust in the various Figures, it appears unlikely that it could originate from a location further to the north, in the case of Figures 1,2,3, 6 and 7 and to the south in Figures 4 and 5.
- 33 For each of these incidents I consider that some of the background sources identified by Mr Cudmore such as the cycle trail, road and riverbed are

unlikely to be the source of dust, given the location that the dust appears to originate, and the amount of dust being generated.

34 I find this information useful to the extent that it provides information on the level of effect from the quarry (which is significantly smaller in scale when compare with the proposed application) using current dust mitigation measures.

35 Clearly the level of dust seen in these videos would be considered in breach of the following resource consent conditions, depending on the exact source of the dust discharge:

Resource Consent 94384, condition 2: "That the consent holder shall undertake dust suppression on all unpaved roads and traffic movement areas to mitigate the effect dust nuisance arising from such areas."

Resource Consent 150052, condition 5: "All material to be crushed shall be thoroughly dampened immediately prior to the crushing process."

Resource Consent 150052, condition 6:" The consent holder shall be responsible for adopting the best practicable means of preventing any dust nuisance to neighbouring occupiers."

36 In my opinion, the current level of dust control is inadequate and based on the evidence I have observed, has the potential to cause adverse effects. Consequently, the continued operation of the quarry and any expansion into the proposed extraction area will require a large "step change" in terms of the type and application of any additional measures.

37 A common theme in these visual records is that they occurred at various times during that day and the year, with a number of these occurring during the winter period, a time that Mr Cudmore considers is likely to represent a lower risk of causing dust discharges.

Evidence of Mr Cudmore

38 I have read Mr Cudmore's brief of evidence and consider that the mitigation measures he has proposed will greatly reduce the intensity and frequency of dust discharges associated with the existing quarry and the proposed expansion, particularly when compared to current levels. However, there are several areas where I disagree with his assessment and the mitigation measures proposed.

39 In the interest of being concise, I have not commented on the areas of agreement, instead focussing only on the areas where I disagree.

Sensitive Receptors

- 40 Attachment F of Mr Cudmore's evidence has identified most of the sensitive receptors located on the submitters' properties. However, I note the following amendments:
- i. R13 is a contractor's base not a seasonal workers camp.
 - ii. A seasonal workers camp to provide for the AOL orchard will be established approximately 70 m to the northeast of R6, within 25 m of the western boundary.
 - iii. HLFT also plan to establish a seasonal workers camp for their orchard, which is likely to be located approximately 100 m to the south of the encroachment area.
 - iv. The building approximately 40 m to the south of the Clark residence is a large garage which includes a sleepout where Ms Clark's son resides.
 - v. A future Cherry orchard is intended to be established to the east of the Clark residence, which is likely to occupy an area of up to 4 Ha.
- 41 All of these receptors are shown in **Appendix A, Figure 1** of my evidence.
- 42 I would also like to point out that the storage shed to the south of the Clark property is accessed frequently by members of the public, with some customers spending large periods of time (up to five hours) working on, or servicing their equipment, such as classic cars and boats etc. It would not be uncommon to have a number of people at this location at various points during the day. Additionally, during these periods the shed doors, which open to the northeast and southeast (the general direction of the proposed expansion), are frequently left open and therefore items being stored at this location are particularly susceptible to dust nuisance effects, especially during strong north easterly winds which are expected to occur frequently.
- 43 Furthermore, Ms Clark has advised me that while the storage shed is relatively modern in terms of construction and that the doors are kept closed when they are not visited by customers, a significant amount of dust has built up inside the sheds, which she considers is attributed to current quarry operations.
- 44 In my opinion, greater consideration should be given to the effects on the Clark's storage business, given its proximity to the main haul road and that it is essentially proposed to be boarded by quarry activities on three sides of the property, with very minimal setbacks.

- 45 The seasonal workers camps associated with both the AOL and HLFT orchards should in my view, also be included within the scope of Mr Cudmore's assessment, along with the sleepout associated with Ms Clark's premises. While these are not permanent residential premises, the people at these locations are permitted to be at this location and are likely to be there at certain times of the year and for large parts of the day, up to 24-hours. Consequently, I consider they should be afforded the same protections that the National Environmental Standards for Air Quality (NESAQ)⁴ provide for locations *where people are likely to be exposed, as per Section 14 (1c)* of the NESAQ.
- 46 In my view the above locations should also be considered as sensitive receptors within the scope of Mr Cudmore's assessment.

Wind

- 47 As mentioned previously, given the lack of onsite meteorological monitoring, Mr Cudmore has relied on the use of various models to simulate the wind environment at the site. Inputs to the modelling exercise included surface observations from the NIWA Cromwell AWS (~12 km from site) as well as Fulton Hogan's Parkburn Quarry AWS (~3 km from site).
- 48 As previously mentioned, I do not consider that wind observations measured at Cromwell AWS are suitably representative of the wind conditions at the site. The Cromwell AWS is located at the end of the valley and is significantly less exposed in comparison to the site. Consequently, winds measured at Cromwell AWS are likely to be lighter (slower) than what would be experienced at the site.
- 49 Winds measured at Parkburn Quarry AWS are likely to provide a much-improved representation of the wind environment at the site in comparison to Cromwell AWS. However, I am unable to express confidence that it is a sufficient representation of the wind environment as Mr Cudmore's evidence has not detailed critical information regarding the AWS, including the location on the site, the height of the anemometer, and pictures of the AWS which would demonstrate that it is appropriately sited.
- 50 I understand that Parkburn Quarry is also less exposed when compared to the Amisfield Quarry.

⁴ Resource Management (National Environmental Standards for Air Quality) Regulations 2004

- 51 Given that the applicant has not completed measurements of the wind environment at the site, and the limitations associated with the alternative data sources, I consider that modelling was required to estimate the wind environment at the site, as a means to draw reliable conclusions as to the likely effects of the proposal.
- 52 Generally, I do not consider that the modelling methodology was inappropriate. However, information was not provided which is pertinent to determining if the meteorological data were appropriate input into the models, and to understand the frequency of high wind speeds at various heights above the ground. The following information was omitted:
- i. Actual anemometer height for Parkwell Quarry AWS.
 - ii. Input anemometer height for both AWS (for TAPM modelling)
 - iii. Radius of influence assumed for assimilation of surface observations (for TAPM modelling)
 - iv. Output wind field height at the site location (from CALMET modelling)
- 53 The consequence of the above omissions is significant. If for example, the anemometer height has been inputted at 10 m above ground, when in fact the anemometer measures wind speeds at 6 m above ground, then the model would underpredict the wind speeds. This would in turn mean that the frequency of high wind speeds would be underpredicted, leading to an underprediction in the risk of impacts and the frequency at which trigger values would be exceeded.
- 54 I do not believe that the meteorological data available is reliably site representative for the purposes of completing a weather dependent risk assessment, as completed by Mr Cudmore. Furthermore, I do not believe that effective and achievable trigger levels can be developed without site specific measurement. If the Commissioner is minded to grant consent, I recommend a review condition, which would require, after the collection of 12 months of data, revisiting of the trigger levels and the management measures which are associated with those trigger levels.
- 55 Having acted for various applicants on similar proposals, I don't believe this review requirement to be especially onerous and consider it to be in general accordance with common practice as part of the consenting process.
- 56 Regardless of the above, I consider that the CALMET model output for the year 2020, on page 9 of Attachment D of Mr Cudmore's evidence is the best estimate available of the wind conditions. The year 2020 is likely most

representative as it incorporates a full year of data from the Parkwell Quarry AWS. I have assumed moving forward that the anemometer heights were appropriate input into the models and the wind field was extracted at 10 m above ground.

Rainfall and wet days

57 Similar to Mr Cudmore I have undertaken my own analysis of the Cromwell EWS rainfall data, by comparing it with numerous Harvest Electronics rain gauges owned by various landowners around the quarry. This analysis is presented in Table 1 and shows the monthly rainfall and number of ‘wet days’. With ‘wet days’ being defined as days where there was at least 1 mm of rainfall, consistent with definition that the National Institute of Water and Atmospheric Research (NIWA) and the Bureau of Meteorology (BoM) use. This definition is not to be confused with Mr Cudmore’s definition of ‘wet days’ provided in Attachment E of his evidence, with this being based on net rainfall, as follows

“Net rainfall was estimated by considering the difference in observed rainfall and evaporation on any given day. All days when net rainfall was observed to be above -1 mm were classified as wet days.”

Table 1: Comparison of Cromwell rain gauge data with local stations

Year	Annual Rainfall (mm)					
	Cromwell	Amisfield	Golden Cow	Parkburn	Parkburn Lakeside	Pisa Range
2010	472	476	No Data			
2011	415	531				
2012	455	536				
2013	490	647				
2014	331	594				
2015	300	319				
2016	348	381				
2017	278	442	337	No data	308	463
2018	544	602	640	664	560	638
2019	417	465	650	533	606	628
2020	641	368	583	446	367	543

58 Based on my findings, I agree with Mr Cudmore’s conclusion at Paragraph 7.9, which essentially states that it is appropriate to use the Cromwell rain data for the analysis rainfall at the Site. However, one aspect of the data that hasn’t been mentioned is the large variability in annual rainfall, with Cromwell measuring between 278 mm and 641 mm and Amisfield measuring between 319 mm and 647 mm over the past 11 years.

- 59 The period of time that Mr Cudmore has analysed in more detail as part of his dust assessment only includes the last three years of data, where the rainfall ranged between 417 mm and 641 mm at Cromwell. Consequently, there can be other periods of time where annual rainfall can be significantly lower, and consequently where the degree of natural mitigation of dust impacts would be reduced.
- 60 As part of my review, I have reproduced Figure 2 included in attachment E of Mr Cudmore's evidence (Total number of 'wet days' per month over 11 years as a tile plot), using the Cromwell EWS data that I downloaded from the National Institute of Water and Atmospheric Research (NIWA) CliFlo database. This is attached to my Evidence in **Appendix E, Figure 1** and I have included Mr Cudmore Figure below my figure for comparison purposes in **Figure 2**.
- 61 Based on even a cursory view of the information, there is little similarity between the two Figures, particularly for the number of 'wet days' during winter months. This is due to the difference in the method used to calculate 'wet days', whereby as evaporation rates observed during the winter months are low, Mr Cudmore's method essentially considers all winter days as 'wet days'.
- 62 This is all the more obvious when looking at the data contained in a climate weather report⁵ prepared by NIWA in 2015, which includes a helpful table on 'wet days' that includes data for Cromwell (defined as days where rainfall was at least 1 mm). This data has been reproduced below in Table 2, along with my calculations of 'wet days', in addition to the values that I have calculated from Mr Cudmore's "wet day" figure in attachment F. Noting that the NIWA report covered the period 1981-2010, whereas Mr Cudmore and I have reviewed the more recent period 2010 to 2020.

⁵ National Institute of Water and Atmospheric Research, The Climate and Weather of Otago, 2nd edition, 2015.

Table 2: Average monthly ‘wet days’ (from NIWA climate weather report, 2015)

Months of the Year (‘wet days’)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
NIWA Report	6	5	6	6	6	7	5	5	5	7	5	7	70
My calculation of ‘wet days’	5	4	5	5	7	4	5	5	6	5	5	5	62
Mr Cudmore’s calculation of ‘wet days’	3	3	4	7	24	28	29	17	5	4	3	3	130

- 63 The NIWA data shows that the average monthly number of ‘wet days’ is no more than 7 with an average of 70 ‘wet days’ per year, which again generally aligns with the data I have presented which provides equivalent values of 7 and 62 for Cromwell. The lower number of ‘wet days’ I have calculated is potentially due to climate being drier in the more recent period of data reviewed. The data provided by Mr Cudmore clearly shows the influence of including days in winter where evaporation rates were less than 1 mm as ‘wet days’.
- 64 While I understand the method used by Mr Cudmore, that being there is a lower potential for the material to dry out on days with low evaporation, I consider the term to be misleading and that another term may have been a better choice.
- 65 Furthermore, while the low evaporation rate during winter will assist with controlling dust to a certain extent, the relationship between evaporation rate is not binary, and risk does not become zero where evaporation is <1 mm. There are a range of other mechanisms that influence the moisture content of the material, and subsequent dust generation risk, including:
- i. the movement of vehicles across haul roads/quarry floor will increase the evaporation rate as the tyres warm up the roading material.
 - ii. Stockpiles are also more exposed to the elements and will therefore experience a higher evaporation rate.

- iii. The length of the proceeding period with no rainfall and associated evaporation.
- iv. Moisture content of the dust generating material.
- v. The mechanical agitation of quarry material will break up the surface layer exposing areas which may remain dry regardless of rain or evaporation rates on the day of the activity.

Dry windy days

- 66 The application of the term “dry windy” days has been used to help understand the frequency of periods where dust generation can occur. Mr Cudmore has defined the term in attachment G of his evidence, with a “dry day” being defined as:

“Net rainfall was estimated by considering the difference in observed rainfall and evaporation on any given day. Any day when net rainfall is less than 0 is classified as dry day and all days with net rainfall greater than 0 were classified as wet day. And Windy periods essentially being defined as winds above 6 m/s.”

- 67 Based on the definition that has been used, if there was no rain on that day, the net rainfall is either zero, or less than zero depending on the evaporation rate and would therefore count as a dry day.

- 68 As shown in Table 2 and **Appendix E, Figure 1**, the average number of ‘wet days’, as per my definition is between 5 and 7 for winter months, notwithstanding any days where the rainfall could be between 0 and 1 mm, I am surprised to see that there are a very small number of dry windy periods during winter months blowing in the direction of any of the receptors identifies in in Attachment G of Mr Cudmore’s evidence.

- 69 I discussed this aspect with Mr Cudmore on the telephone and he sent me an email clarifying/correcting a mistake in his definition (see **Appendix F**) as follows:

*“For any day when (**Rainfall mm/day - Daily Penman ET mm/day**) is > 1 mm, then it is defined as a **Wet day**, and everything else was Dry Day.”*

*“Or else, for any day of no rain fall (0 mm) and when ET is > 1 mm, is defined as a **dry day**.”*

- 70 I also consider this definition to be confusing. By way of example, “if there is 0.5 mm of rainfall for the day and the evaporation rate is 0.5 mm it is

considered a dry day, however if there is a day with **no rainfall** and the evaporation rate is less than 1mm it is considered a “wet day”.

- 71 Mr Cudmore has not provided any justification or evidential basis for the use of this approach to calculating ‘dry days’ and subsequently ‘dry windy days’. I note that the USEPA AP42 emission factors (Section 13.2.2 Unpaved Roads) that Mr Cudmore has used for his modelling of haul road emissions, allow for adjustment to account for days with measurable rainfall, defined as being more than 0.254 mm (or 0.1 inches).
- 72 Based on this definition, I have calculated the number of ‘wet days’ using the Cromwell EWS data and have presented this as a tile plot in **Appendix E, Figure 3**. Using this criterion, the average monthly number of ‘wet days’ is no more than 10, with an average of 82 ‘wet days’ per year. I consider that these values are sufficiently close to the number of ‘wet days’ using the NIWA/BoM method, which were 7 and 62 respectively, that either method could be considered appropriate.
- 73 In my opinion the definition of a ‘dry day’ should include days where no rainfall occurs, irrespective if evaporation rates are low on that day for the reasons provide above.
- 74 I therefore I disagree with Mr Cudmore’s statement provided at paragraph 7.12 “... *I expect that ground conditions (when above the water table) at the quarry site will be relatively wet during the months of May, June and July and probably do not start to dry out (if much at all) until September*”.
- 75 In my opinion the winter period does not offer an increased frequency of days where rainfall can be expected to occur (i.e., ‘wet days’) and while evaporation rates may be lower, I don’t consider this to be a reason to dismiss the risk associated with this period, particularly as ongoing dust control issues are observed from the existing quarry during this period of the year. A good example of this is shown in the video provided in **Appendix D, Figure 5** taken on 5 May 2021, where material is being excavated/placed and generating significant dust emissions.
- 76 As I do not have access to the model outputs from Mr Cudmore’s CALMET model, I am therefore unable to reproduce Table 1 of his evidence, using a more realistic interpretation of the rainfall data, nor am I able to follow the same method as Mr Cudmore to calculate the frequency of dry windy periods based on a different definition.
- 77 Instead, I have simply calculated the periods of time that receptors are downwind during winds above 5 m/s (the windspeed where dust pickup

starts to occur as recommended in MfE GPG Dust⁶), based on approximate values from the CALMET windrose provided in Figure 3, Attachment D and the purple 'active' areas identified in Figure 1, Attachment F of Mr Cudmore's evidence. The results of my analysis are presented in Table 3.

Table 3: Frequency that receptors could be downwind of quarry activities during high risk winds

Receptors	Direction of wind when receptor was downwind of "active areas"	Periods of time receptor is downwind of quarry activity where wind speed is >5 m/s	
		Frequency (%)	Hours per year
R1	W, WNW,WSW,NE,ENE, E	12.9	1,129
R2	SSE, S,SSW,SW,WSW,W	14.3	1,252
R3	WSW, W, SW	6.0	527
R4	W, WNW	0.3	25
R5	W, WNW,NW,NNW	0.3	28
R6	W, WNW,NW,NNW	0.3	28
R7	W, WNW, NW, NNW	0.3	28
R8	WNW, NW, NNW	0.1	6
R9	WNW, NW, NNW, N,NNE	3.0	259
R10	E, ESE, SE,SSE	3.2	284
R11	ENE, E, ESE, SE,SSE, S, SSW	13.3	1,167
R12	ESE, SE, SW, WSW, W, WNW	6.4	561
R13	WNW, NW, NNW, N	0.4	38
R14	NW,NNW, N, NNE, NE	8.7	760
R15	ESE, SE, SSE, S	3.6	315
R16	E, ESE, SE	2.5	221
R17	NNE,NE, ENE, E, ESE	13.1	1,151
R18	NNW, N, NNE, NE,ENE	11.2	981
R19	WNW, NW, NNW, NE,ENE	8.4	732

78 The calculated frequencies that receptors could be at risk of experiencing effects from dust emissions is significantly higher than suggested by Mr Cudmore.

79 I note that the high risk periods in Table 3 do not consider the 'wet' days (approximately 1 in 6 days), which would reduce the frequencies as outlined

⁶ Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016.

above. This exercise was not possible without the meteorological data as discussed above.

- 80 In my opinion, the information provided in Table 3 provides for a more appropriate starting point in which to assess the frequency that receptors are at greatest risk of experiencing dust related effects. Particularly given that there is significant variability in annual rainfall and therefore the number of 'wet days' (using my definition of 1 mm), with the data suggesting this can be as low as 7 days for the entire three-month winter period (June to August), based on the 2020 data set.
- 81 The frequency analysis provided in Table 3 suggests that Ms Clark's storage business, HFLT seasonal workers accommodation and the HLFT orchard could be downwind of active areas during high-risk periods for a considerable period of time. These high risk periods of time are as follows:
- i. Clark's storage business = 14.3 % (1,129 hours per year)
 - ii. HFLT seasonal workers accommodation (inferred from R18) = 11.2 % (981 hours per year)
 - iii. HLFT Orchard between 8.4 % and 11.2% (732 and 981 hours per year), with this likely being an underestimate as the orchard covers a large area as the only wind directions it is not downwind are from the west northwest to the east northeast.
- 82 Consequently, I consider that Mr Cudmore's assessment has underestimated the potential for dust effects from both the existing quarry and proposed expansion area.

Sensitivity of Receptors to Quarry Dust Impacts

- 83 As I have previously mentioned, there are additional receptors that I consider having a high sensitivity to dust that have not been included in Mr Cudmore's assessment, I therefore consider the assessment to be deficient in this regard.

Potential Ambient Dust Effects of the Proposal

- 84 In paragraph 8.8 of Mr Cudmore evidence, he has stated that the World Health Organisation (WHO) is currently considering a reduction in the PM_{2.5} criteria. I can confirm that WHO have provided an update of its global air quality guidelines in September 2021, with the values for PM_{2.5} being significantly reduced from 25 µg/m³ to 15 µg/m³ as a 24-hour average and 10 µg/m³ to 5 µg/m³ as an annual average.

- 85 While these values are yet to be reviewed by the Ministry for the Environment and adopted as national assessment criteria, it is further evidence that there is no safe level of exposure to PM_{2.5} and therefore every practicable measure should be undertaken to protect nearby residences from dust emissions of this nature.
- 86 Notwithstanding that these revised guidelines have not been formally adopted as either National Environmental Standards, or national guidelines, I consider that an assessment against these revised WHO values should also be included within the scope of Mr Cudmore's assessment to provide reassurance to the submitters that quarry activities will not cause adverse health effects. Particularly given the duration of the proposed consent and that it appears likely that these values will be adopted within this timeframe, based on historic precedence.
- 87 There is also the potential for climate change effects to exacerbate conditions within this timeframe, based on the information contained in a NIWA Climate change projections report⁷, whereby inland areas including Cromwell are projected to observe an increase in extreme wind. This may be mitigated to some extent by an increase in rainfall, however an increase wind speeds on worst-case days (high wind days) will be more difficult to manage from a dust control perspective.

Adverse Crop Effects

- 88 At paragraph 8.23 of Mr Cudmore's evidence he has suggested a dust deposition assessment criteria of 1.0 g/m²/day, based on the expert opinion of Ms Arnold in which to assess the effects on the cherry orchard,
- 89 I have discussed this guideline value with Mr Weaver, who has provided evidence for the submitters, and it is his opinion that there is insufficient information available to rely on this value.
- 90 While the specific effects on cherry trees is outside my area of expertise, given the uncertainty associated with using this guidance, I consider there to be little value utilising this value in any way, particularly given that Mr Cudmore's assessment has only provided numeric values associated with dust deposition from the unsealed haul roads and not the cumulative dust deposition associated with the quarry.

⁷ NIWA, Climate Change projections for the Otago Region, October 2019

Assessment of quarry effects with proposed mitigation

- 91 As mentioned earlier in my evidence, in my opinion the frequency of 'dry' windy conditions has been incorrectly assumed and therefore the assessment is likely to underpredict the potential effects of dust discharges on adjacent landowners.

Atmospheric dispersion modelling

- 92 Atmospheric dispersion modelling was completed by Mr Cudmore to inform his assessment of potential impacts from the proposed operation, including impacts on human health, human nuisance and impacts on crops. The technical components of the modelling methodology appear to be sound, as Mr Cudmore has selected an appropriate model and emission estimation factors for the sources included in the model.
- 93 The dispersion model included a single dust emission source only, haulage on unsealed roads of excavated material from the excavation area to the central processing plant. The dispersion modelling exercise estimated that health, nuisance and crop impacts from haulage were within the relevant criteria levels, and on this basis, Mr Cudmore suggests that the exposure of receptors and crops would not have adverse effects.
- 94 It is my interpretation that Mr Cudmore chose to model only the haulage source for the following reasons:
- i. Mr Cudmore considers that dust emissions from haulage represents the greatest risk of leading to impacts at receptor and crop locations.
 - ii. The limitations associated with modelling of other sources, such as wind erosion from stockpiles, outweigh the benefit of modelling these sources.
- 95 With regards to the former, while I agree that dust emissions from haulage can be a major contributor to potential impacts, I do not believe in this case that haulage would pose the greatest risk. I consider that there are a number of simple and effective measures for the management of dust emission from haulage, including haul road watering, control of vehicle speeds, maintenance of the unsealed surface and potentially sealing of the surface if it can't be appropriately managed.
- 96 I consequently do not agree with Mr Cudmore's focus on this source, as I have been provided with evidence which suggests that other sources on the site, including wind erosion from stockpiles and material handling, have

previously led to adverse effects and therefore have the potential to continue or increase with the additional quarrying activity proposed.

- 97 With regards to the latter, I agree that some limitations exist, but I do not agree that this is a valid reason to exclude these sources from the dispersion modelling assessment and subsequently an assessment of effects on this basis.
- 98 Mr Cudmore's assessment of human health, human nuisance and crop impacts relies heavily on the dispersion modelling exercise, through comparison of the dispersion modelling results to the relevant criteria. While Mr Cudmore prefaces these results stating they are associated with the haulage routes only, I believe that any comparison to the exposure criteria that does not consider the entirety of that exposure, is inappropriate and futile.
- 99 An example of this type of conclusion is set out at Paragraph 10.21 of Mr Cudmore's evidence as follows (my emphasis added in **bold**).

*"In summary, the potential for health effects due to respirable particulate which could be generated from **uncontrolled haul road dust emissions** (due to truck movements) would most likely be minor at the nearest four residential dwellings. With the implementation of proposed measures to minimise haul road dust, I consider that the potential for **health effects at these dwellings is likely to be well within guidelines** and less than minor. For houses further afield, the potential for health effects would be lower again."*

- 100 The first part of the paragraph states that the potential for health effects due to respirable particulate from uncontrolled haul road dust emissions to be minor at the nearest residences. However, the final part of the paragraph strongly suggests that this also applies to a much broader assessment of effects, other than haul roads. While I don't believe this perceived inference is intentional, I consider that too much weight has been placed on the findings from the atmospheric dispersion modelling assessment of haul roads.
- 101 In my view the exposure of any receptor to air quality impacts must be determined through the sum of the background level of air pollutants as well as the exposure associated with all sources, whether from a single or multiple operations.
- 102 I agree that dispersion modelling has limitations and is not a typical assessment tool for all sources. I do not agree with Mr Cudmore's use of dispersion modelling in this application, which is a middle ground approach

which allows critical emission sources to be excluded from the assessment of exposure.

Review of proposed consent conditions/dust mitigation measures

- 103 The dust mitigation measures that Mr Cudmore has developed and incorporated within the proposed Dust Management Plan (DMP) have essentially been adopted by Council as recommended conditions of consent. Consequently, the comments I have made in this section of my evidence are likely to be applicable to both documents.

Maintenance of access roads

- 104 I approve of the regular replacement of aggregate used on main quarry accessways that Mr Cudmore has recommended, however I would like to see the DMP contain more detail on the day-to-day decision-making process which defines how the condition of the accessways will be reviewed and what will be the trigger for maintenance procedures, such as replacing/replenishing the aggregate used on the main haul road.

Maintenance of quarry floor

- 105 Mr Cudmore has recommended that inactive areas of the quarry should be covered with reject gravel to reduce the potential for fugitive dust from wheel induced emissions and wind erosion. Similar, to my comment on accessing the condition of the main accessways, I recommend that the DMP should contain information on how the condition of this material will be assessed and what triggers will be used to instigate the replenishment of gravel in these areas.
- 106 From the photos and videos that I have observed, it appears that the sandy/silty condition of the existing quarry floor has a high potential for causing dust nuisance, I am therefore curious as to why this mitigation measure has not already been implemented and whether there are any limitations with implementing this measure.

Vegetating of batters

- 107 I understand that the new bunds that will be formed around the outside of the proposed extension will be vegetated. However, no information has been provided on the length of time that this vegetation will take to become established. In the interim period, no mitigation measures have been identified in the DMP to control dust from wind erosion apart from undertaking this activity during winter months and pre-wetting material, which for the reasons I have identified previously may not mitigate the dust

potential from this source. I consequently consider that some form of mitigation should be required during this period until the vegetation has established itself and the dust potential can be reduced.

- 108 Another observation that I have made from site photographs (such as Attachment C, Figure 3-2 of Mr Cudmore's evidence), is that while the outside of the existing quarry operation bunds appears to have a reasonable amount of vegetation, the inward slopes have limited cover. I therefore consider that if this is also going to be the same for the proposed extension, how will this loose silty material be managed to prevent wind erosion.

Application of water/polymer to stockpiles

- 109 No information has been provided on the practicalities of applying water to the quarry stockpiles of sand, crusher dust and other dust generating material i.e., sprinklers or water misting system. I note that Section 4.4 the Beca Report states that this form of mitigation is currently being used on stockpiles and working areas, however I have not seen any evidence of this infrastructure being used in any of the site photos that have been provided. I therefore consider that the DMP should provide more information on what type of equipment will be used and how this dust control measure will be managed. The DMP should also provide detail on how dust will be managed during periods where the watertruck is unavailable due to breakdown or during periods of routine maintenance.

Anemometer height

- 110 At section 14.31 of Mr Cudmore's evidence he has recommended a wind speed trigger of 7 m/s as a 10-minute average, measured at a height of 6 m. I have calculated this to be equivalent of a 1-hour average trigger value of 6.3 m/s measured at a height of 10 m. This value is slightly lower than a the trigger value of 7 m/s, typically measured at a height of 10 m.
- 111 Given that this requirement is more conservative, in that it will trigger earlier, I agree with Mr Cudmore's recommended wind trigger and anemometer height.
- 112 However, looking at some of the data from of the local orchard weather stations, noting that they have a low anemometer height (2-3 m), windspeeds can rise quickly, going from relatively low speeds (1 m/s) to above the trigger value within a couple of hours. Winds can also be at moderate speeds and quickly climb above the trigger value within a very short period of time (< 1hour).

113 I consequently conclude that the site workers will need to be ready to respond to wind trigger events promptly. Their ability to do this will depend on a variety of factors, such as the size of working areas that require additional mitigation and the availability of resources to deploy these measures.

Dust Monitoring

114 Mr Cudmore has suggested a PM₁₀ trigger value of 150 µg/m³ as a one-hour average to provide feedback to quarry operators on the effectiveness of mitigation measures. While I am supportive of the use of monitoring to inform onsite operations, I am unsure that the value of 150 µg/m³ (1-hour average) will provide the necessary protection to cover the effects of nuisance dust. Having reviewed various ambient PM₁₀ data during my career, I consider it to not be uncommon for ambient concentrations to either hover under 150 µg/m³ for a significant portion of the day, resulting in an exceedance, or exceed the 150 µg/m³ for a few hours and then have the concentration stay at a sufficiently high value to cause an exceedance.

115 For the above reason I recommend a value of 65 µg/m³, as a 1-hour average, to be used as a trigger for investigation and implementing additional dust mitigation, with the value of 150 µg/m³ instead being used as a trigger to stop work and mitigate the cause of the exceedance. This value (65 µg/m³) is consistent with recommendations made by other air quality experts in relation to PM₁₀ discharges from diffuse sources.

116 In paragraph 14.11 of Mr Cudmore's evidence, he disagrees with the notion provided by Mr van Kekem that TSP discharges result in the most common adverse off-site effects associated with quarry effects. While I would tend to agree with Mr Cudmore, I am not certain that given the proximity of the sensitive receptors, some being less than 50 m from dust sources, that relying on PM₁₀ monitoring alone will ensure the potential for dust nuisance effects is appropriately managed, particularly given the nature of the exposed dry windy environment.

117 Given the concern and uncertainty about the effects of dust deposition on crops and the proposed proximity of quarry activities to the various cherry orchards, I consider that the proposed monitoring requirements should also include one portable beta attenuation monitor, (such as an E-BAM Plus) capable of measuring TSP, with this being available to be located on the boundary of the site downwind of quarry activities.

118 The dust modelling of the haul roads suggests that the MfE GPG Dust TSP trigger values would seldom be exceeded, with 95%ile value 1-hour 24-hour average concentrations not exceeding 74 µg/m³ and 30 µg/m³, at any

of the receptors include in his assessment. These values compare with the MfE GPG Dust trigger values for sensitive locations of 200 µg/m³ and 60 µg/m³ as 1-hour and 24-hour average values, noting that there are other sources of dust that will contribute to concentrations. I therefore consider that MfE GPG Dust TSP trigger values should be used as a starting point and refined based on a review of the data after a set period of time.

- 119 As an alternative to long-term TSP monitoring, I would support the use of only PM₁₀ monitors if the applicant could develop a clear relationship between PM₁₀ and TSP from dust generating activities, noting that this will change depending on the distance from the source and type of activity. If this monitoring can identify a suitable trigger for PM₁₀ monitoring which appropriately deals with the larger size fraction, then I would support this approach. This could be written as a condition, requiring a suitably qualified and independent air quality professional, such as Mr Cudmore to review the data and set appropriate values.
- 120 In addition to site personnel having access to the monitoring data, I consider that the information should also be made available to the adjacent landowners, as they will be able to provide CCCL with valuable feedback in terms of any nuisance effects. This will help CCCL understand the effectiveness of mitigation measures and the appropriateness of the proposed trigger values (both dust and wind).

RCS monitoring

- 121 While I accept that the risk of the sensitive receptor locations being exposed to RCS at concentrations above the assessment criteria, recommended by Mr Cudmore is low, based on monitoring data around other South Island quarries. I consider that out of an abundance of caution and to provide the submitters with a greater level of confidence that they are not being exposed to dangerous levels of RCS, that some form of appropriate monitoring is undertaken near crushing activities.
- 122 *Fixed and Mobile crushers*
- 123 Neither the proposed DMP or consent conditions provide any restrictions on the use of fixed and mobile crushers.
- 124 Based on a review of the site location figure in **Appendix A**, the fixed crusher is located within the following distances of nearby sensitive receptors (locations where people can be for significant periods of time)
- i. Clark premises (350 m)

- ii. Clark storage business (320 m)
- iii. HLFT seasonal workers camp (270 m)

- 125 These distances are smaller than is often found for other quarries, whereby I have seen consent conditions requiring this activity to be undertaken up to 500 m from sensitive receptors. The HLFT seasonal workers camp is likely to present the highest risk location, as it is only 270 m away and will be downwind of the crusher for a high proportion of time.
- 126 As previously mentioned, I have recommended that some form of RCS monitoring is undertaken around the fixed and consider this would provide suitable evidence that the current location of the fixed crusher is appropriate.
- 127 In terms of mobile crushers, given that the proposed extension is bordered by sensitive receptors on its eastern and western boundaries there is limited opportunity to locate a mobile crusher within the expansion area and provide a meaningful separation distance. The furthest distance the mobile crusher could be located from sensitive receptors is in the order of 150 m.
- 128 In my opinion the mobile crushers should be at least 150 m from sensitive receptors and the fixed crushing plant should be located as far as practicable from nearby receptors.

Afterhours dust mitigation

- 129 At Paragraph 9.15 Mr Cudmore states that *“The key approach for controlling dust emissions after hours is to ensure haul roads are not prone to dust erosion, and that only some fine chip material stockpiles and limited areas around the excavation site could require watering.”*
- 130 I consider that further information should be provided on how complaints will be responded to in the event of significant dust discharges occur during these after-hours periods, along with evidence on how quickly they can realistically be responded to.

Timing of activities

- 131 Mr Cudmore has recommended that the stripping of topsoil and overburden material occurs during winter months, as ground conditions are damp and while I agree that this period of the year has low evaporation rates, there have been a number of notable dust generation events associated with this time of year and therefore while the risk may be lower, it is not zero and consequently, I recommend further mitigation, such as undertaking this activity progressively and limiting open areas.

132 This is also a measure that has been suggested by Mr van Kekem at paragraph 34 of his evidence, where he states that “...I disagree that the full 8 ha of the extension area should be stripped all at one time. I consider that this activity should be staged and that progressive rehabilitation/surface stabilisation should occur as each stage is completed. This staged process is good practice in many quarries across NZ. Leaving a large open area will exacerbate the potential for dust emissions.”

Designated Site personnel

133 As I have alluded to early in my evidence, I consider that a very large step change will need to occur in the management of dust discharges at the site, particularly give the small buffers/setbacks that have been proposed. I am therefore concerned that the additional mitigation measures will be an overwhelming burden on existing site staff and I would therefore recommend that there is a dedicated staff member responsible for site dust mitigation. As the DMP is currently written the various responsibilities fall under the site/environmental manager and their delegate.

Separation Distances

134 In terms of national guidance on separation distances the MfE GPG Dust recommends the use of separation distances, or buffers as follows:

Separation distances (buffers) are primarily intended to manage

- *the effects of unintended or accidental discharges*
- *the adverse effects of activities that cannot always be adequately avoided, remedied or mitigated without a separation distance, even with the adoption of best practice (for example, large quarries)*
- *reverse sensitivity effects*

135 In my mind the first two bullet points are most applicable, as there will undoubtedly be times where unintended, or accidental discharges occur and even with the stringent mitigation proposed. In my opinion I am not confident that dust effects can be managed within the proposed envelope to deal with these likely eventualities.

136 While in practice the proposed dust mitigation measures have the potential to control dust emissions, I have little confidence that these measures can be maintained at the required level of intensity for all periods of time that dust generation has the potential to occur.

- 137 In my view this is clearly evident when looking at the effects from existing operations, whereby current dust controls are wide ranging and with the omission of real-time monitoring, could be considered best practice.
- 138 With limited separation distance around quarry activities there is very little, if no margin for error. Consequently, accidental gross dust discharges, even if occurring for short durations, are likely to cause significant impacts on adjacent properties, including sensitive crops. This is in addition to the fact that mitigating dust during dry windy periods will be challenging, as currently experienced.
- 139 With strict adherence to the mitigation measures proposed by the applicant along with the amendments I have suggested above, I recommend that there should be a minimum of 150 m setback between site activities and sensitive receptor locations. Noting that if a similar level of dust discharge is observed to that of the existing quarry, then the recommended separation distances are unlikely to be appropriate.
- 140 My proposed separation distance of 150 m is based on a number of factors including:
- i. ongoing frequently observed visible dust emissions from the existing quarry, that on occasions extent more than 300 m downwind of the site. These events typically occur during periods of high wind speed which are clearly difficult for the existing quarry to manage.
 - ii. The environment is both dry and windy, with very low rainfall and frequent strong winds.
 - iii. No site-specific information has been available and therefore uncertainty exists as to the frequency and duration that receptors are at risk of experiencing effects.
 - iv. Numerous sensitive receptors border the site on multiple site boundaries, for both the existing and proposed extension, with many of these receptors being essentially located on the site boundary.
 - v. Large areas of the quarry will be exposed over a long duration of time and will require constant management.
 - vi. Any lapses in mitigation and even the occasional significant dust discharge is likely to have implications on the adjacent cherry orchards, whereby the effects on the trees are uncertain.

- vii. The practicalities of implementing all of the dust mitigation measures and applying these rigorously and vigilantly over the duration of the consent.
- 141 Lastly, I note that there is no provision in any of the plans that I have reviewed for a setback distance around the existing quarry that would provide some level of protection, particularly for the HLFT property, including its proposed seasonal workers camp along with the Clark property. I am unsure why the proposed quarry expansion has setbacks whereas the existing quarry has none, apart from the obvious that there is no space to accommodate these areas.

Comment on CODC and ORC air quality evidence

Evidence of Mr Van Kekem

- 142 Based on the information that had been made to Mr Van Kekem at the time of his review, he recommended a set-back or buffer distance of 100 m between dust generating activities and receptors, stating in paragraph 64 of his evidence, *“.....I consider that acute adverse dust effects may occur when dust generating activities are occurring close (within 100 m) to off-site receptors (crops and dwellings). These acute adverse effects may occur during the period between when dust is observed (either visually or via the boundary dust monitors) and the time it takes to cease activities within the proposed 250 m setback distance. As such I consider a minimum 100 m buffer distance is appropriate.”*
- 143 I agree with Mr van Kekem that there should be an appropriate set back distance that is larger than has been proposed. However, in my opinion, given the limited information on local meteorological conditions, the dry climate, sensitivity of the surrounding environment, the long duration of consent requested, and the operation is currently unable to appropriately mitigate dust discharges, notwithstanding the improvements that will occur though Mr Cudmore’s proposed mitigation measures, I am not confident than Mr Van Kekem’s proposed 100 m buffer will be sufficient.

Evidence of Ms Ryan

- 144 Ms Ryan’s evidence shares similar concerns to those that I have raised above, regarding the effectiveness of the proposed mitigation measures and the ability of dust discharges to be appropriately controlled. In particular, Ms Ryan makes the following statement in paragraph 4.3 which I agree with, *“At best, in my view, the dust controls now recommended by Mr Cudmore may be effective if rigorously applied and maintained vigilantly,*

but I consider that there is a reasonable degree of uncertainty with the Applicant's ability to do so consistently."

Comments on the s42A reports

- 145 I agree with the overall view formed by Mr Whyte, for the reasons that I have provided above, that being the dust discharges from the proposed quarry expansion are likely to have significant adverse effects on the neighbouring properties.
- 146 I am however less confident than Mr Whyte, that the continuation of existing operations is likely to have a less than minor effect.
- 147 In my opinion, the mitigation measures proposed by Mr Cudmore are required to appropriately mitigated dust emissions from the existing quarry, along with the various amendments that I have suggested to mitigate the potential for adverse effects, in particular the potential impacts on the HLFT seasonal workers camp and the cherry orchard.
- 148 Even with the effective implementation of these measures, there is the potential for uncontrolled discharges to affect the HILF cherry trees/associated orchard infrastructure and seasonal worker's camp. The extent to which this will happen and the level of effect, is dependent on the frequency and duration of events, which cannot be determined as they are based on a combination of factors for which we have limited information, these include the coincidence of suitable winds and a lack of mitigation, or ineffective mitigation. There is also limited information on the effects of dust deposition on cherry trees.

Summary and Conclusions

- 149 Having reviewed the air quality assessment provided by Mr Cudmore there are a number of areas where I disagree with his approach and overall conclusions. The following provides a summary of the main areas of contention.
- i. No site-specific meteorological data has been obtained and therefore some of the key inputs that the assessment is based upon are uncertain.
 - ii. I disagree with the method Mr Cudmore has used to define 'wet days', with the assessment essentially excluding the potential for dust generating events to occur during winter months. My evidence demonstrates that the potential for dust nuisance is not insignificant,

given the large number of 'dry days' and ongoing observations of dust discharges occurring during winter and shoulder months.

- iii. A number of important sensitive locations associated with the submitters' properties have not been included in Mr Cudmore's assessment.
- iv. Mr Cudmore has used an atmospheric dispersion model to assess the effects of dust discharges from haul road. While I agree with his finding that if the haul road is well managed, the effects from this source are likely to be minor, the dispersion model did not include emissions from all relevant sources. Therefore, I do not believe that sufficient information has been made available to demonstrate that adverse effects from cumulative emissions will be no more than minor.
- v. No significant separation distances have been provided around the proposed expansion area and no separation distance has been provided for the existing quarry.
- vi. The distance between mobile and fixed crushing equipment and sensitive receptor locations is also well below what I would consider good practice, with the fixed crusher being 270 m from the nearest sensitive receptor location and mobile crushers placed in the proposed extension, unlikely to be sited more than 150 m from sensitive receptor locations.

150 I have identified various additional dust control measures that could be implemented to control dust measures in addition to some amendments to the measures proposed. These include:

- i. Refined procedures relating to the maintenance of access roads and quarry areas.
- ii. Additional dust control measures while bund vegetation is being established.
- iii. Additional detail on the application of water/polymer to stockpiles.
- iv. Weather station anemometer height and trigger values recommendations.
- v. Recommend amendments to the proposed dust monitoring.
- vi. RCS monitoring.

- vii. Suitable separation distances for fixed and mobile crushing equipment.
- viii. Additional detail on how afterhours dust complaints will be responded to.
- ix. Additional information on who will be responsible for dust control measures.
- x. Provision for appropriate separation distances around quarry activities.

151 I consider there will be times where nuisance dust generated from excavation areas, stockpiles and open areas associated with the expansion block, particularly during strong (>10 m/s) winds from the northeast, will be very challenging for the site to manage, given the small buffers proposed. This will almost certainly cause some level of dust nuisance effects on the Clark dwellings and storage business. Even with the mitigation measures Mr Cudmore has proposed, I have little confidence that they will avoid a more than minor adverse effect on these locations.

152 In my view, even with the effective implementation of the proposed measures, there is always the potential for uncontrolled discharges to occur, such as those experienced with the current operation of the Site. The extent to which this will happen and the level of effect that will occur, is dependent on the frequency and duration of events, which cannot be determined as they are based on a combination of factors for which we have limited information, these include the coincidence of suitable winds and a lack of mitigation, or ineffective mitigation. Consequently, I have difficulty with the notion that the proposed expansion of the quarry will avoid a more than minor adverse effect on the submitters' properties, even considering the applicant's proposed conditions and those that I have suggested.

153 Overall, I consider that the proposed buffers/separation distances are insufficient and will not provide any meaningful protection during periods where mitigation measures are not being appropriately implemented.

154 Without sufficient separation, the proposed mitigation measures would require a very high degree of effort from onsite staff and during some periods would likely lead to significant constraints on site operations. This is especially likely during when operating close to sensitive receptor locations during periods coinciding with high wind speeds and drier than average conditions.

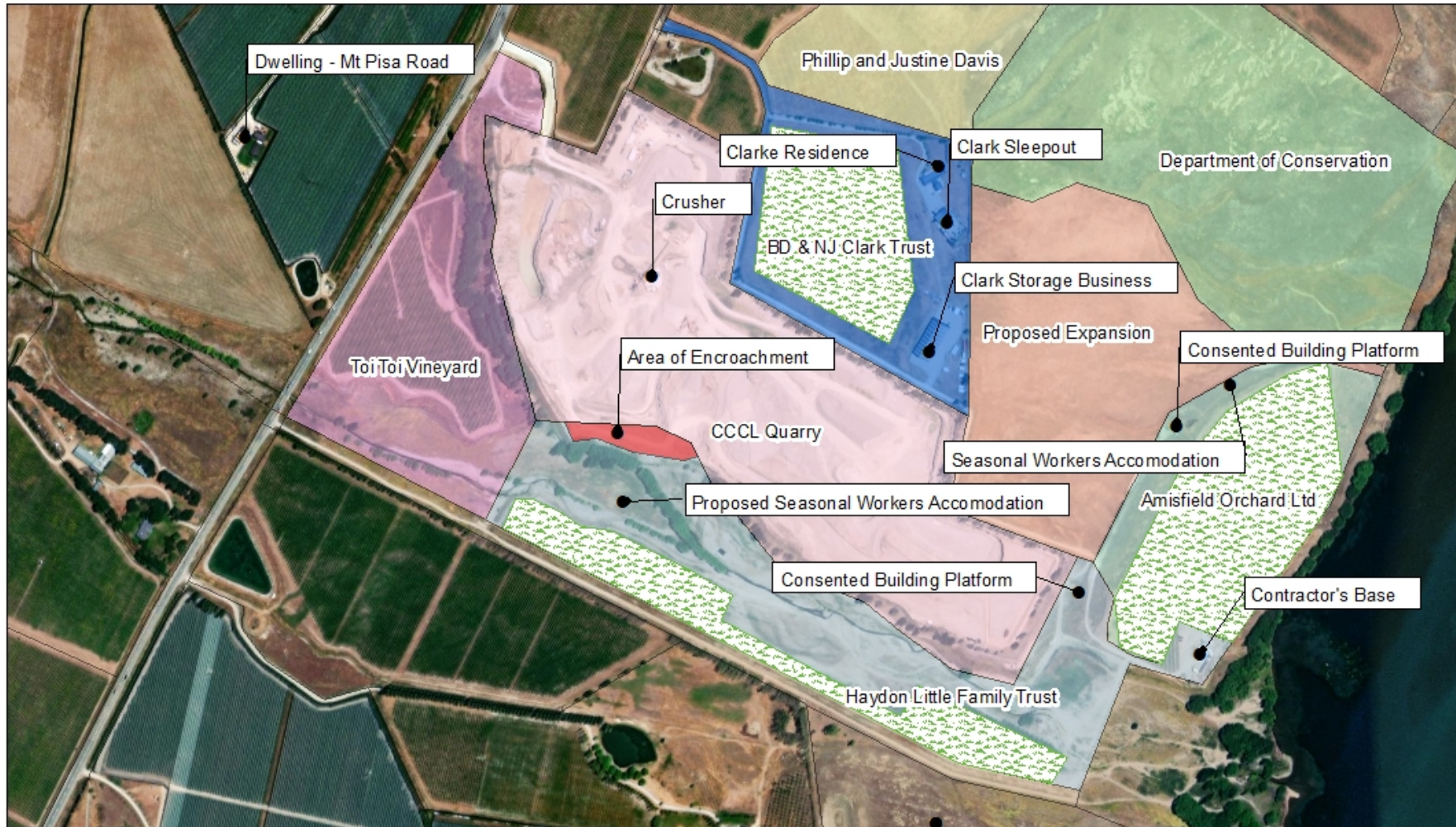
- 155 I also have concerns regarding the practicalities of implementing the significant number of dust mitigation measures, as proposed by the applicant, and applying these rigorously and vigilantly over the duration of the consent, particularly given the burden that this places on CCCL's resources, both in terms of site personnel and from an operational perspective.
- 156 In my view, the conditions proposed are more onerous than what would generally be seen for a quarry of this scale. This reflects the very close proximity of the proposal to existing sensitive receptors and the high level of dust control required to manage effects within the envelope provided.
- 157 Finally, I have seen and presented evidence which demonstrates that sensitive receptors up to several hundred meters from the operation are experiencing adverse effects from existing operations. To protect human health, amenity and the livelihoods of the submitters, I recommend that a separation distance of 150 m is established between quarrying activities and sensitive receptor locations (including crops).

Dated this 8th day of December 2021




Peter Stacey

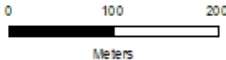
Appendix A: Site Location Map



Legend

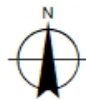
 Existing and Proposed Cherry Orchards

Paper Size: ISO A4



0 100 200
Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator



Hayden Little Family Trust
Site Location Map - Figure 1

Project No. 12552919
Revision No. 01
Date 29/11/2021

Appendix B: Submitters Photos/Video Screenshots



Figure 1: Picture taken on 18/03/2020 (looking northwest from a location on the HLFT property)



Figure 2: Picture taken on 31/08/2020 (looking west from the south-eastern corner of the quarry).



Figure 4: Screenshot from a video taken from the Clark property on the afternoon of the 27 November 2020 (camera is looking southwest)



Figure 5: Screenshot from video taken from the southern Clark property on the morning of the 4/04/2021 (camera is looking south)



Figure 6: Image taken on 05 May 2021 looking towards the west along the southern boundary of the quarry from the HLFT property



Figure 7: Picture taken on 5/06/2021 showing fugitive dust from a stockpile (looking north northwest)

Appendix C: Video of visible dust originating from the direction of the quarry with the video taken on 31 August 2020 at 16:00.

Appendix D: Video of visible dust originating from the direction of the quarry with the video taken on 5 May 2021 at 15:16.

Appendix E: Rainfall Analysis

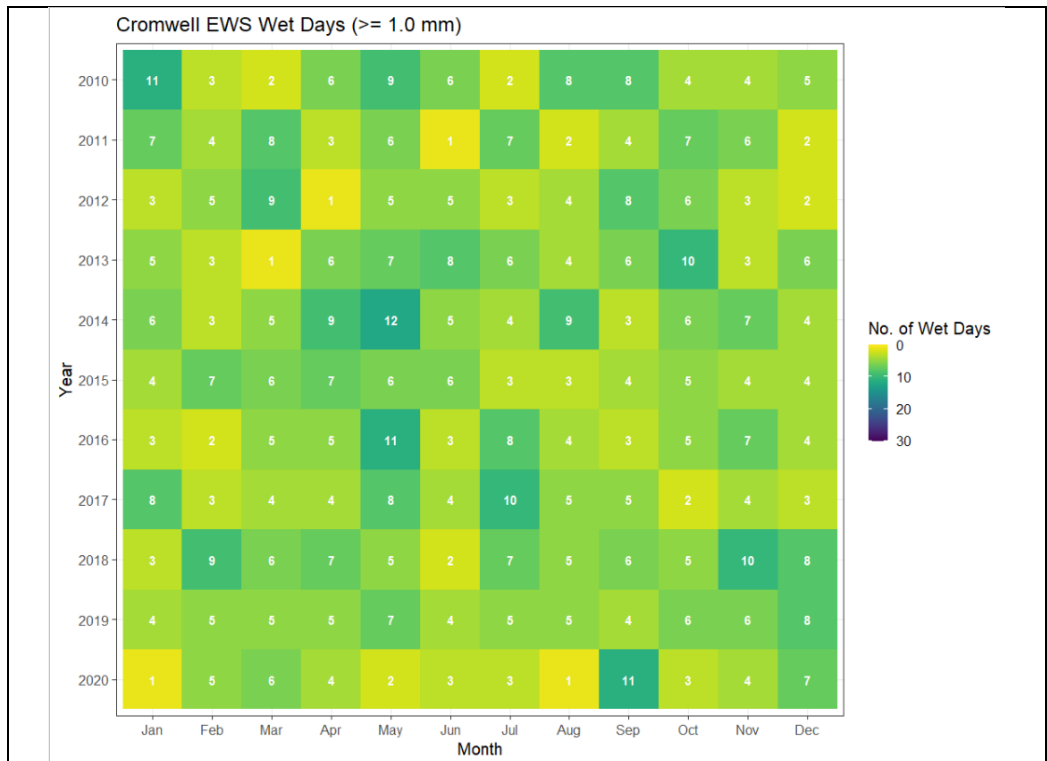


Figure 1: Wet days calculated using Cromwell EWS data

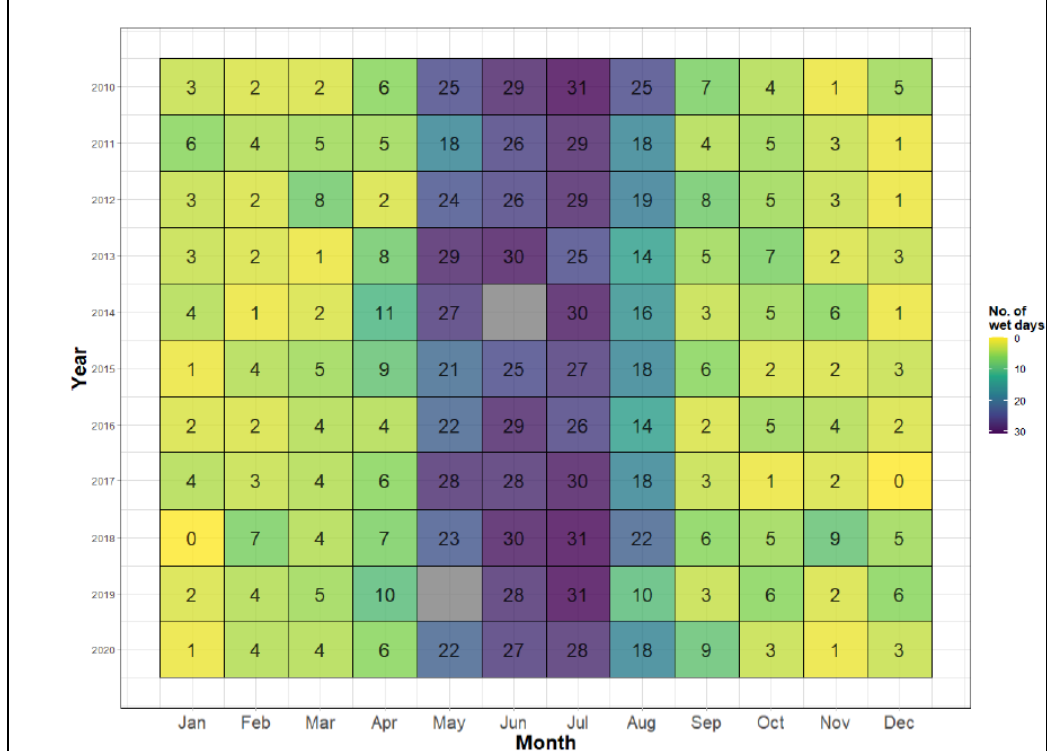
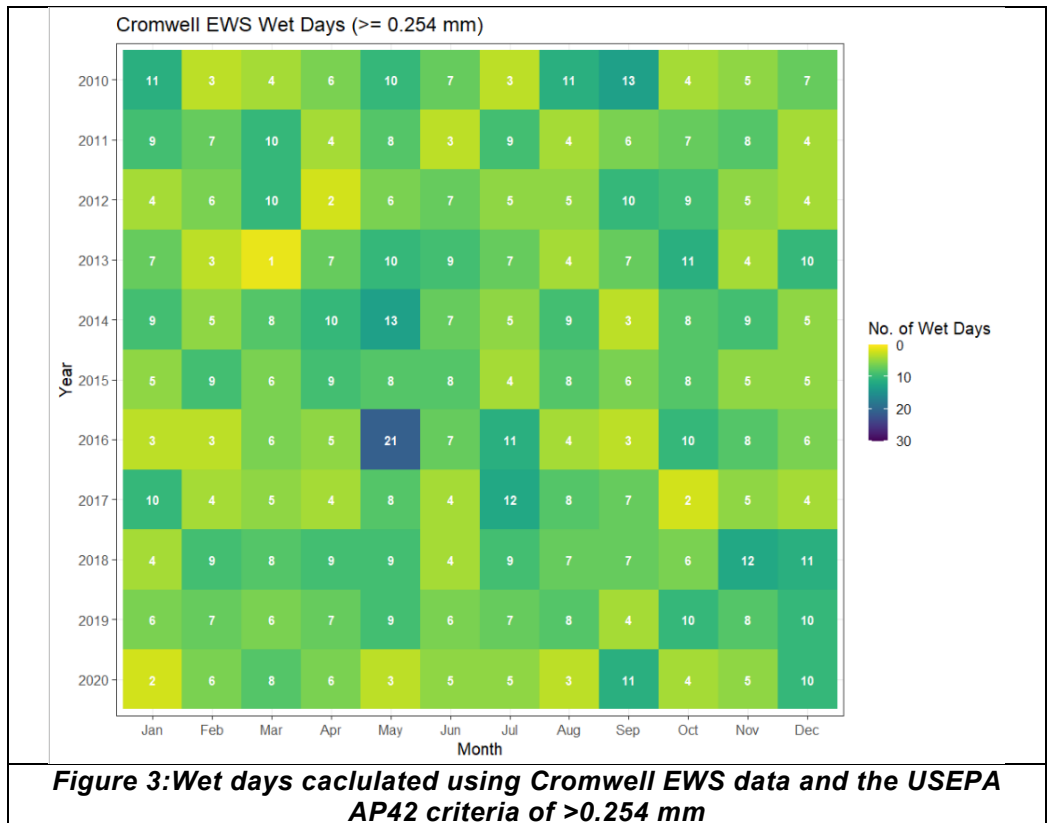


Figure 2: Wet days taken from Mr Cudmore's evidence (Attachment E)





Appendix F: Email from Mr Cudmore calaifying criteria for calculating wet and dry days



Cudmore, Roger <rcudmore@golder.co.nz>

To  Peter Stacey

 Reply  Reply All  Forward 

Fri 3/12/2021 3:36 pm

You don't often get email from rcudmore@golder.co.nz. [Learn why this is important](#)

NOTE: This email chain appears to contain email from outside Golder

Thanks Peter

I just checked that attachment E of my evidence and realised it is not worded correctly.

For any day when **(Rainfall mm/day - Daily Penman ET mm/day) is > 1 mm**, then it is defined as a **Wet day**, and everything else was Dry Day.

Or else, for any day of no rain fall (0 mm) and when ET is > 1 mm, is defined as a **dry day**

Have a good weekend.

Regards, Roger

Roger Cudmore (BE Hons - Chemical & Process)

Principal Environmental Consultant, CAQP



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