

IN THE MATTER	BEVERIDGE NORTH WEST PRECINCT STRUCTURE PLAN, SUPPLEMENTARY LEVY INFRASTRUCTURE CONTRIBUTIONS PLAN AND QUARRY PLANNING PERMIT APPLICATION ADVISORY COMMITTEE
BETWEEN	VICTORIAN PLANNING AUTHORITY
AND	YARRA VALLEY WATER
AND	OTHERS

EVIDENCE OF DR JOHN HEILIG

BACKGROUND

1. My name is Dr. John Herbert Heilig and I am the Director of Heilig & Partners Pty Ltd., a consulting engineering company based in Brisbane Australia. I hold the qualifications of Bachelor of Engineering (BE) Honours in Mining and a Doctor of Philosophy (PhD), both from the University of Queensland in Australia with the latter awarded in 1988. As a Director of Heilig & Partners, and through this company, I have provided services to the industry since 2002. For the 15 years prior to this, I was a blasting consultant for Blastronics/Australian Blasting Consultants. Appendix A contains a statement setting out my qualifications and experience, and the other matters raised by Planning Panels Victoria 'Guide to Expert Evidence'.
2. I have worked in the extractive industries for more than 35 years and have extensive domestic and international experience in the measurement, assessment and impact of blasting activities from mining, quarrying and civil construction projects. I have been associated extensively with analysis and prediction of blasting impacts at more than 1000 sites in some 20 countries throughout the world. I have consulted to mines, quarries, contractors and government agencies with a particular focus on the safe and efficient use of explosives, including the appropriateness of measures to ensure safety and amenity are maintained. I have advised various panels, committees or the court on numerous occasions about the co-existence of quarries and residential developments. I have also provided expert advice to the Victorian Independent Advisory Committee in relation to four recent tunnelling projects in Melbourne.
3. I have been asked by Norton Rose Fulbright to review the documents that are considered relevant to identifying the impacts of establishing a quarry adjacent to future land developments.
4. My opinions in this matter are based upon my assessments of impacts from other quarrying and mining operations adjacent to residential areas, my knowledge of environmental restrictions that are commonly placed upon quarrying operations, my understanding of the scale of blasting that is generally required by activities to meet these criteria and what might

be the consequences of any blasting that would be undertaken. In establishing my views, I have based these on the expected blasting that would be required to efficiently quarry a hard rock resource, such as a basalt quarry. I note that no Blast Assessment Review has been developed which I highlight significantly restricts the ability to complete a site specific detailed review and quantify the environmental impacts that might occur. Notwithstanding this, I believe from my experience in having assessed the blasting requirements at many other quarrying operations and authored numerous blasting assessments for similar green fields quarries, I have been able to prepare a series of identified issues relevant to the project. My evidence summarises my findings and recommendations from that review.

5. I confirm that I have read the Code of Conduct for expert witnesses and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions I express. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Available Information

6. It is understood that an earlier version of the Beveridge North West Precinct Structure Plan (PCP) was developed in 2020 however the outcomes did not make provision for, or contemplate, the inclusion of a quarry in the northern area where a basalt resource has been identified. Based upon further evidence and submissions before the Panel, the recommendation was that the PSP is updated to provide an opportunity for the quarry to be developed. The Panel highlighted the potential conflict between urban development and the quarrying of an extractive resource.
7. It is noted in the Incorporated Document November 2021 "Extractive Industry & Buffer Area Beveridge North West" that an application for a planning permit to carry out works associated with an extractive industry must include information relating to, amongst others, blasting activities.
8. The updated Planning Scheme Amendment documents proposed a Specific Control Overlay (SCO) which highlighted some restrictions on specifically identified land uses within both a 250 metre buffer as well as a 500 metre buffer around the proposed quarry area. The two buffers were referred to as the Extractive Industry Blast Buffer Area and the Extractive Industry Sensitive Use Buffer Area respectively.
9. The two distances are not substantiated in any further detail. Whilst it is not uncommon for a quarry that undertakes blasting activities to facilitate extraction of the resource to be conditioned with buffer distances, these are expected to be for the purposes of maintaining amenity, or a safety matter, such as to limit persons in areas where flyrock could occur.
10. Aside from mentioning the buffer in the SCO and what infrastructure and permitting may be required to facilitate any development within these buffers, no other control measures are identified.
11. It is understood that as part of the approvals process for establishing a quarry within the northern area of the PSP, an Endorsed Work Plan is required. This document has been submitted by Conundrum in 2015 and I have reviewed this plan endeavouring to better understand the planned quarrying and blasting activities. Aside from limited detail which indicates that blasting could occur between 12 noon and 5pm on Monday to Friday and will

comply with the proposed vibration and overpressure criteria in the Australian Standard AS2187.2:2006, I have been unable to understand to any specific degree the planned blasting activities.

Whilst there is no Blast Assessment Report, a dust report by Ektimo and included as part of the Endorsed Work Plan has indicated:

Drilling is conducted to lay charges for a "shot" over an area of typically 100 m by 15 m which may take up to a week and comprise approximately 133 drill holes using a hydraulic drill rig with full dust extraction equipment. Typically each shot would release approximately 24,000 tonnes of rock which is expected to amount to ~2 weeks of process for the plant during peak production stages

12. From these data, I have established that the likely blasthole diameter is 89mm with the quarry developed using 6 metre benches to deliver an annual production of around 600,000 tonnes. Plans shows RL's within the quarry that differ by 12 metre intervals which shows consistency with a 6 metre bench height.
13. A revised Work Plan was submitted in 2019 with operating parameters that differ from those identified in the 2015 Ektimo document. The revised report indicates that because of geotechnical constraints, the following quarrying scenarios would apply:
 - a) Buffers within the Work Authority boundary are at minimum 45 metres on the east and west, and 100 metres on the north and south from property boundaries
 - b) Face height for moderately weathered to fresh material of 12 metres
14. The difference between the two options would necessarily lead to an increase in impacts in terms of vibration, overpressure and the potential of flyrock over that expected from the 2015 Endorsed Work Plan. The two quarry designs differ between that which I consider typical of a small scale compared with that considered a medium scale operation.
15. On another matter I note that set of conditions for vibration and overpressure from blasting relevant to the "Work Authority" have been presented and these are consistent with Australian Standard AS2187.2:2006.

Environmental Impacts from Blasting

16. The potential effects of operations undertaking blasting fall into three categories – vibration, overpressure, and flyrock. Understandably, flyrock is always critical and must be controlled to within acceptable and safe distances although there is no quantitative criterion specified in any quarry conditions or any other standards commonly applied to blasting activities. The zone that ensures a safe area for future development around a quarry is assessed and typically governed by the scale of blasting that can occur.
17. Vibration effects will necessarily occur as a result of the blasting activities within an operating quarrying undertaking works near to properties. Blasting produces impulsive vibration which is short term persisting for generally not more than a few seconds per blast

18. Vibration, if sufficiently high, can cause superficial damage to adjacent buildings. The results of well documented blasting studies linking vibration levels and observed building damage have been published in the international journals and have subsequently been incorporated into vibration standards that are universally applied. Compliance with these limits virtually ensures blasting can be free of vibration related damage.
19. Low levels of vibration, much lower than those that can result in damage, are however readily perceived by persons and often considered annoying and impacting upon their personal amenity. People are very capable of detecting levels of vibration well less than a few percent of those values that are linked with the onset of superficial building damage. Vibration impacts from blasting are therefore assessed against personal amenity criteria with the knowledge that compliance with these limits virtually ensures no impact in terms of building integrity however the limits are not nil affects and some people invariably find vibration from blasting of any magnitude unacceptable.
20. Although permissible limits to protect personal amenity are known to vary, in general they are drawn from one of the two following guidelines/standards, including:
- a) The Australian Standard AS2187.2:2006 “Explosives-Storage, transport and use, Part 2: Use of Explosives”
 - b) The Australian and New Zealand Environment Council (ANZEC) Guidelines of September 1990 “Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration”
21. The Australian Standard AS2187.2-2006 provides a table listing recommended maximum peak particle velocities for different types of structures or more specifically based upon the activity within the structure. The standard suggests that for houses and low-rise residential buildings, a peak particle velocity of 5mm/s is appropriate for long-term blasting that persists for more than 12 months. For the same residential property, but with reduced period of blasting of less than 20 blasts or a duration of less than 12 months, the suggested level of vibration is 10mm/s.

The relevant table for vibration is as follows:

<i>Category</i>	<i>Type of blasting operations</i>	<i>Peak component particle velocity (mm/s)</i>
Sensitive site	Operations lasting longer than 12 months or more than 20 blasts	5mm/s for 95% per year, 10mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
	Operations lasting for less than 12 months or less than 20 blasts	10mm/s maximum unless agreement is reached with occupier that a higher limit may apply
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	25mm/s maximum unless agreement is reached with occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below the manufacturer's specifications or levels that can be shown to adversely effect the equipment operations

Table 1 - Ground vibration limits for human comfort chosen by some regulatory authorities (Reproduced from table J4.5(A) from the Australian Standard AS2187.2:2006

A sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people.

22. The ANZEC guidelines are amongst the most restrictive applied to extractive operations and recommend:

“A maximum level for ground vibration of 5mm/s (peak particle velocity). The level of 5mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10mm/s.”

In regard to personal amenity, the Australian Standards and the ANZEC guidelines are consistent.

23. The Australian Standard AS2187.2-2006 also provides a table listing recommended maximum overpressure levels for different types of structures or more specifically based upon the activity within the structure. The standard suggests that for houses and low rise residential buildings, an overpressure limit of 115dBL is appropriate for long-term blasting that persists for more than 12 months. For the same residential property, but with reduced period of blasting of less than 20 blasts or a duration of less than 12 months, the suggested level of overpressure is 120dBL. The relevant table for vibration is as follows:

Category	Type of blasting operations	Peak Sound Pressure Level (dBL)
Sensitive site	Operations lasting longer than 12 months or more than 20 blasts	115dBL for 95% per year, 120dBL maximum unless agreement is reached with the occupier that a higher limit may apply
	Operations lasting for less than 12 months or less than 20 blasts	120dBL maximum unless agreement is reached with occupier that a higher limit may apply
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125dBL maximum unless agreement is reached with occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below the manufacturer's specifications or levels that can be shown to adversely effect the equipment operations

Table 2 - Overpressure limits for human comfort chosen by some regulatory authorities (Reproduced from table J5.4(A) from the Australian Standard AS2187.2:2006

A sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people.

24. Vibration or overpressure criteria have been proposed in the Endorsed Work Plan to address blasting that may occur. They are consistent with these values. If levels of vibration or overpressure at the sensitive receivers exceed the values given in the above tables, it would however likely lead to an elevated level of complaint.

Blast Design

25. Blasting at any quarry will necessarily employ blast designs that comply with a set of environmental guidelines imposed on the drilling and blasting activities. The primary control measures, as are common to all quarry operations, relate to both ground vibration, expressed in mm/s, and airblast overpressure, expressed in dBL. There are no quantitative guidelines with respect to determining flyrock distances, exclusion zones, or proximity of blasting to infrastructure.
26. The distance from the blast at which different levels of ground vibration occur can be estimated for different blasting patterns. Compliance with the environmental blast criteria will

necessitate different scales of blasting as the distance to the closest property varies. Where blasting occurs at considerable distance from sensitive receiver, a larger scale of blasting can be undertaken. This larger scale of blasting may involve the use of bench heights around 12 metres and a blasthole diameter between 89mm and 102mm. The larger scale of blasting is more cost effective and best practice at nearly all quarries is to optimise either or both the bench height and blasthole diameter. There are some situations, such as unfavourable geology, water flows and so on that may require a change in these practices, although these are not common.

27. As blasting moves towards sensitive receivers, the scale of blasting is generally reduced to maintain compliance with the imposed environmental criteria. Changes to either or both of the bench height or blasthole diameter reduces the explosive weight contributing to the vibration level induced at varying locations around the quarry. The cost of implementing these changes results in an increased drill and blast cost per cubic metre of rock broken.
28. The annual production, bench heights and scale of quarrying, frequency of blasting and so on, affect the amplitude and how often at which sensitive receivers and other structures would be subjected to vibration and overpressure. No site specific information has been presented to assess the likely impacts.

Flyrock

29. Whilst vibration and overpressure exceedances from blasting may occur from time to time as a result of poor quality assurance, unexplainable geological features or varying explosive performance, the impact of the exceedances is generally negligible. The elevated levels will not impact upon the integrity of infrastructure or cause significant impact upon personal amenity, but more likely result in an increased likelihood of complaints which will necessitate management or local government interaction.
30. Practices that potentially result in instances of flyrock are however a far greater concern. Safety is the primary design element for all blasting. Whilst flyrock may occur, the consequences are generally mitigated by ensuring an appropriate exclusion zone around the blast area/quarry perimeter.
31. Flyrock for a quarry is typically considered to refer to the movement of rock beyond a zone of around 50 metres around the blast pattern. Some movement of rock inside this zone is unavoidable, with movements of tens of metres being required in order to render the broken rock amenable to excavation.
32. There are two potential sources of flyrock from blasthole patterns:
 - a) Vertical face;
 - b) Horizontal surface.
33. High velocity rock movement from the vertical face can occur if blastholes are drilled too close to the bench face, enabling the high-pressure gases to easily burst free. If the explosive column approaches to near to the collar of the blasthole, stemming ejection and rapid movement of the rock around the top of the blasthole can occur.

- 34.** The accepted procedure for establishing a safe distance from blasting is that it should be commensurate with the scale of blasting and be protective of the adjacent infrastructure, services or persons. There are occasions where I have supported a blasting exclusion zone of 50 metres, and yet on other occasions the exclusion zone has been more than 1000 metres. This is entirely consistent with guidelines presented by many of the Government Department guidelines. For some of the larger coal mines where blasting utilises large diameter blastholes with significant explosive quantities in each blastholes, some Department's preferred position is that wherever possible, blasting should have an exclusion zone of 1000 metres. Importantly, the extent of the exclusion zone is dependent upon the scale of blasting with a larger scale of blasting equated to a larger exclusion zone. No documents have been provided to allow a calculation of the buffer zone, or an assessment of the suitability of the 250 or 500 metre distances presented in the Draft Amendment C158.
- 35.** The extent of flyrock from potential blasting can be modelled using algorithms based upon accepted motion relationships between projectiles and trajectory paths. The better flyrock models also include a probabilistic component which allows a "random" component of variability to be attached to each of the parameters, thereby essentially presenting a realistic field scenario whilst also accounting for a possible worst case scenario. These flyrock models have previously been used in other hearings where I have provided expert witness statements to assist the court in assessing blast effects. Each standard scenario (i.e. blasthole diameter, explosive weight, uncharged collar length, orientation and so forth) could modelled several thousand times to account for the range of possible "*flyrock landing paths*". The absence of any specifics around the quarry or blast design prevents this and any subsequent assessment of the appropriateness of the 250 or 500 metre buffer conditions.
- 36.** Importantly, the extent of the exclusion zone is dependent upon the scale of blasting with a larger scale of blasting equates to a larger exclusion zone. A smaller exclusion necessarily requires a reduced scale of blasting with design parameters that focus on the control of flyrock. A small scale blasting will lead to an increased excavation cost and for most extractive operations is uneconomic.
- 37.** It is understood that Eastern Arterial Road to the west of the quarry that will remain the closest publicly accessible uncontrolled area. It is also noted that the intent is to quarry the reserve in phases which will lead to varying separation distances between the blasting and the nearest sensitive receiver. The initial stages of quarrying will be closest to the road reserve with subsequent blasting during the later stages of the quarry life resulting in an increased buffer as a result of the expanded internal buffer within the quarry perimeter. This may permit an increased scale of blasting over that necessary for the initial phases.
- 38.** Depending upon the blast location, there may be a requirement to reduce the exclusion zone and limit possible flyrock travel distances. This will necessitate a change to the blast design, including the uncharged collar distance (i.e. stemming) or the blast design pattern. Both changes may affect the amount of oversize produced by the blast and therefore may require additional secondary breakage by hydraulic hammers or similar mechanical methods. The airborne noise from the use of hydraulic rock breakers is commonly perceived as irritating to neighbouring residents and never considered as a regular component when establishing a quarry's schedule of work.
- 39.** There are some quarries where the exclusion zone is very large and a small reduction in this zone may equate to only a small change in the excavation cost. The 200 to 500 metre

zone represents a grey area where changes to the exclusion zone are more likely to necessitate a change to quarrying practices and an overall increase in the cost of the operation.

Blasting Impacts

40. As blasting occurs nearer to sensitive receivers and therefore around the perimeter of the extractive site, the scale of blasting is generally reduced to maintain compliance with the imposed environmental criteria. Changes to either or both of the bench height or blasthole diameter reduces the explosive weight contributing to the vibration level induced at varying locations around the quarry. The cost of implementing these changes results in an increased drill and blast cost per cubic meter of rock broken.
41. As the vibration and overpressure pulses propagate away from the blast area and towards the residential properties, the amplitudes decrease to the point that they become imperceptible/inaudible. The rate at which this occurs varies according to the geology and topography. The distance at which various blast designs comply, the distance at which vibration is imperceptible, or where complaint with varying vibration and overpressure criteria would be estimated from site specific vibration relationships.
42. In terms of assessing the impacts, I understand that no trial blasting has yet been undertaken on site. No blast design details have been provided. There is also minimal information on the quarry productivity. The key element in each of these matters is the bench height as this will ultimately determine the range of blasthole diameters, drilling patterns and uncharged collar lengths and productivity that could be used, although more importantly, the impact that the quarry may have in terms of vibration and overpressure.
43. Trial blasting is normally undertaken to provide confidence in the prediction at which varying vibration and overpressure will occur. Variability in ground conditions being blasted coupled with the degree of weathering and extent of water saturation of the material, as well as the geology of the ground condition between the blast and the sensitive receiver, affect the level of vibration and overpressure. Trial blasting involves drilling a small number of blastholes around the quarrying site, detonating a small explosive charge, and measuring the resulting level of vibration at different locations. These data can be subsequently scaled to inform the predictions. The absence of site-specific data describing how vibration attenuates from the blast area restricts an ability to assess if, or to what extent, the blasting may affect sensitive receivers.
44. Most quarrying throughout Australia typically uses explosive weights that vary between 50 and 100 kilograms per blasthole. The preferred solution is always to maximise the scale of blasting as it leads to reduced blasting costs, however as the explosive weight increases, so too does the level of vibration. Whilst the quarry operator will generally strive for minimum costs, this is accompanied by increased environmental impacts of vibration and overpressure, and a general trend of increasing complaint. The blast design information for the quarry has not been provided to establish whether the operating mantra of the quarry is towards minimum cost or minimum impact in terms of environmental disturbance.

Buffers around Quarry

45. The Incorporated Document November 2021 “Extractive Industry & Buffer Area Beveridge North West” has a purpose to identify and protect the buffer areas of any approved

Extractive Industry for the duration of the approved extractive industry use. The Extractive Industry Blast Buffer Area is noted as 250 metres from the Extractive Industry site and the Extractive Industry Sensitive Use Buffer Area is 500 metres.

- 46.** The same document prohibits certain uses prior to 2028 and after this time, it requires that a permit is required. Within the Extractive Industry Blast Buffer Area, that is within 250 metres of the Extractive Industry site, a permit is required to construct various types of infrastructure, including roads, telecommunications facility, renewable energy structures and so on. The 250 metre buffer is therefore potentially not void of infrastructure or persons. The safety of persons within this 250 metre zone could be jeopardised by possible flyrock, or, the quarry may be required to adopt and implement blasting practices that reduce flyrock to lesser distances.
- 47.** Under the above scenario, the buffer zone around an extractive resource that is necessary for safe blasting procedures associated with unexpected flyrock, is not explicitly under the control of quarry. This could result in situations where equipment in the buffer zone is damaged, or people injured because of unexpected flyrock. Whilst there are exceptions, the preferred approach is that the buffer land around the extractive resource is under the control of the quarry operator, that is, the buffer land is internal to the extractive resource boundary. This ensures the area is free of infrastructure that could be damaged, or persons harmed, at the time of blasting.
- 48.** At locations further from the Extractive Industry Blast Buffer Area, permits will be required to develop various land uses. It is therefore possible that occupied buildings that require the blasting to comply with vibration and overpressure conditions may be as close as 250 metres from the blast area.
- 49.** My experience suggests that although the Incorporated Document November 2021 “Extractive Industry & Buffer Area Beveridge North West” requires a permit for different types of infrastructure, establishing an education centre or hospital potentially as close as 250 metres from an extractive resource would be associated with an elevated risk of unacceptable consequences with respect to vibration, overpressure and flyrock.
- 50.** Experience from other quarries suggests that a 500 metre buffer is generally sufficient to ensure that ground vibration and overpressure are attenuated to acceptable levels, consistent with those presented Paragraph 46 and 47. My experience also suggests that a reduced scale of blasting, often associated with difficulties, occur when the buffer distance and separation distance to a property is less than 300 to 350 metres.
- 51.** The same document also specifies a requirement for the responsible authority to consider the compatibility of land uses within the extractive industry site, that is, the effect that vibration and overpressure from the quarry may have on adjacent developments within the Extractive Industry Sensitive Use Buffer Area, and whether any subsequent developments, approved or not, may have on the operation of the quarry.
- 52.** With respect to the risk of unacceptable amenity impacts (vibration and overpressure) or safety with respect to flyrock, my experience indicates that these are best mitigated through a combination of very good quarry management practices and appropriate buffer zones. The size of the buffer zone should be commensurate with the scale of blasting and for moderately sized quarrying operations established with bench heights in the range of 10 to 15 metres, the risks associated with blasting can be controlled with buffers in the region of 500 metres. Whilst this reasonably guarantees compliance from blasting with most

environmental criteria, it will however not eliminate some complaints concerning blasting impacts that will require attendance from both the quarry operator and local government agencies.

53. My experience suggests that complaints from blasting activities are only moderately linked to the level of vibration or overpressure, and as soon as the effect of perceptible, some persons will complain
54. It should also be noted that the overall number complaints from most quarry blasting is only likely to become negligible when the separation distance between the blast and residents exceeds 750 metres, or the vibration and overpressure are imperceptible.
55. For blasting activities where persons may be unaware of the activity, such as travelling in vehicles along roads, or children within a park, playground or educational facility, it is prudent to adopt a factor of safety to mitigate against unknown geological factors such as weakened ground, undercut faces, open discontinuities, excessive water presence and so on which could unexpectedly increase the extent of any flyrock. In addition to the factor of safety addressing these additional risks, the factor of safety should also consider the consequences associated with these risks. This would necessarily impact upon any decision to allow the construction of say an educational facility at the 250 metre boundary.
56. As an example, it is also best engineering practice to implement a higher factor of safety for blasting near sensitive receivers or other development than for blasting in a remote area where the risk of potential impact by flyrock will be less.

Response to Victoria Planning Authority

57. I note that the Victoria Planning Authority have produced a submission providing comment on the blasting impacts. I have reviewed the relevant matters of the submission that relate to my area of expertise.
58. Paragraph 7.1.2 comments on the effects from blasting and proposes that amenity would be achieved through compliance with the appropriate conditions that would be identified through the permitting stage. Based upon these conditions being consistent with those that I have identified in the early stages of my evidence, I am comfortable with this position.
59. Paragraph 7.1.5 identifies that various land uses may be accommodated within the buffer areas. It also highlights that the Eastern Arterial Road is proposed within 200 metres of the exclusion zone. I have indicated in my evidence that particular attention shall need to be applied to the blasting in those areas closest to this road reserve to ensure flyrock is controlled. A 200 metre buffer alone is insufficient to ensure that normal quarry blasting will lead to safe environment. I have also indicated that any other infrastructure within the sensitive land use buffer that could be affected by flyrock shall also need to be considered in establishing blasting impacts.
60. Paragraph 7.1.8 elaborates on the two buffers and confirms that the VPA support the development of some structures within the 250 metre blast extraction buffer and a mixture of land uses within the 500 metre amenity buffer. As indicated in the previous sections of my evidence, the blast design must recognise the proximity of any sensitive infrastructure or publicly occupied areas to ensure that the area is free from flyrock related effects.

61. Paragraph 7.1.10 addresses the Eastern Arterial Road. Paragraph 59 of my statement indicates that a 200 metre buffer alone is inadequate to allow for an unrestricted scale of blasting. Controls over the scale of blasting, or potentially the timing that the Eastern Arterial Road is developed, remain key aspects in ensuring that the road reserve remain a safe environment.

Response to Council's Draft Permit Conditions

62. I have been provided with the Draft Permit Conditions filed by the Council that would relate to blasting activities at the proposed quarry site. I have reviewed these conditions as they relate to my area of expertise.
63. Condition 6 of the Draft Conditions provides a table which indicates blasting is restricted to Monday to Friday between the hours of 12pm to 5pm. Blasting on Saturday, Sunday or public holidays is not allowed for.
64. Clarification should be provided in regard to the permissible blasting times. Section 3.3.1 of The Department of Primary Industries – Environmental Guidelines – Ground Vibration and Airblast Limits for Blasting in Miens and Quarries indicates that blasting times should only occur during the hours of 9:00am to 5pm Monday to Saturday whilst the Council conditions propose 12:00pm to 5:00pm Monday to Friday.
65. Condition 22 indicates that use of the development must at all times comply with The Department of Primary Industries – Environmental Guidelines – Ground Vibration and Airblast Limits for Blasting in Miens and Quarries. Condition 23 indicates that airblast overpressure from blasting operations must be in accordance with the values presented in Australian Standards AS2187.2.
66. The Department of Primary Industries – Environmental Guidelines – Ground Vibration and Airblast Limits for Blasting in Miens and Quarries indicates in Section 3 both ground vibration and airblast levels that are consistent with the Australian Standards AS2187.2, and as described earlier in my evidence. Whilst it would be unusual to specify permissible levels for ground vibration from one document and a permissible level for airblast overpressure from a second document when both documents propose the same values.
67. Notwithstanding my comments above, the Council's conditions for blasting indicate that suggested vibration and airblast limits that are consistent with those imposed on new quarrying operations. They are also consistent with my expectations. Although the Council's conditions are presented as a draft document, it would be expected that a subsequent version would involve a more prescriptive assessment of the blast monitoring requirements.
68. As would be expected, the Council's draft conditions specify the requirement for a Construction Management and Safety Plan prior to the commencement of any on-site activities. There is however no requirement that the plan address matters relating to how blasting activities at the site will safely managed with respect to flyrock as well as the control of other environmental aspects relating to vibration and airblast overpressure.

Summary

- 69.** The absence of any quarry specific detail regarding the scale of blasting limits an assessment of the suitability of the buffer zones or quantifying possible impact on amenity that may occur through elevated vibration or overpressure matters for sensitive receivers around the extractive resource. The assessment is therefore based upon my experience of other well managed and possibly similarly sized quarry operations, however it is very possible that these could be well removed from the practices that may occur. For the Work Plans that have been submitted, the factor of two in the scale of blasting would lead to substantially different impacts.
- 70.** Possible impact from either vibration and overpressure from medium sized quarry operations typically require some adjustment to the scale of their operations to meet the legislative conditions. Based upon my knowledge of other operations, some residents within a radius of 500 metres, and more likely 750 metres, around the quarry will perceive the vibration and overpressure impacts, and possibly lead to some complaint, albeit unlikely to be justified as a non-compliance with the applicable vibration or overpressure criteria.
- 71.** From my knowledge of the impacts from other quarries, it is expected that some residents will find the blasting disturbing and further, some may be sufficiently disturbed to regularly complain about the effects. The extent of the radius of complaints, and the frequency of these complaints, is heavily dependent upon the scale and frequency of blasting, as well the quarry operator's procedures, neither of which have been provided in the associated documents that would enable a discussion as to whether it would be better or worse than existing quarries.
- 72.** In summary, it is my professional opinion that potentially sensitive receivers or infrastructure that lie near the quarry or within a zone of approximately 300 to 400 metres from the blast zone will necessitate a change to the normal blasting practices in order to comply with the vibration and overpressure criteria, as well as ensuring a safe environment with respect to flyrock.. These adjustments may include, but not limited to, increased uncharged collar lengths, changes to the blast patterns, profiling and surveying of the blast area, smaller blasthole diameters or an increased level of quality assurance practices. These measures will reduce the size of the area where flyrock generated by the blast could land. They will however necessarily increase the cost of blasting over and above that which would be achieved with the larger scale of blasting.
- 73.** The extent of the impact on the quarry operations and costs will vary according to the proximity of the blasting to the receivers. Near the quarry or within uncontrolled areas where the public may freely enter, the blasting could present an unnecessary risk of adverse impact from flyrock and to a lesser degree impact from vibration and overpressure. For those blasting locations nearer to the quarry and within the Extractive Industry Blast Buffer Area, a restricted and more costly scale of blasting will be required. To ensure the blasting minimises the potential risk of injury from flyrock, the preferable solution is to ensure the buffer lies within the quarry boundary. This ensures the quarry operator has control over access within this zone.
- 74.** The blast design information for the quarry has not been provided to establish whether the operating mantra of the quarry is towards minimum cost or minimum impact in terms of environmental disturbance.
- 75.** I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Court.

I declare that I have no financial or other pecuniary interest in relation to Yarra Valley Water or other associated parties.



Signed: John Heilig

Date: 22nd April, 2022

APPENDIX A