c/o 6 Hensman Park Court,

Oxenford

4210

21st June 2021

For the attention:
Liam Jukes
Senior Planner – Major Assessment
City Development Branch
Council of City of Gold Coast

Dear **Liam Jukes,**

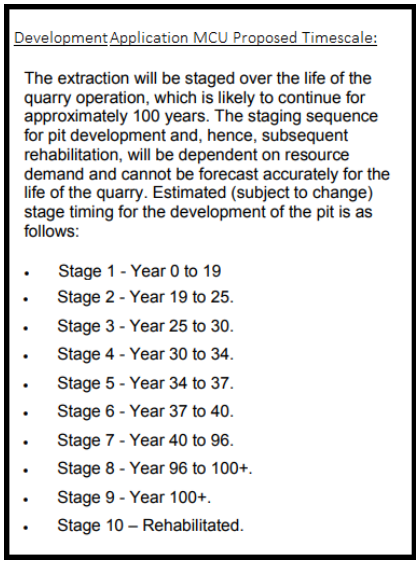
Objection submission COM/2019/81 - Flyrock safety Concerns

Further to my objection dated 17th September 2020: 'Flyrock safety precautions'. Please accept this objection as the contents of my original objection are somewhat outdated by the applicants changes submitted in February 2021. This objection highlights the rules and guidelines and safety concerns surrounding flyrock at existing quarries that appear to have been ignored in the Development Application for the Nucrush Quarry.

It is clear from Queensland blasting guidelines that the exclusion zone to protect workers from blast effects is one kilometre as stated by the employment Skills and Mining Minister Stirling Hinchcliffe: *"Existing safeguards like 1km exclusion zones are already in place during blasting operations to protect workers"* (Attachment A1).

For all blasting quarries of this nature there is an assumed separation buffer of 1000 metrs for all sensitive receptors (these being homes, businesses, people, etc.), as per DES guidelines, I assume this is why the statement above just refers to the safeguards to protect workers. The Queensland State Planning Policy identifying this requirement for blasting quarries is reproduced in Attachment A2.

Given the fact that there are hundreds of perfectly legal sensitive receptors (homes, businesses, community parks, kindergartens, restaurants, petrol station, etc.), affecting thousands of people, within the Nucrush '1 km Blast Exclusion Zone' it would seem ridiculous to even consider this Development Application. Especially considering it is additionally proposing reducing these buffers in every direction still further and it is also proposing raised levels of quarrying operation right up to approximately 80 meters above ground level. Thus, severely raising safety concerns, with flyrock projection in every conceivable direction becoming an ever increasing concern as the above ground level quarrying proceeds for the proposed next 37 years (i.e. Stage 1 to 5):



Development Application MCU Proposed Timescale:

The extraction will be staged over the life of the quarry operation, which is likely to continue for approximately 100 years. The staging sequence for pit development and, hence, subsequent rehabilitation, will be dependent on resource demand and cannot be forecast accurately for the life of the quarry. Estimated (subject to change) stage timing for the development of the pit is as follows:

- Stage 1 - Year 0 to 19
- Stage 2 - Year 19 to 25.
- Stage 3 - Year 25 to 30.
- Stage 4 - Year 30 to 34.
- Stage 5 - Year 34 to 37.
- Stage 6 - Year 37 to 40.
- Stage 7 - Year 40 to 96.
- Stage 8 - Year 96 to 100+.
- Stage 9 - Year 100+.
- Stage 10 – Rehabilitated.

This is a very real concern especially with a Council owned Pony Club a couple of hundred metres away from the extractive boundary, and starting within 150 metres of the extractive footprint (blast area), there are a large number of homes, kindergartens, play parks shops, petrol station, businesses etc. all in the 'Direct Line of Fire' for potential flyrock incidents given the above ground quarrying method proposed (up to approximately 80 metres above sea level).

The following accidents as a result of flyrock emphasize the importance of due consideration when blasting at elevated levels so close to highly sensitive receptors:

- On July 5, 1990, a blaster standing on the top of a 200-ft highwall about 505 ft from the blast site was fatally injured by flyrock [MSHA, 1990a].

- On February 1, 1992, a blaster was fatally injured in a surface coal mine [MSHA, 1992]. The blaster positioned himself under a Ford 9000, 2-1/2-ton truck while firing the shot. Flyrock travelled 750 ft and fatally injured the blaster. This accident illustrates the importance of being in a protected location or using a proper blasting shelter.

The Department of Natural Resources, Mines and Energy highlighted a case of flyrock beyond the blast-exclusion zone at well over 1000 metres from blast epicentre (See 'Attachment B1'). This highlights even the 1 km limit is not enough in some circumstances. And, obviously raises serious health and safety concerns for all local residents especially those within this 1km exclusion zone.

I believe the flyrock dangers at such close range to sensitive receptors should be very seriously considered. In fact the flyrock information sheet from the Office of Surface Mining (reproduced in 'Attachment C1') reveals: "The single factor of Surface Mining That is Most Likely To Cause A Fatality". It also says: "Fly rock can be cast thousands of feet from a blast". Therefore, it would seem highly irresponsible to subject local residents to this known danger when, through no fault of their own, they have found themselves living, perfectly legally, within a flyrock exclusion zone and also within a quarry separation buffer (which should have been maintained in order for a blasting quarry of this type to remain tenable).

Flyrock Incidents in Queensland

In the Queensland Department of Natural Resources and Mines, Explosives Inspectorate OCE Seminar (https://www.dnrm.qld.gov.au/?a=298324) it was demonstrated that flyrock incidents are relatively common and travelling anywhere up to 1230 metres (Attachment D1). This is very worrying given that the closest sensitive places' will be local residents homes within 150 metres and it would appear thousands of homes are within the area of concern for flyrock incidents. In fact this seminar reveals there where 889 explosives incidents in the Central region between 2011 and April 2015.

How can local resident's safety be guaranteed?

It is interesting to note that, according to the Explosives Inspectorate (which is responsible for safety and security in the explosives industry - attachment D2), one of the conditions for a *'Breach of Exclusion zones'* is: *"Personnel being left inside Blast Exclusion Zones"* (Attachment D3). How, can Nucrush quarry be allowed to blast when there are thousands of people within the required 1km Blast Exclusion zone? This, it would seem, is a clear breach of the Explosives Inspectorate's rules.

Smaller Charges (25kg per hole)

The Development application reveals it proposes reducing the charge size to cater for reduced separation buffers: *"blastholes may require decking to approximately halve the charge weight (45 kg) in each blasthole"* and *"At distances to residential housing closer than 330 metres on the eastern side, and 400 metres on the southern side, further reductions in charge weight to around 25 kg may be required"* (Attachment E1). However, it should be noted that in the case of *'Mansell & Neil Mansell Concrete P/L v Marrochy Shire Council & Ors'* [2007] QPEC 086, it was stated: *"Dr Heilig [expert witness on behalf of applicant] agreed (in cross examination by Mr Hughes SC) that the smaller benches and more charges (to cater for the number of residences within the 500m buffer zone) will increase the probability of flyrock"* (Attachment E2). Please note, this quarry was refused permission.

It is sad to note the development application in this case states: *"may require decking"* and *"further reductions … may be required"*. This, to me, clearly emphasises the unknown quantity of blasting at such ridiculously close proximity to residential homes (down to maybe 150 metres) and the dangers local residents will be subjected to on a regular basis. And, further emphasises, that the applicant has not invested sufficient resources into establishing what is and is not possible at such close proximities clearly to the determent of affected local residents.

Further, it should also be noted that in the case of *'Mansell & Neil Mansell Concrete P/L v Marrochy Shire Council & Ors'* [2007] QPEC 086, the judge stated: *"Dr McKenzie [expert witness on behalf of the Council] expressed significant reservations about whether, even with these very unusual measures, and given the many practical difficulties than can lead to error (particularly so given the much greater number of charges now proposed), acceptable impacts i.e. as against the standard, could be achieved throughout the life of the quarry. I share Dr McKenzie's reservations. He was a most impressive expert witness whose experience in quarry and mining operations in this country and overseas is extensive indeed. On a number of occasions he came back to the importance of buffers as a very important factor in reducing impacts from blasting on residences"* (Attachment E3).

And, in the same court case, the judge also stated: *"In relation to blasting evidence, probably most time was taken up with the issue of flyrock. This is because although flyrock incidents are rare, (Dr McKenzie told Mr Cochrane when he initially gave evidence on 25 May 07 that he was aware of eight incidents only in 20 years work) flyrock has the potential not only to cause damage to property but to*

injure and kill nearby human beings. As Dr McKenzie observes (at para 46 of Ex14): "Flyrock can generally be controlled by adoption of good practices, and meticulous care while loading explosives into blastholes, as outlined in the Heilig & Partners report. However, it is impossible to guarantee that an accident will not occur, and it is unusual to see long term projects such as a quarry operating with residents less than 300 meters from blasting faces. Unknown rock conditions are probably the greatest cause of flyrock. The best method to avoid flyrock injury and damage is to not be there – i.e., because flyrock represents a potentially life-threatening threat, a two-pronged approach is recommended, consisting of adequate buffering and meticulous control over charging. This two-pronged approach is consistent with extraction industry risk management principles." (Attachment E4).

I must emphasis: *"flyrock represents a potentially life-threatening threat"* and the two pronged approach suggested: *"consisting of adequate buffering"* and *"meticulous control over charging"* which, quote: *"is consistent with extraction industry risk management principles"* (Attachment E4). Please note both: *"adequate buffering"* and *"meticulous control over charging"* is required not one or the other! And, given the planned regularity of blasting (thought to be every two weeks in the future) it is thought that: *"meticulous control over charging"* cannot be guaranteed.

There was also disagreement in this court case as to the source of flyrock: *"[101] The experts diverged somewhat as to the source of flyrock in a blast. Dr Heilig's evidence was that the most danger comes from the face of the quarry during an explosion. Dr McKenzie says it comes from the collar of the blast which is actually on the bench"*. Given, the Council's expert witness expresses concern that flyrock comes from the collar of the blast, and is thus projected upwards, then all residents close to the blast are in danger. And, as stated: *"[102] The problem for the Mansells here is that in attempting to present a design that will reduce amenity impacts from overpressure and/or vibration by having an increased number of blastholes, this potentially increases the risk of flyrock"* and *"[103] Again the recommended and desirable 500 metre buffer around a quarry operation (which is absent here) looms large in the expert evidence"*. *"[105] The real issue in this case is the difference in opinion between the experts as to whether or not meticulous care and attention to detail throughout the life of the quarry can avoid flyrock incidents given the proximity (particularly of the two closest residents) to the blasting source. [106] Dr McKenzie has concerns that it will not and Dr Heilig believes it can be done"*. And: *"[112] In my opinion, the differences between the experts are more imagined than real when one has regard to the totality of their evidence. There is their agreed statement in Ex25 which I have set out above and, in any event, Dr Heilig properly conceded that even with the best practices and meticulous care (as he proposes here) there can be no guarantee that there can be no flyrock. The real difference between them is that he is of the opinion that with his designs the level of risk can be reduced to an acceptable level whereas Dr McKenzie disagrees because of his concerns particularly relating to the two nearest residences"* and, finally, on flyrock, the judge concluded: *"[114] I prefer Dr McKenzie's more cautious approach here because of the close proximity of the two residences on the eastern boundary. Kelly O'Shea, who is one of the closest home owners, expressed great fear about flyrock and was not comforted by the expert's conditions relating to notifying the residents of blasting"* (Attachment E5).

Flyrock in Detail

"Most of the explosive operations have a lot of energy that can have impacts on the environment and surrounding areas … The common environmental issues of blasting are flyrock, air overpressure, back-break and ground vibration … ***Flyrock can cause the most important effects of damage among them according to several scholars****"* (Attachment F1).

There are three main categories of flyrock: *"Cratering, rifling and face bursting". "Cratering will occur because of the too small ratio of stemming length to diameter in blasting face. Rifling will happen when stemming material is incompetent or is insignificant. In the third case, which is named face bursting, flyrock may occur due to the production of high-pressure gases in weak rocky plates"* (Attachment F1).

A typical blast scenario with multiple blast holes for a blast event, as used by Nucrush, is shown in Attachment F2.

The types of flyrock, discussed above, are demonstrated in Attachment F3.

Flyrock 'Cratering'

It should be noted that there is no guarantee when it comes to flyrock. *"There is a fairly wide-spread belief that improper delay sequencing can result in excessive flyrock form unrelieved back row holes … this may indeed happen and produce "wild" flyrock and certainly flyrock in unexpected directions ... If a back row hole shoots before the holes in front of it have detonated and moved some of the rock between it and the free face, the effective burden of the back row hole is so large that it cannot be broken by the detonation of the back row hole. Consequently, this detonation is "relieved" by producing excessive "cratering" (and flyrock) at the top of the bench"* (Attachment F4). This affect can be observed in attachment F5.).

Note this type of flyrock maybe particularly dangerous due to its nature of ejecting from the bench top (Attachment F2) in unknown, unplanned, directions so is particularly relevant for the closer sensitive receptors backing onto the blast (e.g. Rosewall Place, Emerson Drive, Appollo Drive, Bakers Ridge Drive, Tamborine-Oxenford Road, Maudsland Road, etc. etc. dependant on blast epicentre).

Flyrock 'Rifling'

"Flyrock can be cast thousands of feet from the blast. The most dangerous source is ejection from a crack or weak zone in the highwall face where gases violently vent. This action is akin to a rifle where the expanding gases eject a projectile. Frequently the ejection of stemming out of the top of a blast hole is called rifling" (Attachment F6).

Note this type of flyrock is prone to fly backwards due to the angled design of the blast holes so is particularly relevant for the closer sensitive receptors backing onto the blast (e.g. Rosewall Place, Emerson Drive, Appollo Drive, Bakers Ridge Drive, Tamborine-Oxenford Road, Maudsland Road, etc. etc. dependant on blast epicentre).

Flyrock 'Face-Burst'

There is a highly relevant flyrock damage incident recorded by the Queensland Explosives Inspectorate as follows: *"A crib hut, located at a distance of 1230m, was damaged when a flyrock incident occurred … The blast-exclusion zone was set at 1000m. Blast guards and other people were just outside the exclusion zone. The flyrock was linked to a face defect that was not noticed before the firing the overburden blast that ejected rock from a face burst"* (reproduced in attachment F7).

Note this type of flyrock is by its nature projected forward and is thus a particular dangerous at elevated levels above ground level as is proposed. This is especially concerning on the eastern benches at heights up to RL 80 metres where the blast faces will be indirect line with residents and businesses to the west starting at only 650 metres from the blast epicentre (e.g. Oxenford Community Pony Club, Sherman Drive, Amanda Street, Charlies Crossing North, Community Freshwater lake, Tamborine-Oxenford Road, Maudsland Road, wake and aqua park, etc. etc.).

Summary

It is clear that flyrock is a very real risk in the Nucrush quarry for all the types of the flyrock scenarios discussed above i.e. 'Cratering', 'Rifling' and 'Face-burst' all of which are highly relevant. What is becoming patently obvious is that these scenarios are highly unpredictable but in no way unique. With a believed plan for a blast every two weeks or so (to increase the production output to 1,000,000 tonnes as proposed) at close proximity to homes and all forms of suburbia (starting at just 150 metres) I do not believe this to be a safe scenario.

<u>Blast monitoring at the Nucrush Quarry</u>

It should also be remembered that the blast monitoring at the quarry over the preceding years has fallen far short of what should be acceptable.

As my other objections have proved, time and time again the blast monitoring has not been performed at *'The nearest sensitive receptor'* as is clearly required (e.g. David Street, Upper Coomera, that is approx 710 metres from quarry current extractive footprint, is repeatedly used in preference to Sherman Drive, Upper Coomera, that is only 400 metres approx, despite the DES proving that David Street is a more sensitive location - Attachment G1). Instead seemingly arbitrary locations, maybe based on a claimed historical basis, which unfortunately have failed to allow for the continual residential development that has been lawfully permitted over the intervening years. Thus, the monitored results do not show the actual ground vibration and airblast overpressure that would have been experienced at the closest sensitive receptors but a more subdued result logged at distances of up to 1.6 km (e.g. Yallaroi Road and Kopps Road - Attachment G1) despite closest sensitive receptors starting at maybe 300 or 400 hundred metres, that in the majority of cases appear to be completely ignored.

This clearly gives skewed results that do not reflect the actual ground vibration and airblast overpressure (that may well have been non-compliant and/or damaging, maybe structurally) that closer, more sensitive, receptors (residents and/or public using the Tamborine Oxenford Road etc.) would have been subjected to. Thus, I believe, these officially monitored results will culpably not reflect the higher ground vibration and airblast overpressure effects that more sensitive receptors were subjected to.

I therefore can only assume, as per blast monitoring, the flyrock considerations could be similarly manipulated and local residents will be clearly at higher risks of danger, maybe fatally, through no fault of their own, than is being highlighted within the development application.

Australian Standard AS2187.2 2006

Having perused the Australian Standard for Blasting (AS2187.2 2006), with specific reference to flyrock, I cannot believe that the proposed reduction in separation buffers to 40 metres in the west, zero metres to the north, 150 metres to the east and 340 metres to the south from sensitive receptors is in any way acceptable especially given the increased risk from flyrock injury that is associated with a reduction in distance.

These Australian Standard for Blasting assume a separation buffer (or Blast Exclusion Zone) of 1000 metres will be adopted (unless to quote from the State Planning Policy on the separation area: *"In some cases the separation area may be less than the minimum distances [1000 metres] in consideration of local features such as topography or existing development commitments for incompatible land uses"* - Attachment A2).

It is clear these significantly reduced separation buffers (a fraction of the 1000 metre requirement) cannot be attributed to *"local features such as topography"* in this particular circumstance e.g. It is predominately flat to the west, there is no buffer whatsoever to the north, the quarry and local residents homes are on similar levels of contour to the east (e.g. Rosewall Place, Roche Court and Emerson Drive).

Similarly, the *"existing development commitments for incompatible land uses"* reason cannot, I believe, be used in this particular case as it is the quarry proposing to ignore legal agreements which are part and parcel of the current approval e.g. Prohibited development areas known as *"Rural 'B' "* (as shown in Plan "C1495:00:13B" reproduced in Attachment H1, Close up in H2 annotated in H3) and *"Buffer Land"* (to the southwest) and *"Permanent Trees and Shrub screening"* (to the west) and thus encroaching on these sensitive receptors in these areas (as shown in 'Third Schedule' of the Rezoning agreement reproduced in Attachment H4) and thus resulting in any *"existing development"* to be far closer to the extractive footprint than they ever could have envisaged (based on their understanding of the Current approval as per the Rezoning agreement) and is thus highly unfair on these *"existing development[s]".*

* *Please note the 'Third Schedule' (or 'Plan 362-010'), reproduced in Attachment H4, revealing detailed information concerning the prohibited development areas known as "Buffer Land" and "Permanent Trees and Shrub screening", appears to have been culpably omitted from the development application having been removed from the submitted copy of the Rezoning agreement and replaced with the relatively innocuous 'Fourth Schedule' (with its title culpably removed it would seem) as reproduced in Attachments H5 and H6. This was only discovered in a subsequent long drawn out 'Right To Information' (RTI) enquiry to the Gold Coat City Council.*

** Similarly, please note plan 'C1495:00:13B', reproduced in Attachment H1,, revealing detailed information concerning the prohibited development area known as "Rural 'B' ", appears to have been culpably omitted from the development application. This too was only discovered in the subsequent 'Right To Information' (RTI) enquiry to the Gold Coat City Council.*

In summary, I do not believe a proposed reduction in separation buffer in every conceivable direction can be successfully argued, for this development application in this particular case, for either *"local features such as topography"* or *"existing development commitments for incompatible land uses"*

which are the only two permissible reasons in the State Planning Policy for a relaxation of separation buffer. Therefore, I believe these proposals are legally unfounded.

Conclusion

It is blatantly obvious that all Queensland current legislation relating to flyrock assumes an exclusion zone of 1km has been maintained for the health and safety of all concerned. And, it would seem in the majority of cases within the Gold Coast that the quarries do by and large have this exclusion zone e.g. KRA 67, Northern Darlington Range (Attachments I1 and I2) and KRA 65 Nerang Quarry (Attachment I3). However, this is clearly not the case for the Nucrush quarry that is located in the middle of suburbia (Attachment I4).

It seems to be assumed, incorrectly, by DES that the Nucrush quarry is a very similar case to the other quarries within the Gold Coast. However, comparing the attachments I1 through I4 I think you can see it is a very different case indeed (Please note all these maps are to the same scale).

It is simply inconceivable that local residents who are living within a truly suburban environment, such as this, can be subjected to the very real possibility of a potential fatality and/or serious injuries within their own homes. Also, members of the public, going through their lawful business in the area, through no fault of their own, are also at risk of serious fly rock incidents.

It would seem absolutely inconceivable that a blasting quarry, such as this, could be permitted to quarry above ground with so many sensitive receptors clearly in a direct line and well within range of serious fly rock incidents.

Similarly, it would seem inconceivable that a blasting quarry such as this, could be permitted to blast within 150 metres of residential homes where children could be playing in their gardens and/or 40 metres from public areas (such as Tamborine Oxenford Road and Maudsland Road) where people could be lawfully walking or cycling, when there is a very real risk of fly rock 'rifling' or 'cratering' that could easily send projectiles in their direction.

I do not believe the development application adequately investigates the dangers of all the different types of flyrock that are likely to happen in a blasting quarry such as this. In fact, I do not believe the flyrock danger is covered to the extent that is required in the development application especially with the miniscule separation buffers or Blast Exclusion Zone (BEZ) between blasting and residential homes and public areas that it is proposing (150 metres as opposed to the required 1 Km BEZ). Will the City of Gold Coast Council commission a much needed independent report to establish if the flyrock dangers have been adequately covered or will they accept a somewhat biased report provided by the applicant that may have an alternative agenda that may minimise inherent dangers given the obvious failures of an adequate BEZ?

I hope the City of Gold Coast Council Planners and Councillors, when deciding the fate of this Development Application, will take these very real and serious health and safety issues on board when considering the Development Application and how it might affect local residents who are within the 1km BEZ through no fault of their own. And, it must be remembered the Queensland '1 km Blast Exclusion Zone' is there for a specific reason i.e. for the safety of workers who may be affected by the blast. Thus, it would seem highly irresponsible and extremely reprehensible to subject members of the public who have no choice to these same dangers.

I strongly believe if this Development Application is approved then all parties in the decision making process will be guilty of culpable negligence by subjecting members of the public to untenable risks to their health and safety. It would then be up for the Courts to decide the lawfulness of the City of Gold Coast Council Planners and Councillors decision, given the clear guidelines from the Queensland Mining, safety and Health Directorate with regard to the necessity for appropriate blast exclusion zones and separation buffers and the complete lack of any independent expert evidence sought by the City of Gold Coast Council in reaching their decision (as they relied upon in reaching their decision on the very similar Boral Reedy Creek quarry case).

Thank you in anticipation,

Kind regards

Tony Potter

* Disclaimer. Please note my findings are believed correct and are to the best of my ability. However, there may be errors and assumptions I have made that are incorrect. I do not believe this to be the case, but, realise with the vast amounted of submitted data from the applicant, errors and assumptions on my part may occur. Hopefully this is not the case, but please accept my apologises if this is so. Thank you.

Attachment A1

australianmining.com.au/news/qld-to-develop-new-blasting-guidelines/

QLD to develop new blasting guidelines

March 21, 2011 News Cole Latimer

After two dangerous blasting incidents at BMA mines, Queensland is new developing new shot firing guidelines.

The Mining Safety and Health Directorate have created a steering group to investigate post blast fume events and to minimise gas fume events during blasting operations.

The Employment, Skills and Mining Minister Stirling Hinchliffe has said that QLD mine safety representatives have met with mining companies, explosives suppliers and the Construction, Forestry, Mining and Energy Union (CFMEU) to look into the issue.

Hinchliffe said recent incidents at BMA's Saraji and Peak Downs coal mines had prompted the creation of the steering group.

"Queensland has a reputation of holding one of the safest records in the world when it comes to mining and we want to keep it that way," Hinchliffe said.

The group will be headed by Noel Erichsen, the Deputy Chief Inspector of Explosives.

While it is accepted that all explosions generate gas and that post-blast fume events will never be fully eliminated the steering group is focused on minimising the risk.

"We want this happen quickly, that's why the steering group will be reporting back with draft guidelines by May 6," Hinchliffe said.

Existing safeguards like 1km exclusion zones are already in place during blasting operations to protect workers.

On average there are between 120 and 150 shots fired per week during blasting operations in Queensland, and typically less than two per cent of these result in a fume event.

Investigations into the post-blast fume events at BMA's Saraji and Peak Downs mines continue.

The miner suspended shot firing at the mines early last week, but resumed operations following inspections by the Mackay District Mines Inspector.

Attachment A2 - State Planning Policy - Identifying a KRA

spp-guidance-mining-and-extractive-resources-july-2017.pdf

An identified KRA is made up of four components, as shown in Table 2 and Figure 2.

Table 2: KRA components

Component	Detail
Resource/ processing area	The extent of the extractive resource and any operational areas associated with the extraction and processing of the resource. The boundary of the area is defined by the potential for extractive industry activities, and includes the resource area where blasting and other primary extraction would take place. The area can include adjacent areas where other extractive activities (such as crushing, screening and stockpiling) may occur.
Separation area	The separation area is the area surrounding the resource/processing area required to maintain separation from people who may be affected by residual impacts such as noise, dust and ground vibrations of existing or future extractive operations in the resource/processing area. The minimum distance is 200 metres for resources that do not require blasting or crushing to extract (sand, gravel and clay) and 1,000 metres for hard rock resources where blasting and crushing of material is required. An extractive resource might extend beyond the boundary of the resource/processing area and, where this occurs, an extractive industry could take place in the separation area, provided that the function of the separation area is not compromised. In some cases the separation area may be less than the minimum distances in consideration of local features such as topography or existing development commitments for incompatible land uses.
Transport route	The shortest practical route used to transport extracted resources to market. The transport route is a road or a rail link from the boundary of the resource/processing area to a major road or railway.
Transport route separation area	The area surrounding the transport route needed to maintain separation of people from undesirable levels of noise, dust and ground vibration produced as residual impacts from the transportation of extractive material. The distance is measured 100m from the centre line of the indicated transport route for a KRA.

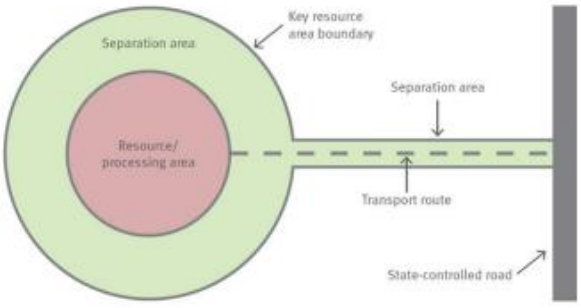


Figure 2: Components of KRAs

Attachment B1

dnrme.qld.gov.au/business/mining/safety-and-health/alerts-and-bulletins/explosives/flyr...

Queensland Government

Department of Natural Resources, Mines and Energy

Flyrock damage outside the blast-exclusion zone

Explosives safety alert no. 61 | 13 August 2012 | Version 1

What happened?

A crib hut, located at a distance of approximately 1230m, was damaged when a flyrock incident occurred at a coal mine in Central Queensland. (The image below, shows the damage.) The blast-exclusion zone was set at 1000m. Blast guards and other people were just outside the exclusion zone. The flyrock was linked to a face defect that was not noticed before firing the overburden blast that ejected rock from a face burst. (See the image below.)

Recommendations

1. Conduct blast survey for correct blasting parameters and design.
2. Review design and load plan when under burden, defects, ground abnormalities or excessive back break is identified.
3. Survey blast faces accurately before marking out blastholes and loading explosives.
4. Loading procedures are to be followed, including recording of explosives loaded per hole and slumping.
5. Be aware of the quantity of explosives used, particularly when voids and cracks might be filled.
6. Consider the use of shelters for blast guards for protection from flyrock.
7. Keep the blast design, drilling and loading within known parameters.
8. Prior to a blast, consider any variations encountered and adjust the blast-exclusion zone accordingly, or perform other mitigations such as using overburden or leaving holes free of explosives.
9. Review safety management systems to ensure that there are suitable controls and procedures to address recommendations 1 to 8 above.
10. All people involved in these activities ensure that the safety management system, controls and standard operating procedures are followed and that on-the-job risk assessments are made and acted on.

Flyrock damage to crib hut

Face burst showing rock ejection

Authorised by Geoff Downs - Chief Inspector of Explosives
Contact: , Manager, Explosives Licensing, +61 7 3199 8057 explosives@dnrm.qld.gov.au
Issued by Queensland Department of Natural Resources and Mines

Safety: This information is a guide only and is issued to promote safety through experience. It is not to be taken as a statement of law and must not be construed to waive or modify any legal obligation.

Attachment C1

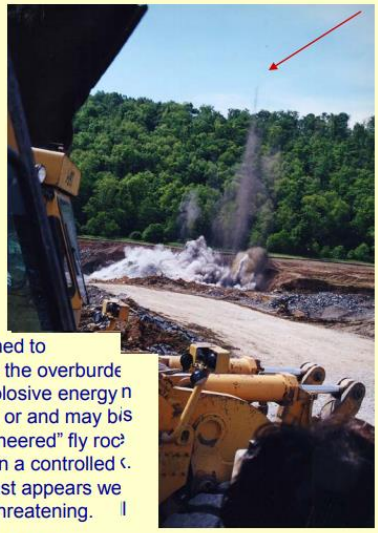
osmre.gov/resources/blasting/docs/WYBlasterCertModules/8AdverseEffectsBlasting.pdf

Flyrock

Material that is ejected from a blast site that travels through the air or along the ground. Flyrock may be rock or soil. Any size material is capable of damaging property or injuring people.

The Single Factor Of Surface Mining That Is Most Likely To Cause A Fatality!!!

Flyrock control is essential. The blaster is responsible for securing the area around the blast site where flying debris may occur.



Fly rock can be cast thousands of feet from a blast. The most dangerous source is ejection from a crack or weak zone in the highwall face where gases violently vent. This action is akin to a rifle where the expanding gases eject a projectile. Frequently the ejection of stemming out of the top of a blast hole is called **rifling**.

A blast that is designed to horizontally displace the overburde material with the explosive energy n called **cast blasting** or and may bis referred to as "Engineered" fly roc This material move in a controlled c safe manor. The blast appears we controlled and non-threatening.

Flyrock Damage

Flyrock damage is quite obvious when a structure is hit. Holes and marks are very visible.

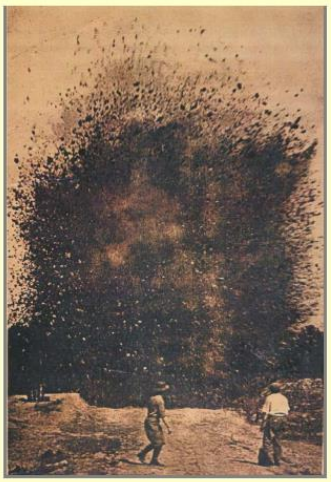
A rock that lands harmlessly in a field may not appear to be a large issue. However, mowing and tilling become hazardous when rock is struck by farm equipment. Rock through timber stands mar trees and potentially impact the market value.

In areas of steep slopes, a rock set in motion by the explosive energy may roll hundreds of feet. In this instance the rock rolled through a trailer down slope from the mine. Children were playing in the front yard at the time. Fortunately no one was injured.

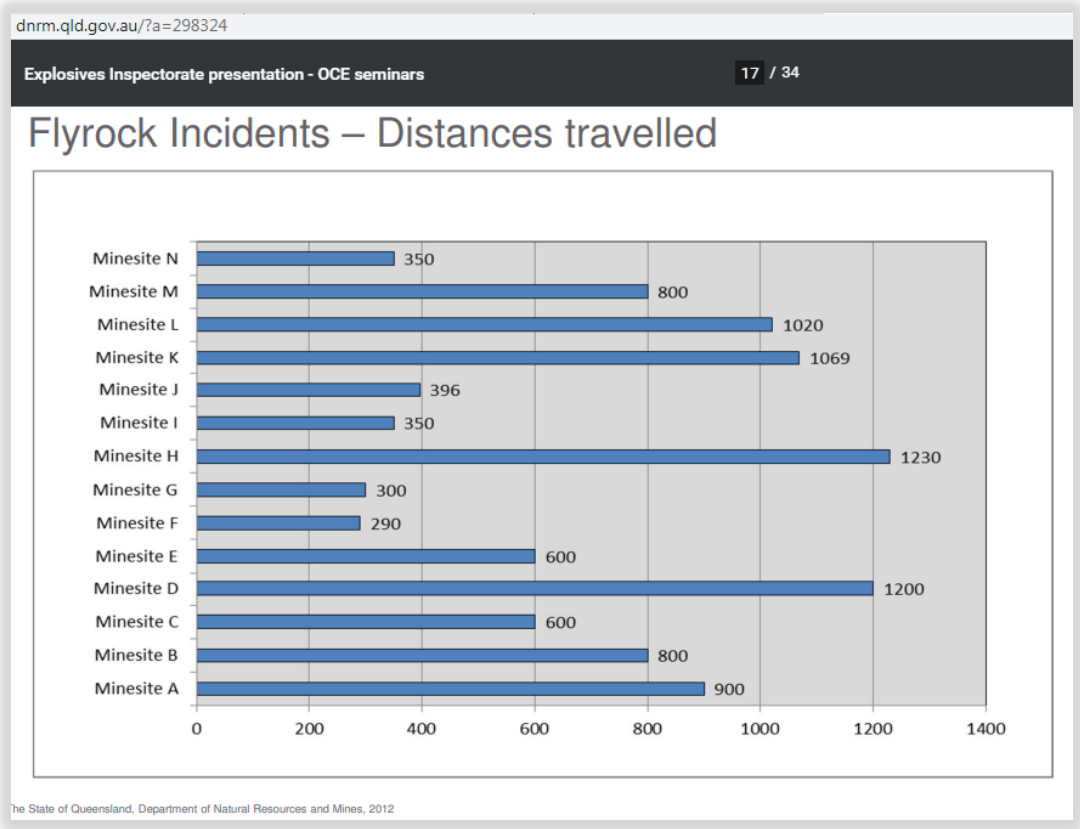
Causes of Flyrock

Often, the factors that cause excessive airblast and ground vibrations have the potential to cause flyrock as well. Flyrock is the number two killer in mining operations. For this reason, it is crucial that blasters understand and control the factors that can create flyrock. Some of the common causes of flyrock are:

1. Overloaded blastholes with excessive amounts of explosives
2. Heavily confined charges or the lack of relief (eg. lift blasts)
3. Explosives loaded into incompetent materials (eg. mud seams, fractures, and/or voids)
4. Insufficient front-row burden, causing front-face blowouts
5. Burdens and spacings too close together (resulting in high powder factors)
6. Inadequate/insufficient stemming material
7. Inadequate delay between holes in the same row or between rows; detonators firing out of sequence
8. Deviation of blast hole detonation from the intended sequence
9. Changing geology or rock type
10. Spacing and burden exceeds borehole depth
11. Angled boreholes
12. Secondary blasting
13. Human error, improperly loaded blasts

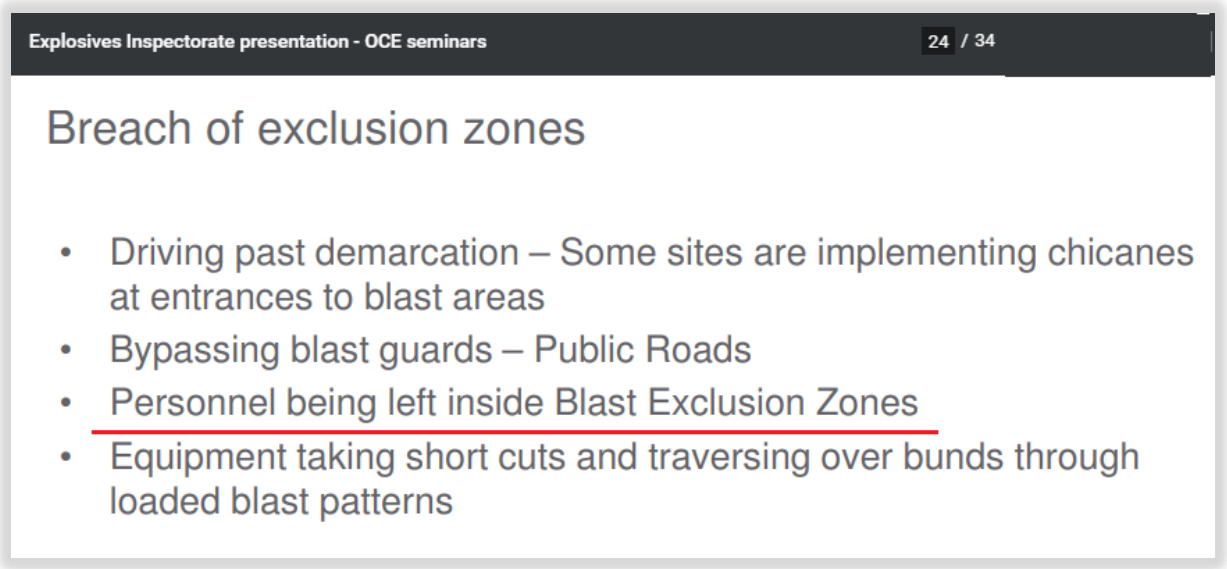


Attachment D1 - Flyrock Incidents

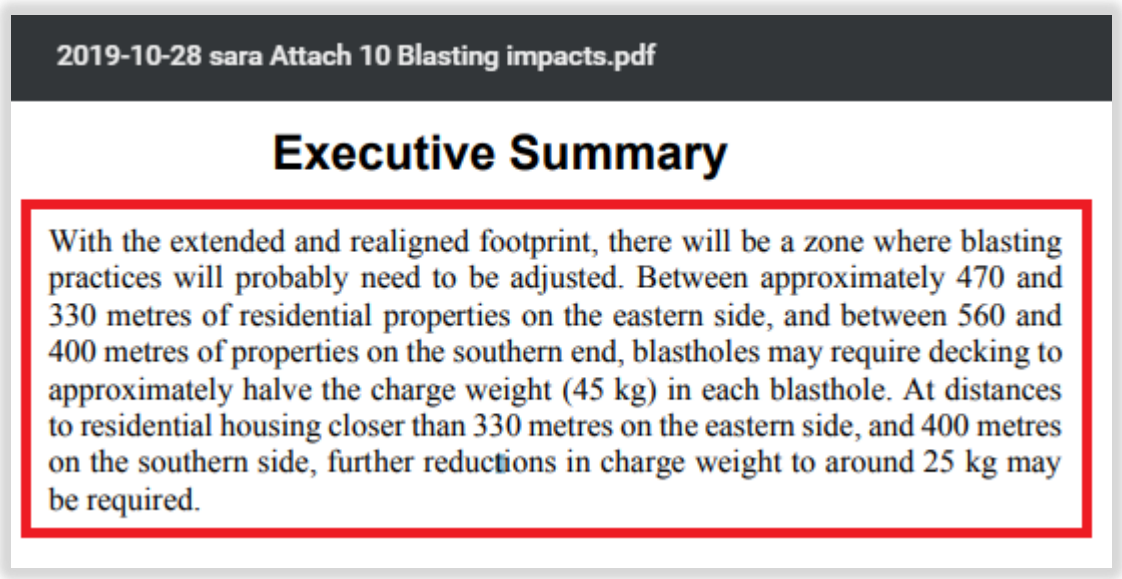


Attachment D2 - Role of Queensland Explosive Inspectorate

Attachment D3 - Breach of Exclusion Zones



Attachment E1 - Increased danger of flyrock

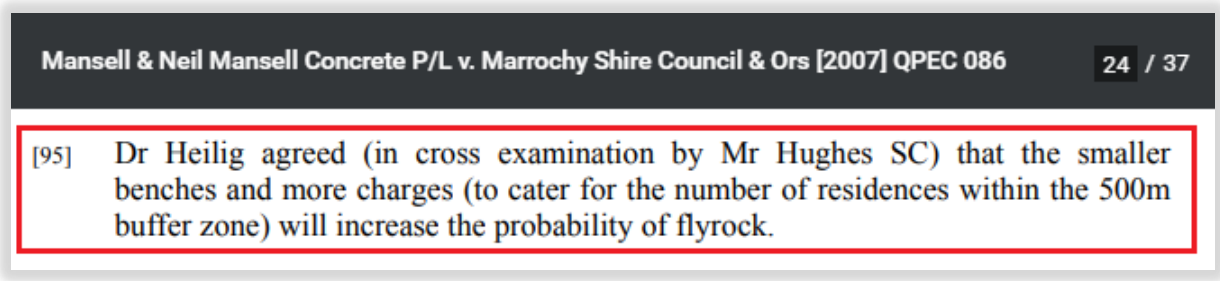


2019-10-28 sara Attach 10 Blasting impacts.pdf

Executive Summary

With the extended and realigned footprint, there will be a zone where blasting practices will probably need to be adjusted. Between approximately 470 and 330 metres of residential properties on the eastern side, and between 560 and 400 metres of properties on the southern end, blastholes may require decking to approximately halve the charge weight (45 kg) in each blasthole. At distances to residential housing closer than 330 metres on the eastern side, and 400 metres on the southern side, further reductions in charge weight to around 25 kg may be required.

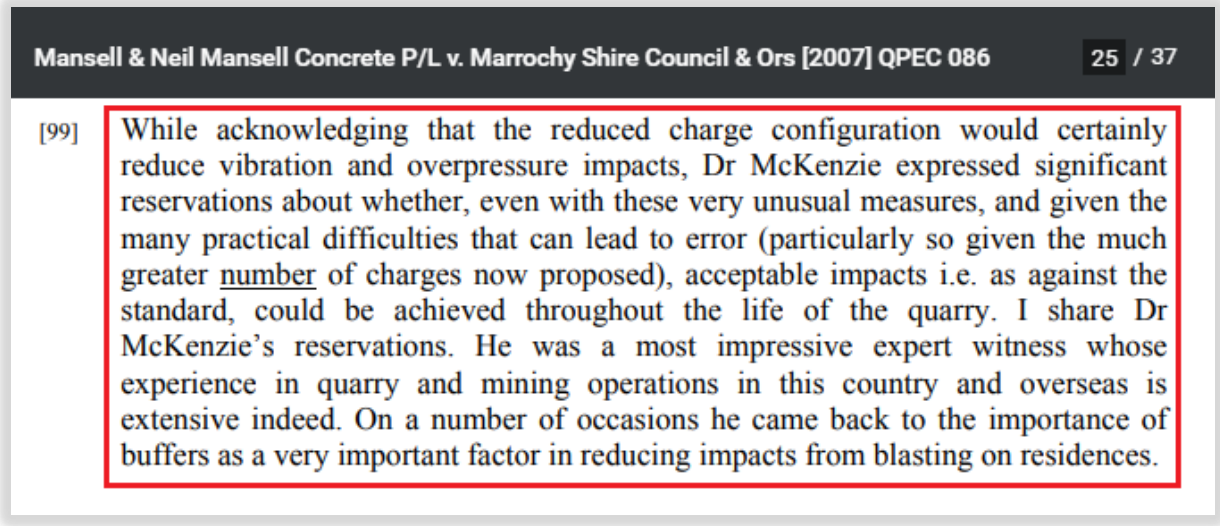
Attachment E2 - Increased danger of flyrock



Mansell & Neil Mansell Concrete P/L v. Marrochy Shire Council & Ors [2007] QPEC 086 24 / 37

[95] Dr Heilig agreed (in cross examination by Mr Hughes SC) that the smaller benches and more charges (to cater for the number of residences within the 500m buffer zone) will increase the probability of flyrock.

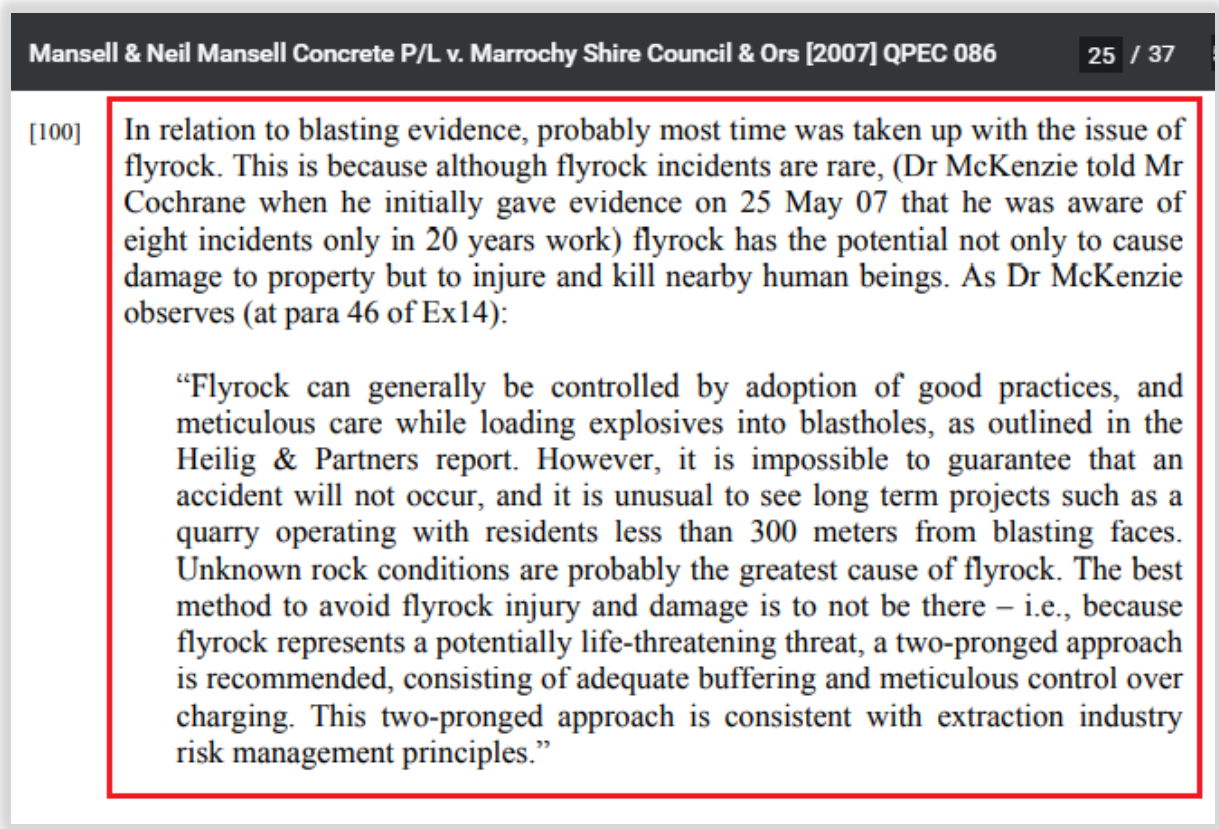
Attachment E3 - Unusual measures may increase errors



Mansell & Neil Mansell Concrete P/L v. Marrochy Shire Council & Ors [2007] QPEC 086 25 / 37

[99] While acknowledging that the reduced charge configuration would certainly reduce vibration and overpressure impacts, Dr McKenzie expressed significant reservations about whether, even with these very unusual measures, and given the many practical difficulties that can lead to error (particularly so given the much greater number of charges now proposed), acceptable impacts i.e. as against the standard, could be achieved throughout the life of the quarry. I share Dr McKenzie's reservations. He was a most impressive expert witness whose experience in quarry and mining operations in this country and overseas is extensive indeed. On a number of occasions he came back to the importance of buffers as a very important factor in reducing impacts from blasting on residences.

Attachment E4 - Flyrock represents a potentially life-threatening threat



Mansell & Neil Mansell Concrete P/L v. Marrochy Shire Council & Ors [2007] QPEC 086 25 / 37

[100] In relation to blasting evidence, probably most time was taken up with the issue of flyrock. This is because although flyrock incidents are rare, (Dr McKenzie told Mr Cochrane when he initially gave evidence on 25 May 07 that he was aware of eight incidents only in 20 years work) flyrock has the potential not only to cause damage to property but to injure and kill nearby human beings. As Dr McKenzie observes (at para 46 of Ex14):

> "Flyrock can generally be controlled by adoption of good practices, and meticulous care while loading explosives into blastholes, as outlined in the Heilig & Partners report. However, it is impossible to guarantee that an accident will not occur, and it is unusual to see long term projects such as a quarry operating with residents less than 300 meters from blasting faces. Unknown rock conditions are probably the greatest cause of flyrock. The best method to avoid flyrock injury and damage is to not be there – i.e., because flyrock represents a potentially life-threatening threat, a two-pronged approach is recommended, consisting of adequate buffering and meticulous control over charging. This two-pronged approach is consistent with extraction industry risk management principles."

Attachment E5 - Flyrock contd.

[101] The experts diverged somewhat as to the source of flyrock in a blast. Dr Heilig's evidence was that the most danger comes from the face of the quarry during an explosion. Dr McKenzie says it comes from the collar of the blast which is actually on the bench.

[102] The problem for the Mansells here is that in attempting to present a design that will reduce amenity impacts from overpressure and/or vibration by having an increased number of blastholes, this potentially increases the risk of flyrock.

[103] Again the recommended and desirable 500 metre buffer around a quarry operation (which is absent here) looms large in the expert evidence. In Ex25 they say:

> "The EPA recommended buffer distance of 500 metres around quarry operations is considered "safe" as regards flyrock risk, and many operations operate with distances around 300 metres. Fewer long-term blasting operations regularly involve blasting at distances of 200 metres or less from residences. Many incidents have occurred in which large rock fragments have been projected much greater distances. As the buffer distance is reduced, the need for meticulous procedures in explosives charging increases, and the tolerance to errors can become very narrow."

[105] The real issue in this case is the difference in opinion between the experts as to whether or not meticulous care and attention to detail throughout the life of the quarry can avoid flyrock incidents given the proximity (particularly of the two closest residents) to the blasting source.

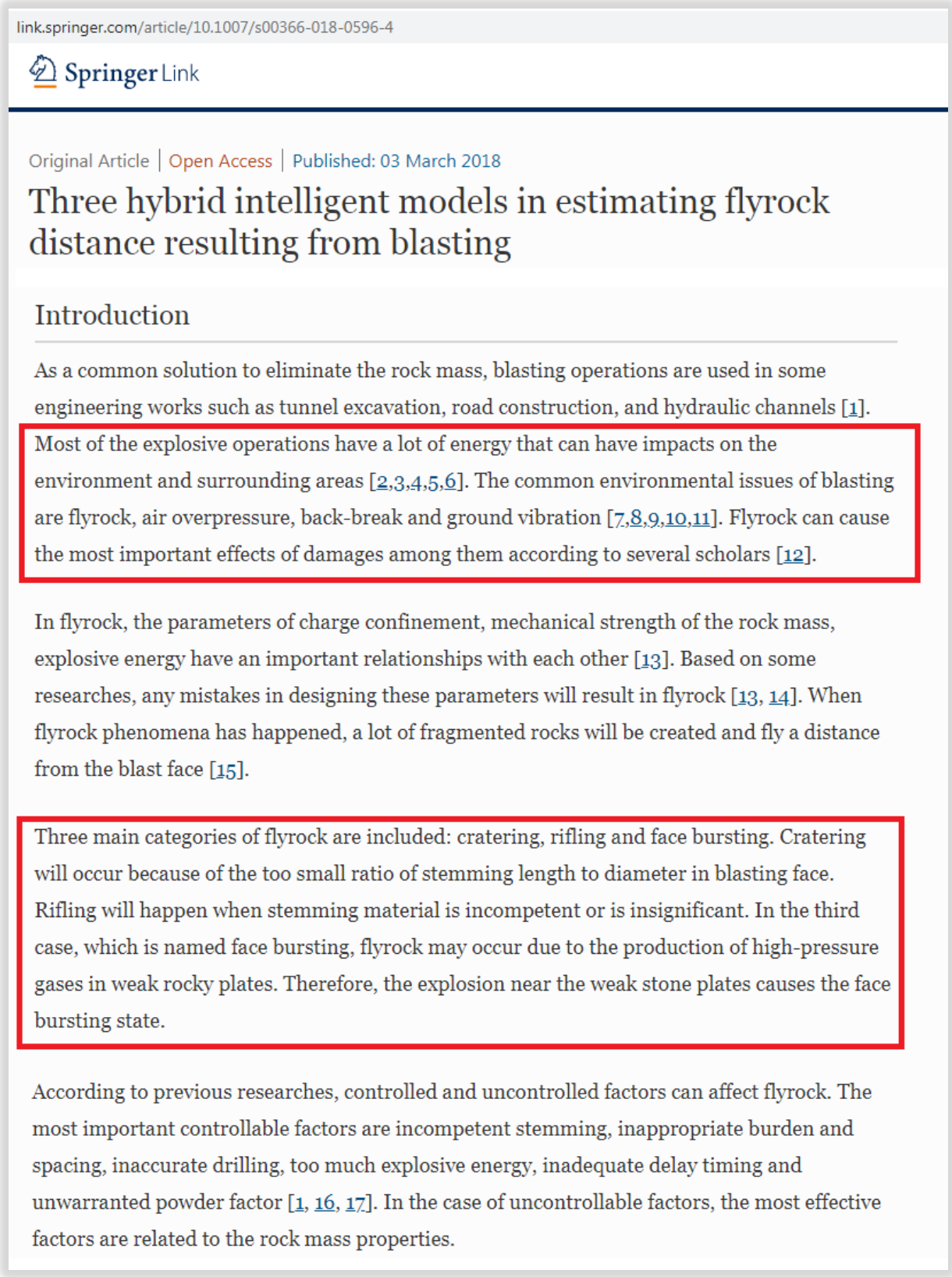
[106] Dr McKenzie has concerns that it will not and Dr Heilig believes it can be done.

[112] In my opinion, the differences between the experts are more imagined than real when one has regard to the totality of their evidence. There is their agreed statement in Ex25 which I have set out above and, in any event, Dr Heilig properly conceded that even with the best practices and meticulous care (as he proposes here) there can be no guarantee that there can be no flyrock. The real difference between them is that he is of the opinion that with his designs the level of risk can be reduced to an acceptable level whereas Dr McKenzie disagrees because of his concerns particularly relating to the two nearest residences.

[113] What Dr McKenzie also said in his further evidence on 17 August 2007 was that when he and Dr Heilig investigated the recent Waihi Mine incident they discovered that there had been an earlier incident many years ago as a result of which the operator introduced systems to avoid a repeat which had now failed because of human error.

[114] I prefer Dr McKenzie's more cautious approach here because of the close proximity of the two residences on the eastern boundary. Kelly O'Shea, who is one of the closest home owners, expressed great fear about flyrock and was not comforted by the expert's conditions relating to notifying the residents of blasting.

Attachment F1 - Categories of Flyrock



link.springer.com/article/10.1007/s00366-018-0596-4

SpringerLink

Original Article | Open Access | Published: 03 March 2018

Three hybrid intelligent models in estimating flyrock distance resulting from blasting

Introduction

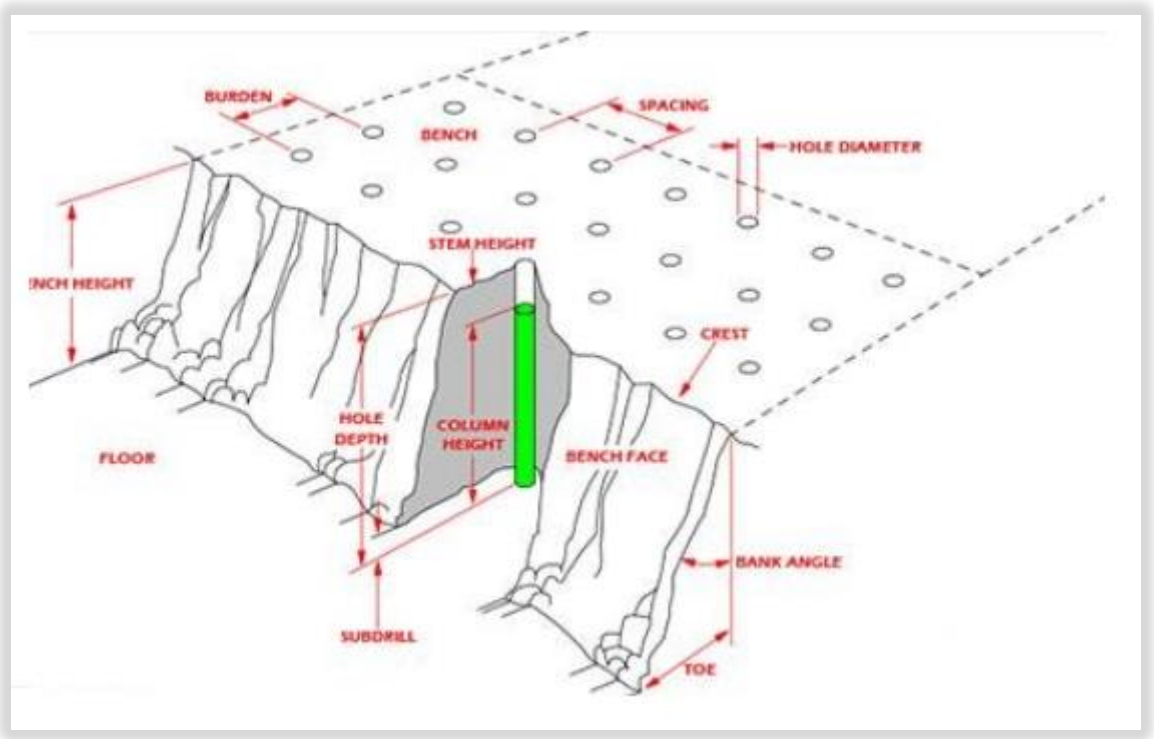
As a common solution to eliminate the rock mass, blasting operations are used in some engineering works such as tunnel excavation, road construction, and hydraulic channels [1]. Most of the explosive operations have a lot of energy that can have impacts on the environment and surrounding areas [2,3,4,5,6]. The common environmental issues of blasting are flyrock, air overpressure, back-break and ground vibration [7,8,9,10,11]. Flyrock can cause the most important effects of damages among them according to several scholars [12].

In flyrock, the parameters of charge confinement, mechanical strength of the rock mass, explosive energy have an important relationships with each other [13]. Based on some researches, any mistakes in designing these parameters will result in flyrock [13, 14]. When flyrock phenomena has happened, a lot of fragmented rocks will be created and fly a distance from the blast face [15].

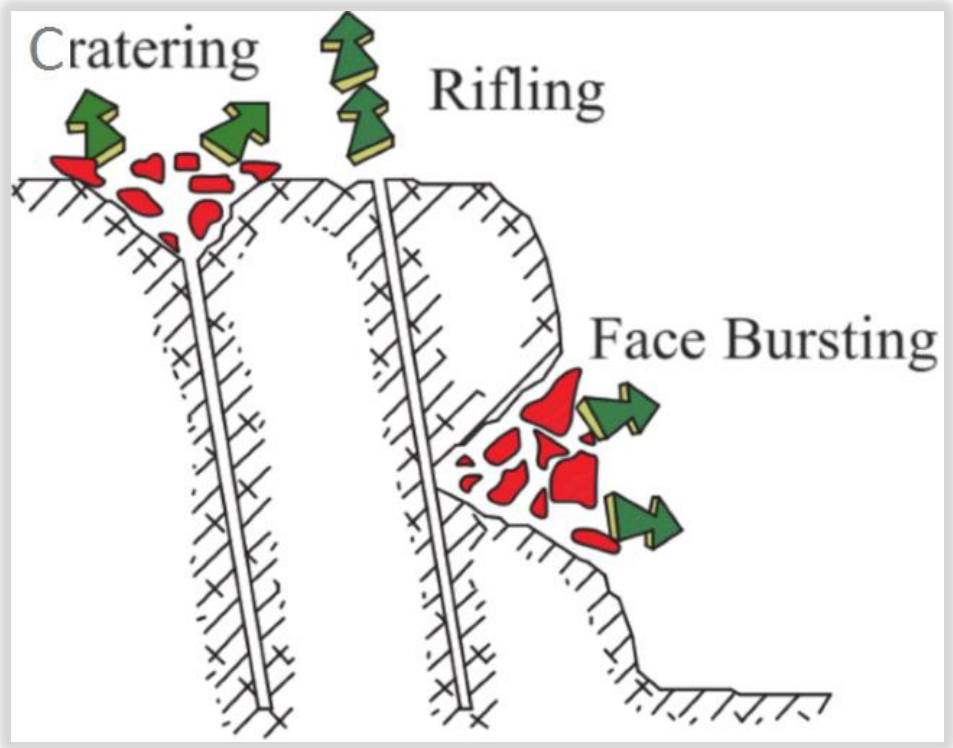
Three main categories of flyrock are included: cratering, rifling and face bursting. Cratering will occur because of the too small ratio of stemming length to diameter in blasting face. Rifling will happen when stemming material is incompetent or is insignificant. In the third case, which is named face bursting, flyrock may occur due to the production of high-pressure gases in weak rocky plates. Therefore, the explosion near the weak stone plates causes the face bursting state.

According to previous researches, controlled and uncontrolled factors can affect flyrock. The most important controllable factors are incompetent stemming, inappropriate burden and spacing, inaccurate drilling, too much explosive energy, inadequate delay timing and unwarranted powder factor [1, 16, 17]. In the case of uncontrollable factors, the most effective factors are related to the rock mass properties.

Attachment F2 - Typical Scenario as used at Nucrush quarry



Attachment F3- Flyrock Rifling



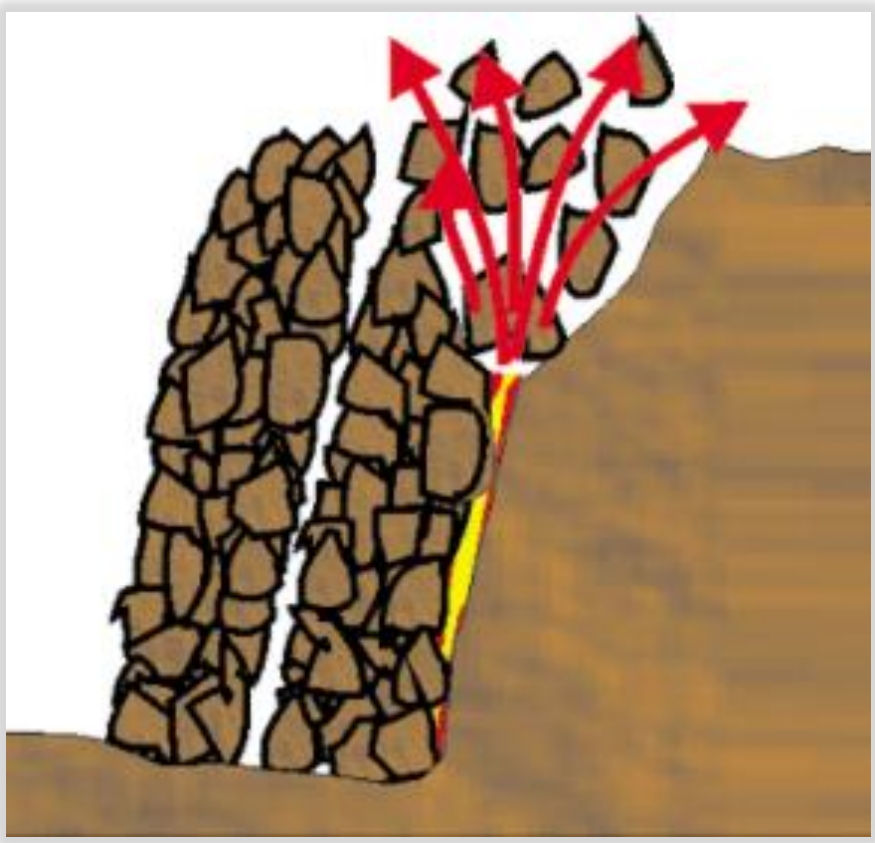
Attachment F4 - Flyrock in unexpected directions

osmre.gov/resources/blasting/docs/Flyrock/FlyrockRange1979.pdf

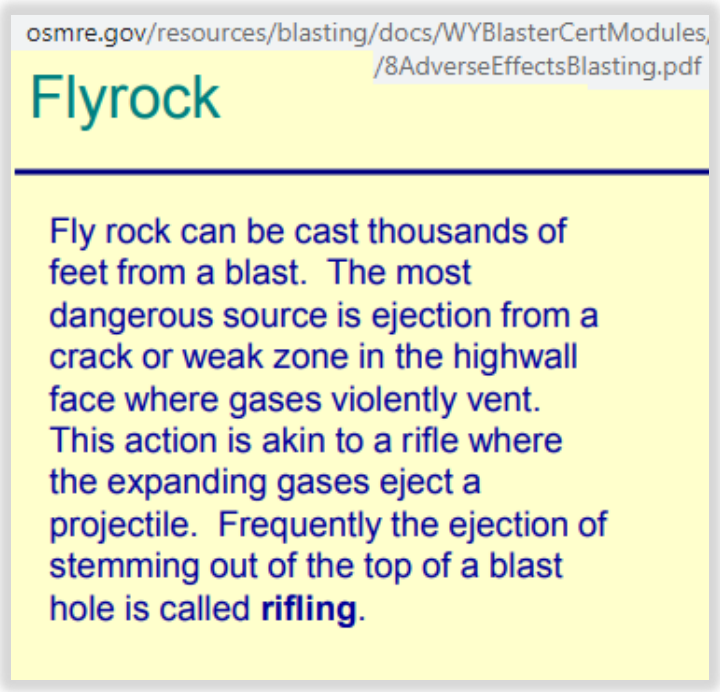
FlyrockRange1979.pdf 27 / 97

There is fairly wide-spread belief that improper delay sequencing can result in excessive flyrock from unrelieved back row holes. Under favorable conditions, this may indeed happen and produce "wild" flyrock and certainly flyrock in unexpected directions. The rationale for this belief is as follows. If a back row hole shoots before the holes in front of it have detonated and moved some of the rock between it and the free face, the effective burden on the back row hole is so large that it cannot be broken by the detonation of the back row hole. Consequently, this detonation is "relieved" by producing excessive "cratering" (and flyrock) at the top of the bench. However, such a sequence of events is limited to conditions for which the explosive load is less than a "critical" depth below the bench top. With sufficient stemming, both actual blasting experience* and experiments[14] indicate that there will be no such cratering even in the absence of any nearby free face other than the bench top. Flyrock from bench tops will be considered in Section 6.

Attachment F5 - Flyrock projected upwards and backwards (as a result of cratering)



Attachment F6- Flyrock rifling



Attachment F7- Flyrock face-burst

rshq.qld.gov.au/safety-notices/explosives/flyrock-damage-outside-the-blast-exclusion-zone

ALERT | ALERT | ALERT | ALERT | ALERT

Explosives safety alert no. 61 | 13 August 2012 | Version 1

Flyrock damage outside the blast-exclusion zone

What happened?

A crib hut, located at a distance of approximately 1230m, was damaged when a flyrock incident occurred at a coal mine in Central Queensland. (The image below, shows the damage.) The blast-exclusion zone was set at 1000m. Blast guards and other people were just outside the exclusion zone. The flyrock was linked to a face defect that was not noticed before firing the overburden blast that ejected rock from a face burst. (See the image below.)

What factors contribute to flyrock?

Many factors contribute to flyrock, in particular front-row holes. Examples are:

- weak rock structure including ground geology, fault, back break etc.
- insufficient front-row blasthole burdens
- stemming depth
- initiation sequence
- blasthole diameter, angle and depth
- blast pattern
- stemming material, decking, solid and air
- charge weight per hole
- failure to inspect the free face for defects.

See also AS2187.2, page 70.

Investigations are ongoing and further information may be published as it becomes available. The information in this publication is what is known at the time of writing.

We issue Safety Notices to draw attention to the occurrence of a serious incident, raise awareness of risks, and prompt assessment of your existing controls.

Authorised by Geoff Downs - Chief Inspector of Explosives

Contact: Manager, Explosives Licensing , +61 7 3199 8057 explosives@dnrm.qld.gov.au

Issued by Queensland Department of Natural Resources and Mines

Attachment G1 - Seemingly arbitrary blast locations adopted

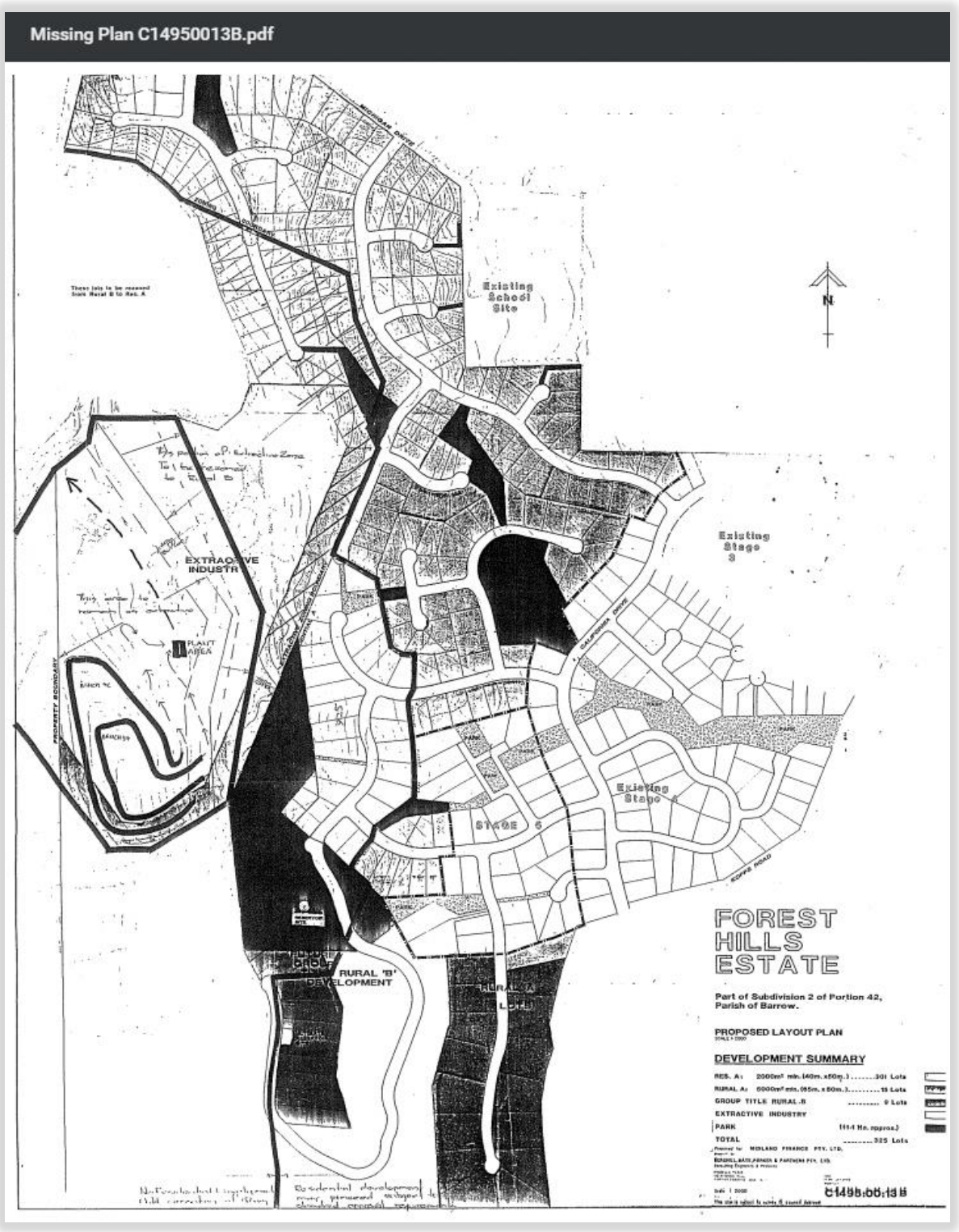
5.1 Individual Impacts from Oxenford Quarry

The individual historical impacts on nearby sensitive receptors to the Oxenford Quarry are summarised in Table 4 below, for those locations where monitors were located near to residential development, i.e. excluding monitoring conducted inside the quarry property or on undeveloped land.

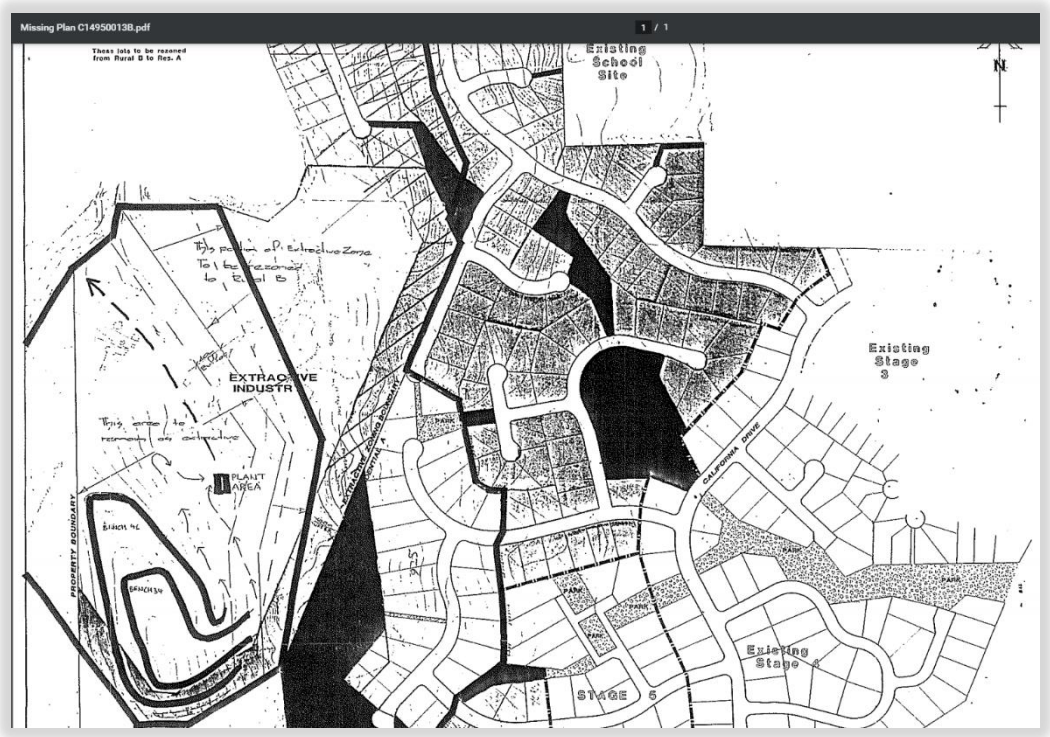
Table 4. Summary of individual vibration & overpressure impacts of blasting at Nucrush Oxenford Quarry.

Location	Count	Vibration Impacts			Overpressure Impacts		
		Avg PPV	90% PPV	Max PPV	Avg dBL	90% dBL	Max dBL
Barrs Rd	2	0.7			113.9		
Brittany Court	6	1.0	1.1	1.2	107.7	111.8	111.8
Charlies Crossing	10	1.4	2.9	3.5	109.8	113.4	117.5
Coomera Is.	5	1.7	2.2	2.2	109.9	112.7	113.5
David St	101	1.3	2.0	7.0	107.4	111.7	120.0
Dorchester Court	114	0.8	1.2	2.4	107.4	112.0	118.8
Emerson Way	117	1.1	2.0	4.4	112.2	117.7	127.9
Hensman Court	66	0.9	1.4	2.6	105.2	110.5	117.3
Kopps Rd	53	0.8	1.5	2.7	101.8	109.4	114.1
Platypus Park	4	1.5	2.0	2.2	107.6	108.7	108.9
Pottinger Cres	6	1.1	1.5	1.6	110.3	116.2	119.0
Queens Park Circuit	20	0.9	1.6	2.1	105.0	110.5	112.8
Rosewall Place	65	1.6	2.8	6.6	109.4	115.2	124.3
Sherman Drive	28	1.7	2.3	2.8	111.7	115.8	122.9
White City Drive	14	2.3	3.1	5.1	111.1	117.4	119.5
Wimbledon Way	36	2.4	3.8	5.1	112.4	119.0	120.0
Yallaroi Rd	67	0.8	1.2	2.2	104.6	111.8	115.5

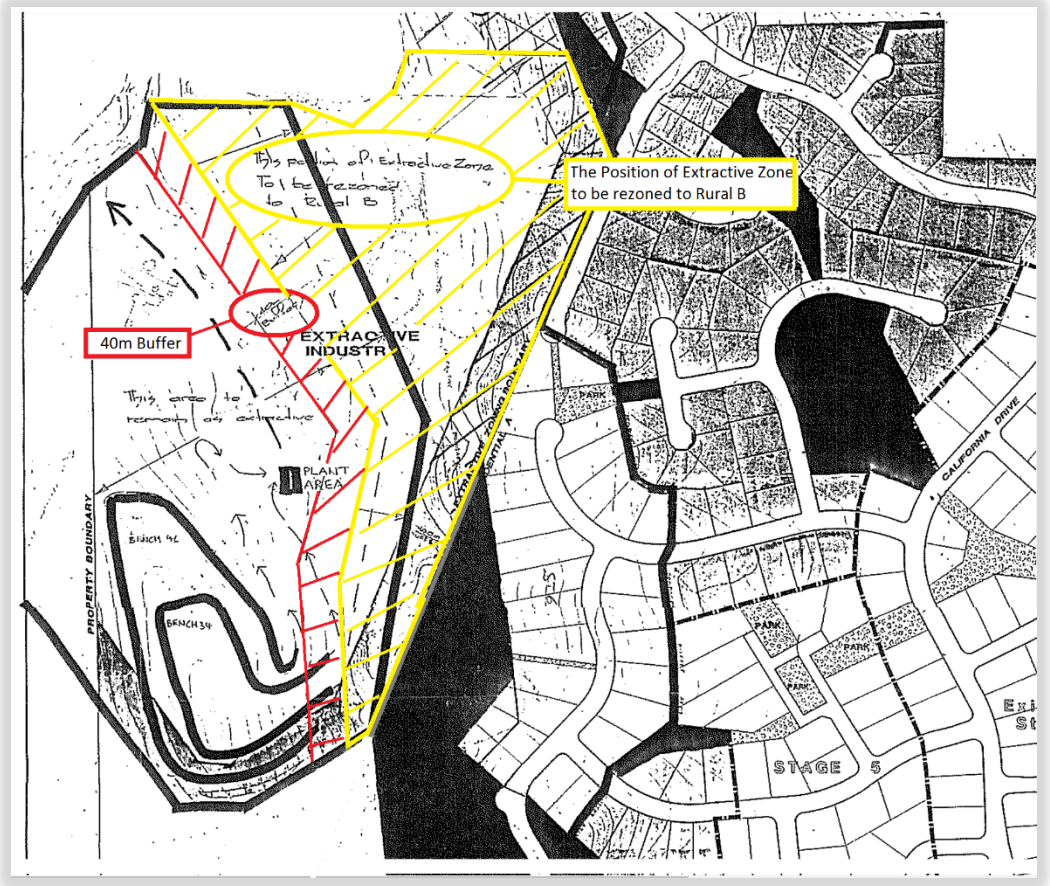
Attachment H1 - Plan C1495:00:13B



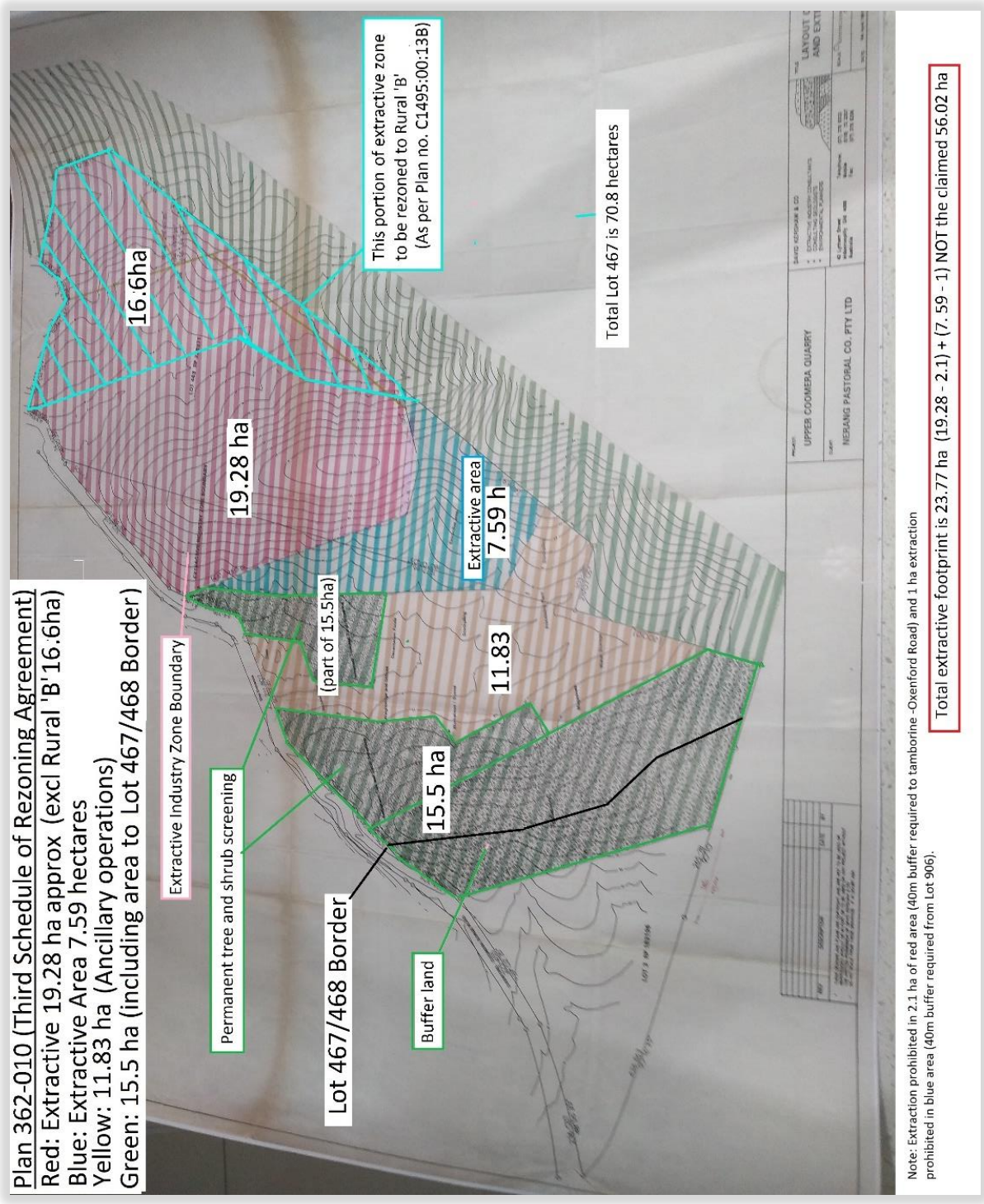
Attachment H2 - Plan C1495:00:13B (Showing close-up of Rural 'B' area)



Attachment H3 - Plan C1495:00:13B (Showing annotated close-up of Rural 'B' area)

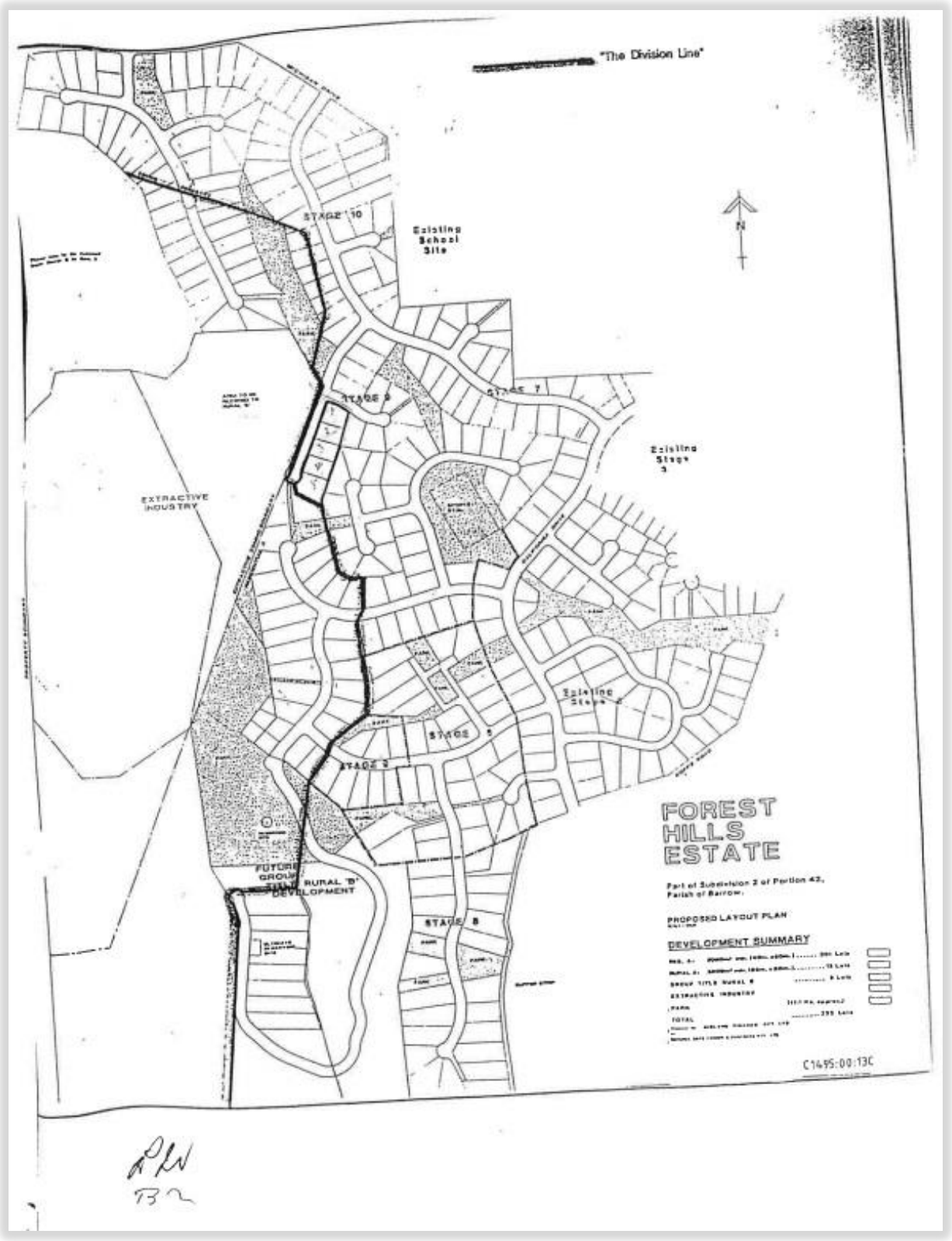


Attachment H4 - 'Plan 362-010' or 'Third Schedule' of Rezoning agreement (Annotated version)



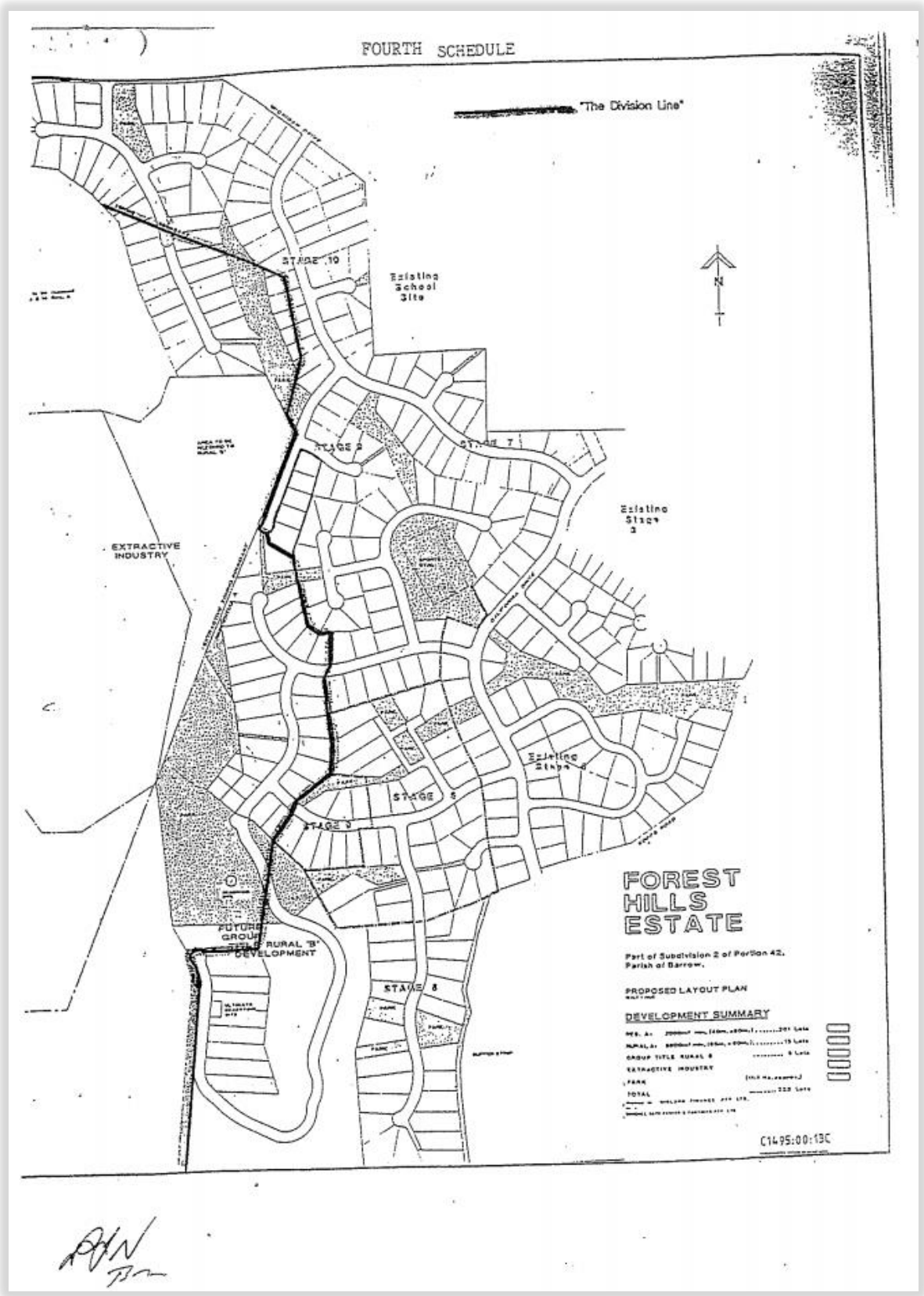
Attachment H5 - Fourth Schedule of Rezoning agreement altered to seemingly appear as Third Schedule'

Note title "FOURTH SCHEDULE' has seemingly been removed and signature changed. Original shown in Attachment H6 below.

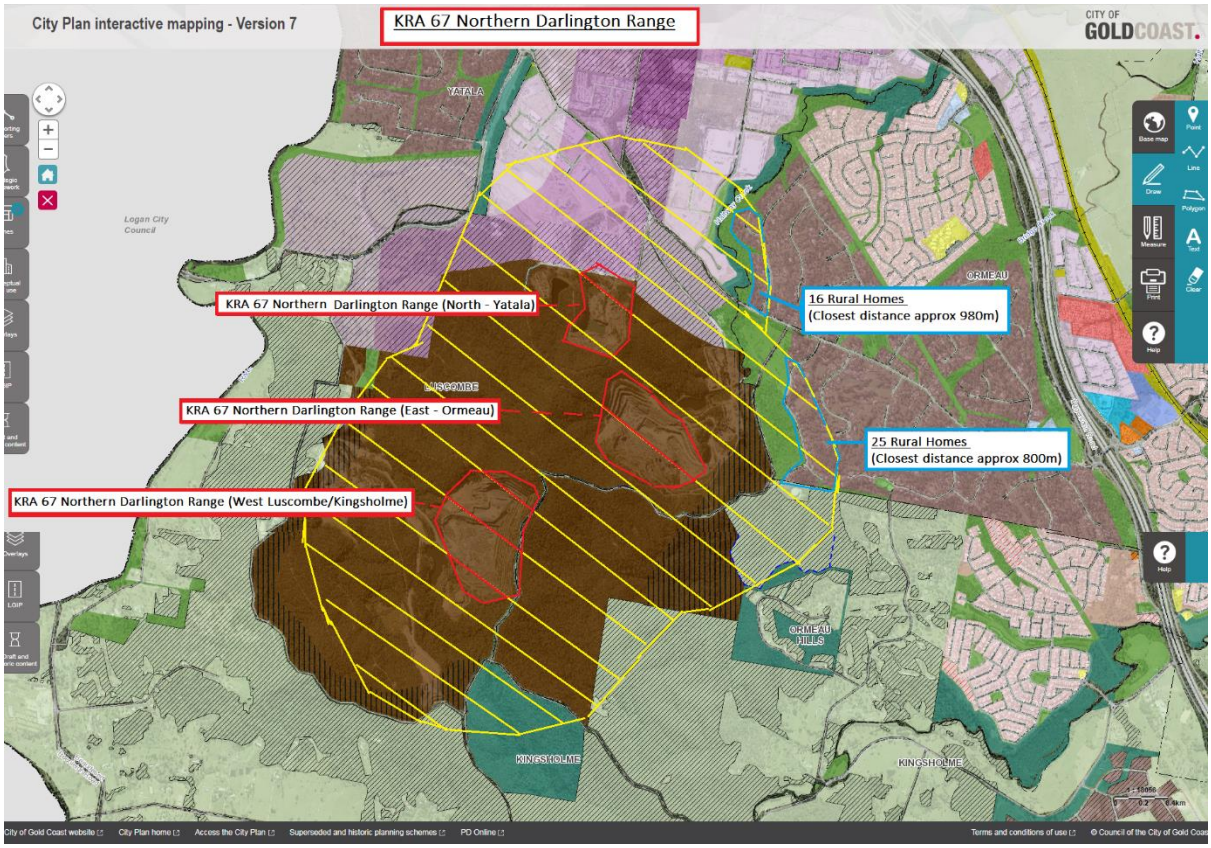


Attachment H6 - Fourth Schedule of Rezoning agreement

(note title: “FOURTH SCHEDULE’ has not been removed in this version)

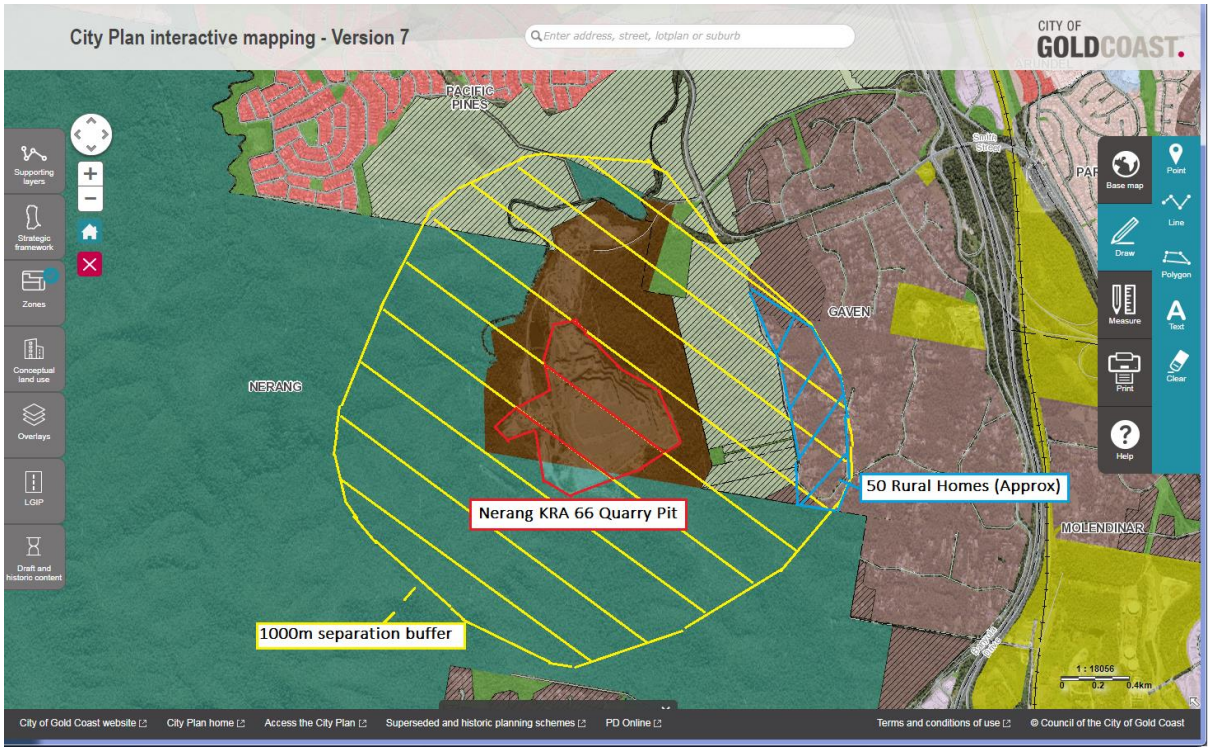


Attachment I1 - KRA 67 Northern Darlington Range (North, West and East)



Attachment I2 - KRA 67 Northern Darlington Range (South, Kingsholme and KRA 62 Blue Rock)

Attachment I3 - KRA 65 Nerang Quarry



Attachment I4 - KRA 68 Oxenford Quarry