

PROJECT

Technical Review

for
Parkworth Pty Ltd
1350 Pound Road
Clyde North

Information and Opinion on: “Environmental implications and appropriate “Buffer” for potential blasting at Tuckers Rd Quarry Clyde North”

I am a mining engineer who has specialised in explosives technology and commercial blasting applications for my 45 year career. As outlined in my CV (Appendix) I work in most areas of civil and mining blasting including opencut and construction blasting. A major portion of my work in the past 20 years has been in managing Risk Assessments, blasting project evaluation, auditing blasting performances and training engineers and shotfirers in safe & efficient blasting.



Nick Elith B.E. Mining
MAusIMM, Member ISEE
Principal Blasting Consultant
techNick Consulting P/L
Consulting Explosives Engineers

16 January 2014

Limit of Liability

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1. Background

- 1) There are plans to develop a residential and commercial precinct adjacent to a non-operational quarry. Quarry owners wish to retain the right to use explosives blasting if necessary, to rehabilitate the quarry excavation and comply with regulations.
- 2) A default "buffer zone" of 500m around the quarry has been suggested by planning authorities in the absence of any expert knowledge in relation to potential blasting activities.
- 3) A 500m buffer from the quarry will sterilise a large area of potential residential development. It is under question as to whether 500m is necessary to ensure safety of persons and property in any new housing development.

2. Executive summary

- 1) Areas in the northern sections of the quarry appear to be of soft to medium rock strength and any further work here will not require blasting.
- 2) Further earthworks and treatment of the underwater areas is unlikely to have any impact on residences if a 200m buffer were to be applied at the quarry boundary.
- 3) Even if blasting were to be the preferred option for further earthworks, blasting in the current softer rocks could be safely conducted with a 200m buffer zone from the quarry boundary to any residential housing or commercial infrastructure.

3. Scope

- 1) Visit the site and identify geology, quarry areas and infrastructure within and adjacent to the quarry.
- 2) Express an opinion on the methodology needed to contour the quarry so as to establish satisfactory batters and basic environment.
- 3) In the event that blasting should be considered necessary in order to rehabilitate the quarry site, this report outlines a review of potential 'best practice' drilling and blasting activities.
- 4) The principle side-effects or impacts of blasting are considered. (flyrock, vibration, airblast, dust and fumes)
- 5) We consider precedents for controlled blasting in proximity to occupied premises and the strategies consistent with safe practice.
- 6) The requirements of Australian Standard 2187 Part 2: 2006, Explosives Regulations and Workcover have been considered.

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4. Opinions

4.1 Visit site and identify geology and infrastructure

- **Geology and slopes of overburden and quarried stone**

A cursory inspection of the top 80m of the northern perimeter of the quarry indicates that most of this ground surface has batters or gradients of less than one-in-three (about 20° from horizontal). Such slopes would appear to not need significant earthworks to satisfy the rehabilitation requirements. Additionally, the overburden of around 2m to 4m appears weathered and of low strength. Such material has been previously contoured mechanically and would not need any blasting in order to further contour and reshape it. See Appendix A – Photographs A to E.

A number of boulders of harder ‘caprock’ or quarried stone were examined and found to be of weak to moderate strength. Such rock can generally be displaced and removed by excavators and rippers without the need for more expensive and complex blasting. See Appendix A – Photograph F.

- **Quarried benches underwater**

The angles and heights of the existing quarry benches are not clear because they are currently under water. If they needed significant rehabilitation such activity would not have much bearing on the northern property land development as the underwater areas are at least 150m from the boundary and over 300m from the subject allotment. See Appendix A – Photograph G & H.

Additionally it would be unlikely that any blasting would be required as the water-filled excavations would most likely either be left as lakes, be back-filled, or carefully contoured in order to achieve the necessary rehabilitation profiles.

Blasting in the quarry bench areas is not to be expected.

- **Existing main shed housing kiln**

The presence of the existing main shed means that no extraction or blasting could be performed within ~60m of the northern quarry boundary in this corner of the quarry and about 270m from the subject allotment.. See Appendix A – Photograph G & H.

- **30m unquarried bund and perimeter corridor on separate title**

There is doubt as to whether any quarry extraction would be permitted in this 30m zone even if an application were to be submitted. See Appendix A – Photograph H.

- **Main HV powerline and posts at ~ 150m from quarry boundary**

The presence of the main powerlines in the northern easement means that there would be restrictions on any intention to blast. See Appendix A – Photographs G & H.

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- **Small powerline and posts at ~ 20m from quarry boundary north**

As in the point above, the presence of the small powerlines in the northern easement means that there would also be restrictions on any intention to blast.

See Appendix A – Photograph G.

- **Local powerline and posts along edge of quarry boundary east**

As in the point above, the presence of the small powerlines along the eastern boundary means that there would also be restrictions on any intention to blast.

4.2 Methodology needed to contour the quarry.

As mentioned above, overburden of around 2m to 4m appears weathered and of low strength. Such material shows signs of having been previously contoured mechanically (using earthworks machinery) and would not need any blasting in order to further contour and reshape it.

In the unlikely event that blasting was considered suitable to facilitate rock breakage and earthworks, any such blasting in the rock zones would be very mild with low Powder Factor and ample stemming. Blasting of this type is often carried out in sensitive areas near houses and infrastructure and can be conducted so as to comply with regulations, so has limited impact on nearby properties. An example of the kind of blast design that would be used is given in the next section, so as to allow blasting impact calculations.

4.3 'Best practice' drilling and blasting

I have been involved in blasting for rehabilitation work at sites over the years. For completeness I provide here an example of the type of design that has been used in trimming hard rock benches to a suitable profile.

Blast design – Rehab shot

- Blasthole depth 5m
- Explosives charge ~ 12kg
- Powder Factor ~ 0.2 kg/m³

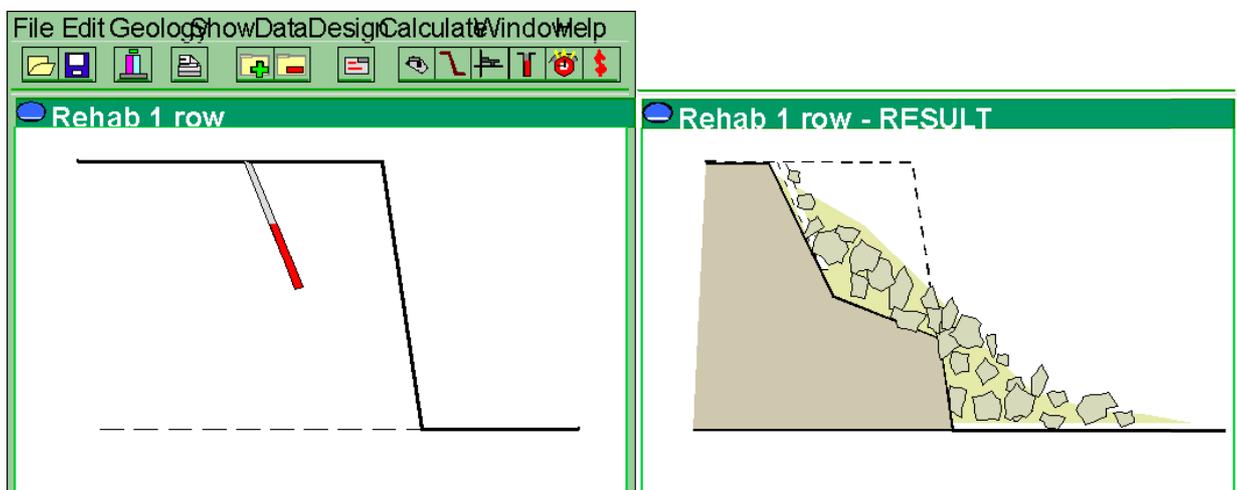


Figure: Trimming shot for bench rehab

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4.4 Environmental Impacts of blasting

Flyrock

For very low Powder Factors as illustrated in the previous design, there is minimal risk of flyrock beyond ~ 50m. Blasts of this type have large 'Burdens' and increased stemming lengths.

Vibration

AS 2187.2 2006 contains information specifically in relation to Vibrations from blasting, with detailed guidelines in APPENDIX J - TABLE J4.5(A) Portion is reproduced here;

Sensitive site*	Operations lasting for less than 12 months or less than 20 blasts.	10 mm/s maximum unless agreement is reached with occupier that a higher limit may apply
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Using the Australian Standard formula with an explosives charge of **12kg** per delay, the vibration at **200m** from the blast might be expected to be about **2mm/s** which is well below the allowable vibration for occupied residential houses (constant used for calculation is 1450)

Vibrations from rehab blasting will not cause any damage and will conform to standards.

Airblast

For very low Powder Factors as illustrated in the previous design, there is minimal risk of airblast problems. Blasts of this type have large 'Burdens' and increased stemming lengths.

Dust and fumes

For very low Powder Factors as illustrated in the previous design, there is minimal risk of large volumes of dust or fumes. Blasts of this type have large 'Burdens' and increased stemming lengths which means reduced ground movement and disruption.

4.5 Controlled blasting in proximity to occupied premises

There are numerous examples of controlled blasting work around Australia. I list here just a few examples.

- Quarry blasting has been routinely conducted at a Montrose quarry in much harder rock than that in question, for decades, with houses closer than 200m.
- Controlled blasting has been used in Victoria in recent times on the western Regional Rail Link project with houses closer than 100m (evacuated during the blast time) and occupied houses and buildings less than 200m away.
- Excavations were aided by blasting in the hardest rocks on the Eastlink project with houses less than 100m away.

There is no reason why controlled blasting in softer rocks cannot be safely conducted adjacent to residential housing.

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5. Conclusion

1. Most areas in the northern sections of the quarry appear to be of soft to medium rock strength and have been previously excavated and contoured mechanically. Further work here will not require blasting.
2. Any deeper and steeper rock faces in the quarry are currently underwater and hundreds of metres from the subject development allotment. Treatment of these unidentified, underwater areas is unlikely to have any impact on residences if a 200m buffer were to be applied at the quarry boundary.
3. Even if blasting were to be the preferred option for further earthworks, there is no reason why blasting in the current softer rocks cannot be safely conducted with a 200m buffer zone from the quarry boundary to any residential housing or commercial infrastructure.

Yours faithfully

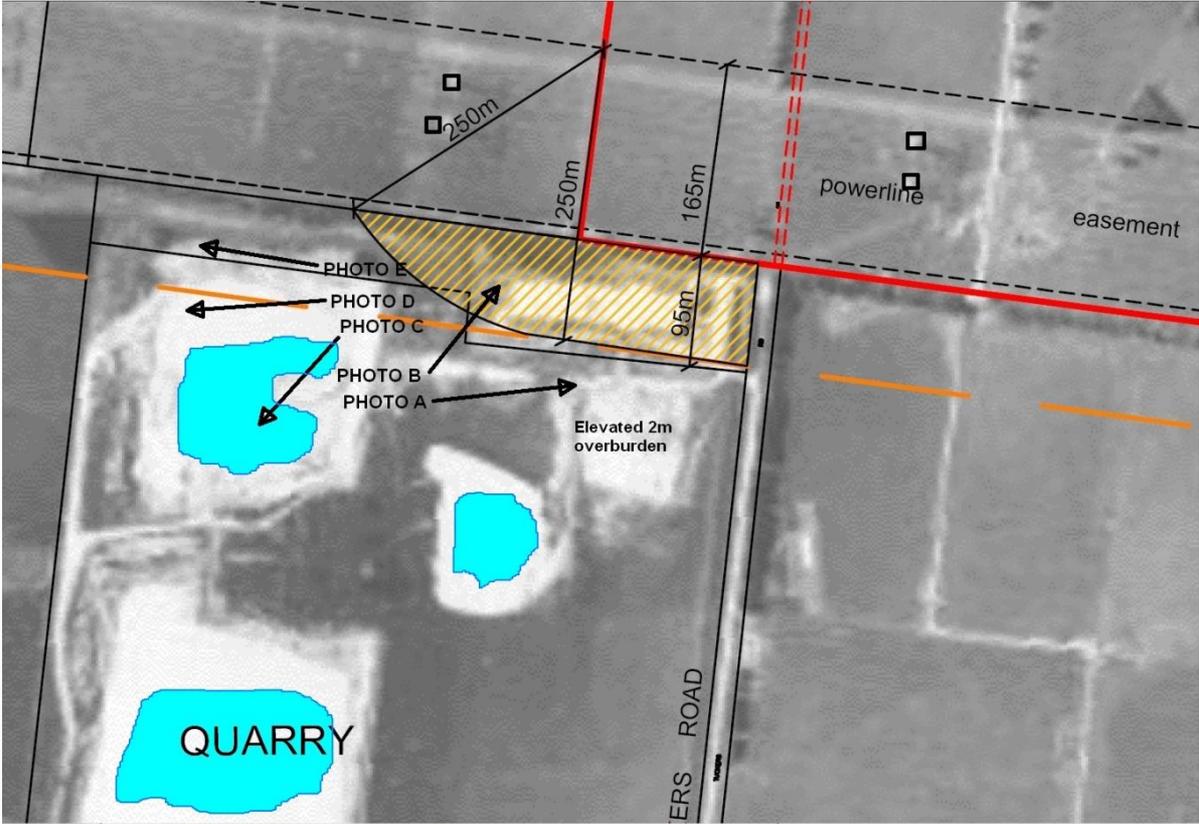


Nick Elith B.E. (mining)
Blasting Consultant



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6. APPENDIX A - Photographs



Photograph directions



PHOTO A NE corner Kiln shed broad view

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PHOTO B NE corner beside Kiln shed



PHOTO D NW lake view West batter

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PHOTO E NW lake view West bund



PHOTO F Weathered rock - overburden

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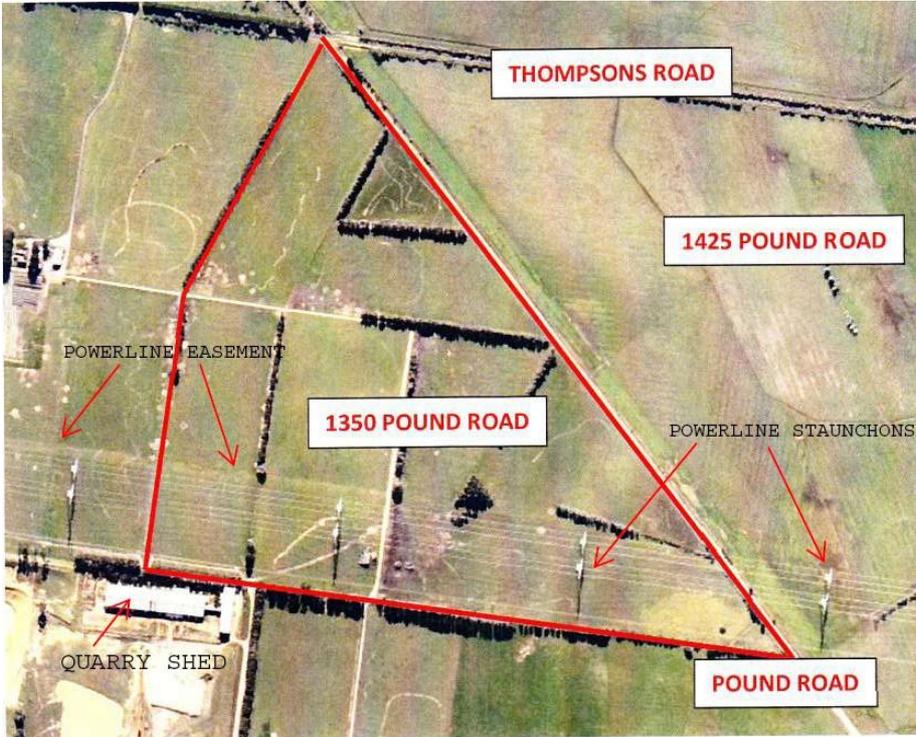


Figure 1: Aerial Location Plan
PHOTO G Allotment, powerlines & quarry shed

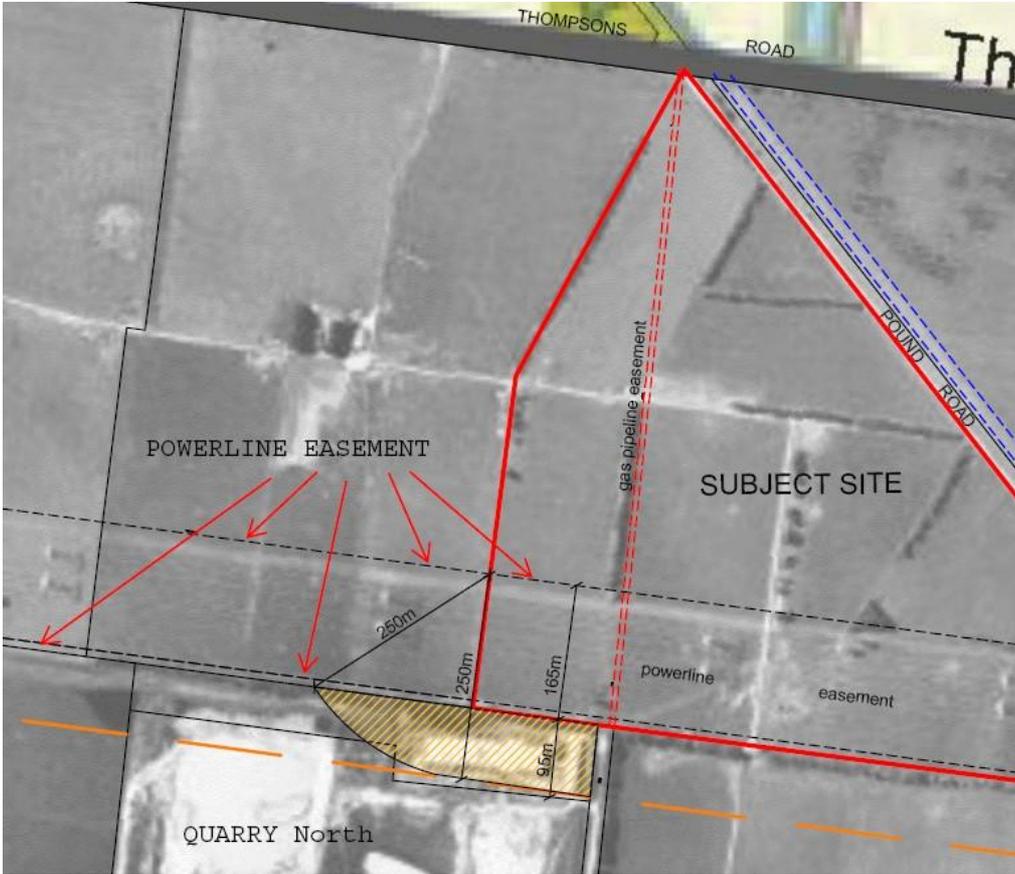


PHOTO H Quarry aerial view with easements & 250m zone

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7. APPENDIX B - Nick Elith - Qualifications and Experience

NAME NICK ELITH
Bachelor of Engineering (Mining)
University of Sydney 1971

POSITION Principal Blasting Consultant
TechNick Consulting P/L. - Consulting Mining Engineers

DATE OF BIRTH 1948

AFFILIATIONS Member; Australasian Institute of Mining & Metallurgy
Member; International Society of Explosives Engineers

EXPERIENCE Over 44 years involvement with explosives and blasting practices.

1971 - 1976 Explosives Engineer with ICI Australia (Australia's largest explosives supplier)
working as a blasting engineer throughout Australia in:

- Opencut and Quarry Blast Design and improvement
- Civil engineering, Construction, Roadworks and Excavations
- Initiation Systems design and development
- Underground blast design, Tunnelling, Shaft sinking, Stopping
- Safety and skills Training
- Submarine blasting, Harbour deepening, Offshore Oil-well operations
- New explosives development and field testing

1977 - Present:

Principle Blasting Consultant : technick Consulting Pty. Ltd.
Consulting to the mining, quarrying and construction industries in :

- ✓ Blasting principles and Blasting Physics applications
- ✓ Safety and Cost Efficiency in blasting; Opencut and Underground
- ✓ Blast Design and implementation - Opencut and Underground
- ✓ Conducting On-site drilling & blasting Operational Audits
- ✓ Initiation Systems application and design
- ✓ Field evaluation of new explosives and Initiation Systems technologies
- ✓ Technical writing: Blasting manuals, Operational Procedures
- ✓ Training resources, graphics, Safety / promotional materials
- ✓ Competency-based Shotfirer training
- ✓ Author of Opencut and Underground blasting manuals
- ✓ Demolitions: Structures, Buildings, Machinery (steel, concrete etc.)
- ✓ Submarine / Underwater blasting and demolitions
- ✓ Environmentally sensitive blast design, analysis and supervision
- ✓ Investigation of explosives accidents and Incidents
- ✓ Legal "Expert Witness" representation

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Advanced blast engineering and design

- Opencut and Quarry Blast Design and improvement
- Civil engineering, Construction, Roadworks and Excavations
- Initiation Systems design and development
- Underground blast design, Tunnelling, Shaft sinking, Stopping
- Underground Coal Mine Shotfiring, Training, Risk Assess, Design
- Accredited Safety and Blasting skills Training
- Submarine blasting, Harbour deepening, Offshore Oil-well operations
- Advise, design, execute unusual / sensitive construction / demolition projects:
- Control vibrations, air blast, flying fragments, underwater concussion
- Buildings, foundations, underwater, mechanical equipment,
- Recovery of jammed drill rods, pipes, liners, slag, operating equipment
- Calculate, predict environmental effects of blasting in critical areas
- Feasibility studies for controlled explosives applications
- Legal investigations, reporting and representation

Mining & Quarry Blasting

Current: All Aspects of Opencut blasting

- ✓ Tender Assistance, Safety, Risk management,
- ✓ Establish Blast Management Plans
- ✓ Designs, Cost Estimations, Product Recommendations,
- ✓ Auditing of Mine Drill & Blast Safety, Procedures and Optimisation
- ✓ Problem Solving, Incident and Misfire Response Management
- ✓ Special Methods, Wall Control, Fragmentation
- ✓ Productivity, Optimisation, Mine-to-Mill Studies

ONGOING: optimisation design and controls – critical environments

1971 – current: Design Blasting methods, Initiation, Optimisation

1971 – current: Advanced technical support to Mining / Quarry industries Aust-wide

1971 – current: Quarry blast designs NSW, VIC, WA, SA, NT, Tas, ACT, QLD

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Civil Engineering, Construction Blasting & Tunnelling

Current: All Aspects of Civil Works incl. Tunnelling

- ✓ Tunnelling Designs, Cost Estimations, Environmentals
- ✓ Foundations, Abutments, Spillways D&B Excavations
- ✓ Tender Assistance, Safety, Risk management,
- ✓ Designs, Cost Estimations, Product Recommendations,
- ✓ Auditing of Drill & Blast Safety, Management Plans, SWPs and Optimisation
- ✓ Problem Solving, Incident and Misfire Response Management
- ✓ Special Methods, Wall Control, Fragmentation
- ✓ Blasting Vs Mechanical Productivity, Optimisation Studies

ONGOING: optimisation design and controls – critical environments

Current Advanced technical support to Civil Construction industries Aust-Asia

2013 Site Audit UG Mine Drill & Blast Safety, Procedures and Optimisation - Mongolia

2012 - 2013 Rail widening close-proximity, sensitive blasting – Regional Rail VIC

2011 - 2013 Gas plant construction proximity blasting, wall control, Gorgon NWWA

2011 Sub-station proximity blasting, environmental specifications – ACT

2011 Underwater proximity blast design, Risk definition, costings - Qld

2011 Pipeline construction -proximity blasting, blast design – Water Authority NSW

2011 Water pipeline proximity blasting, Audit blast designs – Murrumbidgee NSW

2011 Dam construction Proximity blasting, Audit blast designs - Cotter ACT

2010 Pipeline Risk Assessment, Procedures, blast designs – Moomba Gas pipe QLD

2010 Dam Procedures, Expert Reviews, Audit blast designs Keepit Dam NSW

2010 Dam construction Procedures, Reviews, Audit blast designs - Cotter ACT

2010 Dam Procedures, Expert Reviews, Audit blast designs Googong Dam NSW

2010 Rail extension project - Procedures, Reviews, Audit designs - VIC

2010 Pipeline trench blasting adjacent to old existing pipelines – Specifications QLD

2010 Satellite dish foundations Procedures, Reviews, blast designs - ACT

2009 Pipeline excavation blasting onshore to offshore Design, Risk Assess - NWWA

2009 Water pipeline relocation near major Communications facilities - Townsville

2008 -10 Protection of Ancient Rock-Art - Procedures, Reviews, Audit blasts - NWWA

2008 Highway Roadworks expansion, Cuttings - Design, Risk Assess - S NSW

2008 Ocean outfall / Desalination pipeline feasibility- Design, Risk Assess - SA

2007 Pipeline excavation blasting onshore / offshore Design, Risk Assess - SWWA

2007 Foundations Industrial Estate D&B Procedures, Reviews, blast designs - ACT

2006 Industrial Estate foundations D&B Procedures, Reviews, blast designs - ACT

2006 Foundations Industrial Estate D&B Procedures, blast designs, Misfires - VIC

2006 Road widening, Cutting project - Procedures, Reviews, Designs NWWA

2000 to 06 Jammed auger near city hospital – blast free Melbourne - VIC

2000 to 06 Hydro dam tunnel blast designs NSW

2000 to 06 Underground shaft risk assess, design approvals – City Melbourne - VIC

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Environmental Blasting and Controls

Current: Regular assessment and prediction of blasting effects & impacts

Environmental calculations & design near houses, optics, cables, pipes, shafts, liquid tanks, bridges, 'green' concrete and sensitive sites

- 2012 - 2013 Rail widening close-proximity, sensitive blasting – Regional Rail VIC
- 2012 - 2013 Environmental implications blasting for new mines - NZ
- 2011 - 2013 Gas plant construction proximity blasting, wall control, Gorgon NWWA
- 2011 Proximity blast design, Risk definition, underwater near jetties - Qld
- 2011 Sub-station proximity blasting, environmental specifications – ACT
- 2011 Pipeline nearby Review, Risk Assess blast design – ACT dam construction - ACT
- 2011 Gas plant construction proximity blasting, wall damage, specifications – Gorgon NWWA
- 2011 Underwater proximity blast design, Risk definition, costings - Qld
- 2010 Pipeline Risk Assessment, Procedures, blast designs – Moomba Gas pipe QLD
- 2010 Pipeline nearby Review, Risk Assess blast design – QLD
- 2010 Foundations near Satellite dish Procedures, Reviews, blast designs - ACT
- 2010 Review / Approve blast design damage Risk – Cotter Dam - ACT
- 2010 Bridge nearby, Review blast design damage Risk – Mackay QLD
- 2010 Review / Approve blast design damage Risk – Keepit Dam - NSW
- 2009 - 10 Review blast damage Risk – Googong Dam refurbishment - NSW
- 2009 Blasting near ventilation services –Tunnel development Narrabri NSW
- 2009 Blasting near critical services – UG Coal mine - NZ
- 2009 Environmental impacts of blasting underwater near marine habitats (SA, WA)
- 2009 Blasting near critical underground pipes – Tunnel development coal mine - NSW
- 2009 Blast design & Risk Assessments – Dam construction near infrastructure ACT
- 2008 Blast design & Risk Assess – construction near infrastructure WA, NSW
- 2006 - 2010 Risk manage / Design / Audit proximity blast proc - Heritage sites Karratha WA,
- 2005 Design & environment calcs for blasting near Melb city hospital - VIC
- 2002 /06 Various mine extension EIS supporting reports: Drilling & Blasting effects
- 2001 Mine extension environmental effects, blast designs NZ
- 2000 /06 Guest lecturer – Melbourne University “Environmental Risk” - VIC
- 2000 /04 Conduct Risk Assessment studies for sensitive blasting near dams, electronic switchgear, sensitive facilities, overhead / underground services - various
- 2001 Blast mine Portal Tasmania, 5m from pipelines, 30m from workshops - TAS
- 1998 Close proximity blasting 3 metres from highway; Wollongong NSW
- 1998 Blasting consultant to Botany underground LPG tanks study - NSW
- 1998 Controlled blasting amongst major LPG tanks - Woodside Petroleum; WA
- 1996 Investigation / Clearances at Canberra Hospital Implosion - ACT
- 1993, 94 Blast design, vibration, air blast monitoring of tunnelling works - homes, school, temples, within tens of metres in - Taiwan
- 1971 – 2008 Design blasting to optimise productivity and minimise disruption to locality - various