



ABN 004 117 828

Orica Quarry & Construction Services
1 Nicholson St, MELBOURNE, VIC, 3000

Blasting Management Plan and Work Method Statement

Project Identification

Young – Wagga Wagga Loop Pipeline Project

Prepared and Authorised by :

Melanie Hodgson
Technical Service Engineer
Orica Quarry & Construction Services - NSW

Table of Contents

1.	Scope of Work.....	3
2.	Document Control	4
3.	Specific WH&S and Blast Management Items.....	5
4.	Risk Assessment.....	8
5.	Implementation Plans.....	9
6.	Other Procedures and Documents	10
Appendix A	Risk Assessment - Blasting Operations	12
Appendix B	Site Specific Pre-Blast Checklist	20
Appendix C	Trial Blast Designs	21
Appendix D	Personnel List	23
Appendix E	Site Specific Blast Clearance Procedure	24
Appendix F	Instructions for Blast Sentries (Guards)	26
Appendix G	Radio Phrases for Blasting.....	27
Appendix H	Instructions for Security Guard on Sleeping Shot	29
Appendix I	Definitions	30
Appendix J	Index Mapping to AS2187.2-2006 Appendix 2.....	31
Appendix K	Sign Offs	33

1. Scope of Work

WDS have been contracted to lay the 61 kilometres of pipeline required for the Young-Wagga Loop Pipeline Project. During trenching operations hard rock was encountered that requires blasting.

WDS have engaged Orica Quarry Services to design and implement a blasting method that breaks the rock to a manageable size for excavation while ensuring that the existing gas pipeline situated seven metres parallel to the trench is not damaged by the blast.

It is proposed to fire a test blast initially to confirm the maximum instantaneous charge weight(MIC) for the vibration allowed at the pipeline. This will be followed by the main blasting, broken up into manageable sized blasts based on the conditions.

Project Principal :	APA Group
Client :	WDS
Blasting Contractor :	Orica Quarry and Construction Services
Drilling Contractor :	To be advised

2. Document Control

This is a controlled document, frequently amended and updated as site conditions change and procedures are amended. This document is controlled by the Author. Check with the Author that you have the latest copy before using this document. The revision in use will be identified by the date and time of printing shown on the bottom of each page.

Author : Melanie Hodgson Orica Quarry and Construction Services Ph 0423 783 489

Distribution Register : These people will be sent new copies of the document each time it is amended :

Garrett O'Mahony	Assistant Project Manager - WDS	garrett.omahony@divcon.com.au
Cam Harbrow	Area Manager - Orica Q&C	cam.harbrow@orica.com

Revision List

Date	By	Revision Details
13/7/10	M. Hodgson	Initial Issue
28/7/10	M Hodgson	Review and addition – Environmental Limits

3. Specific WH&S and Blast Management Items

Legislative References, Codes of Practice and Standards

The following have been identified as specifically relevant to the activities to be undertaken.

- Explosives Act of 2003 (NSW)
- Explosives Regulation of 2005 (NSW)
- Australian Standard 2187.2 Use of Explosives
- Australian Explosives Code (AEC) (6th Edition)

High Risk Construction Activities

The following High Risk Construction Activities are expected to occur on this job :

High Risk Construction Activity

Entering a Trench more than 1.5m deep	N
Using explosives;	Y
Entering a confined space;	N
Using a hazardous substance;	N
Working where the person could fall at least 2.0m;	Y
Doing asbestos work or demolition work;	N
Working near moving powered mobile plant at a workplace;	N
Working in, over or adjacent to water where there is a risk of drowning;	N
Working on, or adjacent to, a road or railway;	N
Working on or near a pressurised gas distribution mains or pipes;	Y
Working near exposed energised electrical installation;	N
Other work that could result in death or bodily harm :	N

The following activities are NOT covered by this risk assessment as these are activities to be undertaken by other parties :

- **Drilling Blastholes.** The drilling contractor is to prepare and implement his own Work Method Statement.

Responsible Persons

Engineer	Skill / Competency / Licence	Expires
Melanie Hodgson	Technical Service Engineer	n/a

Shotfirers	Skill / Competency / Licence	Expires
Jonathon Keller	NSW Expl Licence #05-101832-001	24 July 2013

The shotfirer and engineer for each blast in a project may vary from time to time. The responsible shotfirer for each blast is named on the front of the Orica Jobpack Folder.

The Orica Shotfirer will provide supervision of Orica activities. The Shotfirer will inspect and assess the work area before starting work and will have the final authority regarding all aspects of the work related to Orica's contract while onsite.

The Orica Engineer is responsible for cross checking the shotfirer's work and updating the Site Data Sheet as required when the blast design parameters change.

Consultation

Orica operate a system of blast classification from Class 1 (simple blasts) to Class 4 (complex blasts). The blast design must be cross checked and reviewed by others, with the level of review being commensurate with the class of blast. Full details are contained in the Orica Shotfirer's Work Instructions (SWIs).

Orica use the "Take 5" system for conducting daily pre-start assessment of working conditions and on-the-spot hazard assessment.

Electrical Equipment

Orica propose to bring the following electrically powered portable equipment on site :

- o nil

Personal Protective Equipment (PPE)

The minimum standard of PPE required by Orica is :

- * Hard Hat, Safety Boots, Safety Glasses
- * Long sleeves and long trousers (hi-visibility)
- * Hearing Protection, Respiratory Protection, Face Shields if required
- * Gloves (When operating)
- * Dust Masks (when required eg. Working near drill)

Hazardous Substances

The Orica Engineer will provide Material Safety Data Sheets to the client for all explosives and ancillary chemical items brought on site. Up to date MSDSs for all Orica products can be obtained from www.oricamining.com.

Lifting Gear

Orica do not propose to bring any lifting gear on site.

Plant

Orica propose to bring a light vehicle (Shotfirer's Vehicle) to site.

Supply of Explosives

All explosives and related accessories will be supplied by Orica from their licensed plant at Marulan, NSW. All unused explosives will be securely stored in the registered magazines on the shotfirer's vehicle.

Warning Signs and Control Measures

Warning signs will be erected around the blast area.

Accidents and Incidents

All accidents and incidents are to be reported to WDS and Orica. See the list in Appendix C for details of contacts to be notified.

Fire Protection

Fire extinguishers on light and heavy vehicles are checked daily as part of the Orica Pre-Start checklist. Light Vehicles are equipped with one 1.5kg dry chemical extinguisher.

Permits and Licences Required

Permission to blast from Workcover, Local Council and Landowner is required. This is to be sought by WDS.

Environmental Limits

All blasts will be designed to generate overpressure and ground vibration results below those limits specified in the Project Approval, specifically below 115dB_L overpressure and 5mm/s peak particle velocity at the nearest affected residence.

4. Risk Assessment

A Risk Assessment for the job is contained within Appendix A. The following points were identified as the greatest risk or hazards to be addressed:

Summary of Risk Brainstorming Points

- Working and driving on unstable ground
- Transport of Explosives
- Storage of Explosives – risk of loss or theft
- Key Personnel – ensuring availability of
- Flyrock – damage to surrounding pipes on surface.
- Vibration – damage to existing gas pipeline
- Rushing – to meet fixed blast times

Summary of Risk Matrix and Conclusions

- WDS to prepare access to blast area and safe working surface
- Explosives to be transported in approved vehicle
- Explosive vehicle to be under supervision or empty overnight
- 200m exclusion zone for blasting.
- Existing pipeline to be exposed and monitored during blasting.
- Key personnel to be made available
- Charge weights to be designed for max PPV of 50mm/s
- Blast to be sized to allow loading and firing in one day without rushing.

5. Implementation Plans

The following plans and responsibilities have been identified from the Risk Assessment and must be executed before the commencement of the project.

ACTIONS	PERSON
Establish "No Smoking" onsite while explosives are onsite	WDS
Obtain/submit notifications to Workcover	WDS
Provide written and verbal communications to neighbours if applicable	WDS
Provide additional blast sentries (2) where needed	WDS
Provide stemming (7-10mm clean drainage aggregate) and place in piles as directed by Orica	WDS
Design, Load and Fire Blast	Orica
Prepare Blast Clearance Procedure and instruct sentries	Orica
Monitor Gas Pipeline during blasting operations	Orica
Provide access to existing pipeline for monitoring	WDS
Provide survey control of pipeline alignment and depth to invert	WDS
Contingency plan for sleeping blast overnight	Orica/WDS
Contingency plan for overloaded / bridged blastholes	Orica
All personnel involved in Risk Assessment meeting to sign off	ALL
All personnel involved in job to sign onto this document	ALL

6. Other Procedures and Documents

This section details other Orica documents that form an integral part of the Blast Management Plan. The objective of the Blast Management Plan is to ensure the safety of all personnel is maintained and appropriate environmental controls are in place. A Blast Management Plan is required to conform to AS2187.2 Appendix A.

The process of developing the Blast Management Plan commences with a site visit by Orica personnel to record and assess the Site Safety Management Plans already in place on the customer site. Orica personnel conduct a Risk Assessment to identify risks that people may be exposed to while working on the customer site.

The Blast Management Plan comprises the following documents;

- **Customer Site Risk Review** – A review of safety processes already existing at the site, conducted before commencing work on site for the first time.
- **Risk Assessment** – Assessment of all risks associated with blasting operations at the site. Identifies site-specific gaps in existing procedures, including the Shotfirer's Work Instructions. Updated and reviewed as the task, conditions or method of work changes.
- **Orica Shotfirer's Work Instructions (SWIs)** - a standard set of existing Orica Procedures that are used to manage everyday blasting operations and control blasting risk. A copy of these is carried by the shotfirer at all times.
- Customer Procedures as applicable.

Orica Job Pack

The blast designs and blast records will be contained in the standard Orica "Jobpack". A jobpack is prepared for each blast and is kept on file by the local Orica plant office. The jobpack contains all standard records of the blast including :

- Pre-blast survey data and boretraking (if applicable)
- As-drilled depths and locations of all blastholes
- Record of short or blocked blastholes
- As-loaded record of all short or blocked blastholes
- Types and quantities of initiating explosives and packaged explosives used;
- Types and quantities of bulk explosives used;
- Initiation plan including charge mass per delay (MIC) and method of initiation
- Vibration and Airblast records

Orica Site Data Sheet (SDS)

Under normal Orica Quarry Blasting procedures, the blast design parameters to be used for a specific site will be contained in the "Site Data Sheet" (SDS). The SDS will be updated if blast design parameters change. The Site Data Sheet is an integral part of the blast management plan, and is kept in the Orica Jobpack for each blast. In the case of construction blasts, the Site Data Sheet may be represented as a series of design drawings (Drill design, Loading design, Cover design, Initiation design) to facilitate more effective communication of detail.

Blast Evaluation Report

After each blast the Orica Shotfirer will complete a one page "Blast Evaluation Report" outlining the general results of the blast, quantities used, volume of the blast, monitoring results and any other notable occurrences. This will be kept in the jobpack.

Main elements: (from AS / NZS 4360:2004)

- a) Communicate & Consult
- b) Establish Context
- c) Identify Risks
- d) Analyse Risks
- e) Evaluate Risks
- f) Treat Risks
- g) Monitor & Review

Communicate & Consultation Steps:

- Consider costs, payment and liability for Orica conducting risk assessment.
- Physically visit and “walk” the area of any blasting proposal.
- Convene a meeting in a location with whiteboard / write-up capability.
- Gather a team of persons familiar with the site and blasting objectives.
- Review the objectives of any blasting proposal.
- Specify a “typical” blast design that might be anticipated.
- List potential hazards associated with setting up, charging and firing such a blast.
- Describe the expected environmental and other potential effects of such a blast.
- Locate site plans covering the full potential range of vibrations, airblast, flyrock.
- Highlight circles of radius around blast site (eg 10 m, 50 m, 100 m, 200 m, etc.)
- Identify all equipment, services, facilities within target ranges.
- Use the assessment sheets provided to identify the hazards, determine the risk and identify the controls associated with each potential target or hazard.
- Document these on the risk management forms.
- Determine whether each hazard can be safely reduced and managed.
- Arrange to draft site-specific operational procedures covering all aspects of the blasting process.
- After completion, have qualified persons review the draft and when completed produce the final operational procedure documentation.
- Ensure every appropriate person on site is familiar with the assessments and the procedures in place to ensure safety.
- Measure and record blast outcomes and effects.
- Complete summary report after blasting as required by law and site procedures.

Context of Risk Assessment

When identifying blast-related hazards, we consider:

- | | |
|--|--|
| <input type="checkbox"/> Regulation requirements | <input type="checkbox"/> Operator competence |
| <input type="checkbox"/> Other activities in area | <input type="checkbox"/> Delays in charging / firing |
| <input type="checkbox"/> Associated tasks | <input type="checkbox"/> Neighbours |
| <input type="checkbox"/> Site layout | <input type="checkbox"/> Traffic/ Speed limits |
| <input type="checkbox"/> Property in non-safety zone | <input type="checkbox"/> Restricted areas / Signs |
| <input type="checkbox"/> Internal property damage | <input type="checkbox"/> Face / ground conditions |
| <input type="checkbox"/> Power lines, underground services | <input type="checkbox"/> Geology |
| <input type="checkbox"/> All weather conditions | <input type="checkbox"/> Off-spec drilling, lost holes |
| <input type="checkbox"/> Timing of activity | <input type="checkbox"/> Oversize |
| <input type="checkbox"/> Safety equipment needed | <input type="checkbox"/> Toe |
| <input type="checkbox"/> Visitors and contractors | <input type="checkbox"/> Backbreak |
| <input type="checkbox"/> Uneven surfaces | <input type="checkbox"/> Airblast, Vibration |
| <input type="checkbox"/> Vehicle suitability | <input type="checkbox"/> Evacuation areas, Road blocks |

BLASTING RISK ASSESSMENT TABLE (Acknowledgement to Orica Australia)

L (Likelihood) X C (Consequence) = R (Risk)

Likelihood of Occurrence	Potential Consequences					
	5 Notable	10 Significant	15 Highly Significant	20 Serious	25 Very Serious	30 Catastrophic
Probable	25	50	75	100	125	150
Possible	20	40	60	80	100	120
Unlikely	15	30	45	60	75	90
Very Unlikely	10	20	30	40	50	60
Extremely Unlikely	5	10	15	20	25	30

Likelihood of Occurrence

5	Probable	A common occurrence. The event is expected to occur in most circumstances.
4	Possible	Event will probably mostly occur - known to have happened in similar situations.
3	Unlikely	The event could occur but not expected.
2	Very Unlikely	The event may occasionally occur at some time but rarely
1	Extremely Unlikely	The event may occur only in exceptional circumstances.

Note that the risk estimations and “weightings” are subjective and based on the experience and interpretation of those persons contributing to the study. For matters relating to blasting technology and design this is mostly provided by the writer of this report.

Orica Australia takes all reasonable efforts to ensure an accurate understanding of client requirements. The information contained in this report is as accurate and up-to-date as possible based on this understanding. Orica Australia accepts no liability to any person for any injury, loss or damage resulting from the use of or reliance upon the information contained in this report or for any injury, loss or damage resulting from the omission of any information in this report. No expressed or implied warranties are given other than those implied mandatorily by Commonwealth, State or Territory legislation.

Orica Internal Hazard Management Table

Risk	Who Signs Off	Type of Investigation
1-10	Shotfirer / Supervisor	Site visit, sign off note in job pack
11-20	TS Blasting Engineer	Site visit, report in job pack
21-50	Snr TS Engineer / Project / Business Mngr	Site visit, Risk report in job pack
Over 50	Must be reduced	Unlikely to accept work

Potential Consequence Examples

	Notable	Significant	Highly Significant	Serious	Very Serious	Catastrophic
Safety & Health	1 Minor Injury	Single MTI	Single LWC or Multiple MTI	Permanent disability or Multiple LWC	Single Fatality	Multiple Fatality
Environment	Very Minor pollution	Minor Local pollution	Evident Pollution local concern	Significant Local pollution	Major Local pollution	Extremely Severe pollution
Reputation and Image	Minor issue 1 complaint	Local issue 10 complaints	Local media 100 complaints	Regional or state media	National media coverage	Headlines, corporate damage
Services / Business Interruption	Minor re-connection required	Minor temporary loss of resource	Short-term supply loss of major resource	Medium term supply loss for major resource	Long term loss of production and/or major resource	Permanent loss of production and/or major resource
Business Liability	>\$5000	>\$50,000	>\$200,000	>\$1m	>\$15m	>\$50m

BLASTING RISK EVALUATION GUIDE (ISEE)

The Journal of Explosives Engineering, July/ August 2000

Concern	Primary Impacts	Controls
Flyrock	Damage and Injury	Pre-qualification requirements, blasting controls (blast mats-burden requirements) stemming requirement blast plan reviews, and inspection work.
Structural damage to buildings	Damage claims, work delays or suspension	Pre-qualification requirements, blasting controls, blast plan submittals and reviews, careful inspection of work, public education, effects monitoring and pre, blast condition surveys.
Damage to rock slopes and final excavation walls	Rock fall , remedial slope repairs, work disruption	Evaluate in situ condition of slopes and install additional support is needed. Develop blasting controls and carefully monitor the work.
Damage to buried pipes and utilities	Unrealistic restrictions or total ban on blasting	Pre-qualification requirements, blasting (controls, blast plan submittals and reviews, careful inspection of work, effects monitoring and blasting effects evaluation study by expert.
Startled people	Complaints	Inform neighbours before each blast.
Damaged water wells or aquifers	Blasting prohibition or project delays	Blasting controls, pre-blast / post blast inspections, effects monitoring and blasting effects evaluation study by expert
Environmental Impacts or other Animal Effects	Disapproved EIS, blasting prohibition or delays	Blasting controls, pre-blast and/or post. blast inspections, and blasting impacts and mitigation study by expert.
Work or business disruption	Financial damage claims and/or organised opposition to the work	Public education, blasting controls, monitoring and schedule blasting during non-working hours.
Contractual Claims and Legal Actions	Financial damages	<i>Owners and Engineers:</i> Have appropriate experts review contract documents and specifications. Prepare pre-qualification requirements to ensure personnel are capable of performing the work, and carefully inspect and document all non-conforming work. <i>Contractors:</i> Carefully evaluate all available documents-including all geotechnical information, attend pre-construction meetings, document all efforts to conform and barriers to conformance

Blasting Job Safety & Risk Assessment Form .. YWL Pipeline Project							Page / Date 13/Jul/ 10			
Event or Activity	Potential Hazards & Effects	L	C	R	Possible Elimination Measures	Comments	L	C	R	
Commit Key Personnel	Limited number of qualified and inducted personnel in the event of sickness or other problem will delay project.	4	10	40	Prepare Key Personnel with advance notice and inductions. Coordinate with site to allow for maximum notice for scheduling of personnel		2	10	20	
Obtain Blast Permits and Notifications	Notification not submitted. Notification to neighbours not done.	5	5	25	Notification by Orica Neighbours notified by WDS		1	5	5	
Design Blast	Poor Blast Design may lead to safety, environmental or productivity problems (flyrock, vibration, misfires, hard digging).	5	15	75	Blast design to be documented in Job Pack Cross check of blast design internally within Orica Adopt design measures to reduce the risk of misfires, flyrock and vibration.	Fragmentation will be limited by small charge weight required to control vibration and flyrock	2	10	20	
Mark Out Pattern	Mark out holes in wrong place Marks may get moved or lost	5	5	25	Use survey control to and ensure holes marked in correct location.		3	5	15	
Drill Blastholes	Holes drilled to wrong depth or in wrong place – fail to achieve grade. Holes blocked after drilling or redrills not remedied – poor fragmentation	3	10	50	Supply drilling plan to driller Driller to use hole collar protection if required. Drilling contractor to supply own WMS.	WDS to confirm if they prefer overbreak or underbreak. Orica and WDS to agree on subdrill accordingly.	1	10	10	

Blasting Job Safety & Risk Assessment Form .. YWL Pipeline Project							Page / Date 13/Jul/ 10			
Event or Activity	Potential Hazards & Effects	L	C	R	Possible Elimination Measures	Comments	L	C	R	
Access worksite	Unable to access site due to weather	5	10	50	Coordinate with WDS to plan for blasting during acceptable weather conditions		1	5	5	
Secure Worksite	Other activities or people in work area may conflict with blasting.	3	20	60	Check with Trenching Supervisor that no other activities are occurring onsite.		1	20	20	
Select Blast Time	Blast time fixed too far in advance – rushing	5	10	50	Blast times to be agreed between Shotfirer and Trenching Supervisor.	Neighbours should not be notified of fixed firing times. Specify a window of 4 hours minimum.	1	10	10	
Transport Explosives to worksite	Wrong quantity of explosives brought to site – project delay	5	5	25	Orica engineer and Shotfirer to prepare IE/HE manifest required to ensure sufficient stock onsite.		2	10	20	
Store Explosives at worksite	Theft, Loss Fire	3	25	75	Explosives to remain under control of SSAN cleared Orica person or locked in Vehicle. Daily reconciliation of quantities used. Theft or loss to be reported. Fire near explosives vehicle will demand immediate relocation of vehicle or evacuation.		1	25	25	

Blasting Job Safety & Risk Assessment Form .. YWL Pipeline Project						Page / Date 13/Jul/ 10			
Event or Activity	Potential Hazards & Effects	L	C	R	Possible Elimination Measures	Comments	L	C	R
Return unused explosives to magazine	Magazines are not accessible at all hours. Long drive back to magazines – fatigue issue	3	10	30	Orica Engineer & Shotfirer to plan delivery and return of unused explosives within timeframe. Quantities brought to site to match exact requirements whenever possible, or use up excess stock onsite so no return is required.		2	5	10
Check and Load Blastholes	Holes not deep enough – will not achieve design depth. Incorrect quantity of explosives loaded – vibration / fragmentation problems Explosives jammed in blasthole – flyrock / airblast	5	15	75	Design extra depth, overdrill holes and backfill as required. Orica Shotfirer responsible for ensuring correct quantity is loaded and reconciled. Work area must be free of standing water.		2	10	20
Tie Up Blastholes	Incorrect initiation sequence may cause vibration or frag problems. Missed connection will cause misfire.	5	15	75	Orica Shotfirer to do tie-up Orica Engineer to check tie-up		2	10	20
Clear Blast Area	Failure to clear could result in death or injury	4	25	80	Orica Shotfirer and Engineer to develop written blast clearance plan. Orica to brief blast guards.		1	25	25

Blasting Job Safety & Risk Assessment Form .. YWL Pipeline Project							Page / Date 13/Jul/ 10			
Event or Activity	Potential Hazards & Effects	L	C	R	Possible Elimination Measures	Comments	L	C	R	
Arm Monitors	Miscommunication could mean monitors are not armed.	3	10	30	Orica Engineer to supervise and communicate with Shotfirer to ensure monitors are armed before firing.		2	10	20	
Fire Blast	Breakdown in blast clearance – personnel in area Delays due to initiation problems. Communication with community / monitors.	4	20	80	Written blast clearance plan required. Communication method to be established to confirm if/when blast will be fired		1	20	20	
Vibration	Existing pipeline damaged by vibration	4	25	100	Blasts designed to MIC determined from test blast to be within allowable vibration levels as outlined in the project approval. Pipeline to be monitored during blasting.	Damage to pipeline highly unlikely even if vibration limit is exceeded many times.	1	25	25	
Flyrock	May damage infrastructure, equipment or people	4	20	80	200m exclusion zone radius. Surrounding pipes to be covered or moved if necessary.		2	10	20	
Check for misfires	Misfires pose a high threat to excavator operator and future users of spoil	3	20	60	Check blast and all test holes for visible signs of misfire. Orica crew to carry out explosive identification TBT for WDS excavation crew		1	10	10	

Blasting Job Safety & Risk Assessment Form .. YWL Pipeline Project						Page / Date 13/Jul/ 10			
Event or Activity	Potential Hazards & Effects	L	C	R	Possible Elimination Measures	Comments	L	C	R
Clear Blast	Leaving misfires	3	20	60	Orica Shotfirer or Engineer to confirm no visible misfires.		1	15	15
Muck out blast	Not the subject of this JSERA				Not the subject of this JSERA JSERA for this activity to be completed by WDS				
Review JSERA					This JSERA is to be reviewed after each blast.				

Appendix B Site Specific Pre-Blast Checklist

This checklist is to highlight actions specific to the site that are to be completed during loading and before each firing.

Pre-Blast Checklist	By	Completed	Comments
Before first blast			
Orica personnel to attend induction onsite before starting work			
Minimum 1 day before loading			
Ensure stemming is in place			
Day of the blast (start of shift)			
Orica Shotfirer to conduct pre-blast meeting.			
30 minutes before the blast			
Secure area			
Orica Shotfirer and WDS site supervisor meet and confirm blast area is clear.			
After the blast			
Orica Shotfirer to confirm no visible misfires to WDS.			

Appendix C Trial Blast Designs

The following formulae will be used to calculate vibration results.

$$\text{Vibration} \quad V = K \left(\frac{R}{\sqrt{Q}} \right)^{-n}$$

where R=distance in m, Q=Mass in kg,
V = Vibration in mm/s
K, n = coefficients determined in field

The design kilograms of explosives per hole will be determined based on the above formula in correspondence with the allowable 50mm/s limit on the gas pipeline.

Using a conservative K coefficient the test blasts will be fired with an MIC from 0.15kg to 0.5kg.

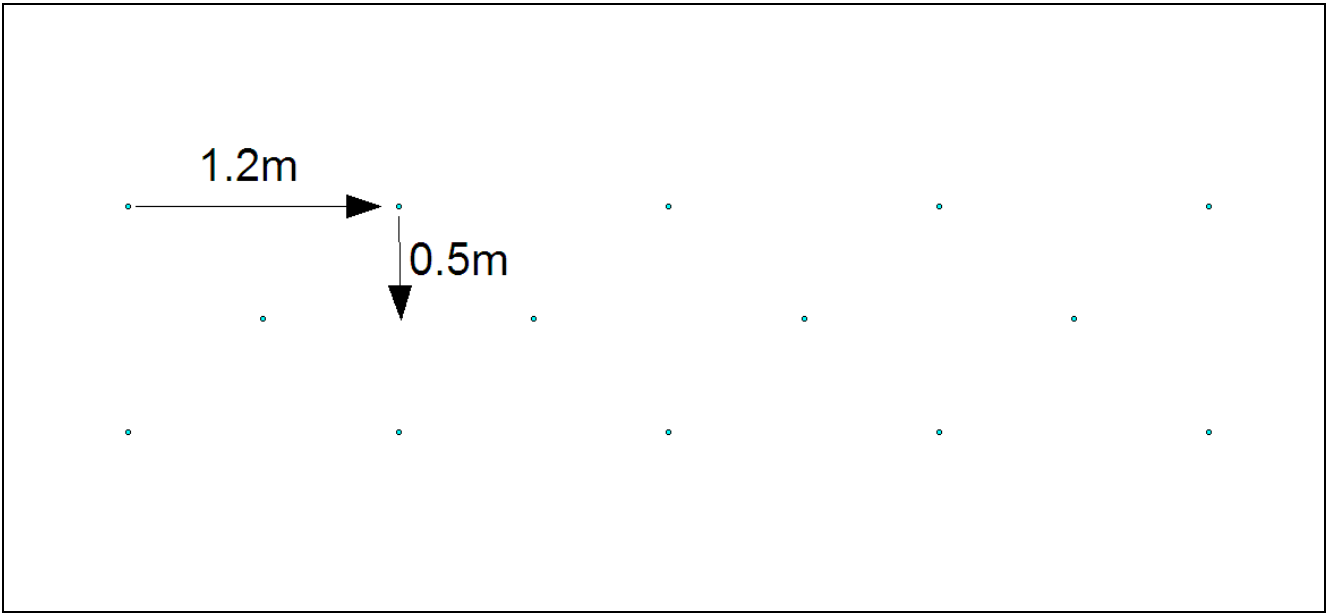
Initially a small number of test holes will be fired to measure the pipeline's response to blasting. The results will be analysed and used to design the blast pattern for the remainder of the project.

During the test blast the existing pipeline will be uncovered and monitored to determine the maximum PPV recorded at the pipe. From this information the K and n coefficients can be determined correctly to allow for the maximum charge to be used in the main blasting to achieve the best possible results.

After the allowable MIC has been determined a small test blast will be fired to gauge the effectiveness of the pattern prior to beginning the main blasts.

The pattern used initially can be seen below. 45mm diameter holes are to be drilled to the two metre depth required with a 0.3m subdrill. The blast will be fired with non electric detonators on a 25ms delay between holes.

During the main blasting events the length of the blasts will be determined by the location and timeframe. The blasts will be designed to be loaded and fired within one day.



Appendix D Personnel List

Contact details of people involved in this project.

State Water		
Project Manager	Garrett O'Mahony	0427 179 529
Trenching Supervisor*	Damien Horan	0428 886 517
Orica		
Blasting Engineer	Melanie Hodgson	0423 783 489
Shotfirer	Jonathon Keller	0423 849 246
Area Manager*	Cam Harbrow	0411 234 575
Area Business Manager	Nigel Convey	0413 483 654
Orica Emergency Number	24 / 7	1800 011 333

*** - nominated contacts to be called immediately in the event of an incident**

Appendix E Site Specific Blast Clearance Procedure

1 Day Before Blast

1. Orica to prepare a site layout plan with clearance area marked

Day of the Blast

2. Orica Shotfirer confirms blast time with WDS Site Supervisor

30 minutes before the blast

3. Blast sentries meet at the blast for pre-blast meeting.

5 minutes before the blast

4. Blast guards in position;
5. 5 MINUTE CALL by Shotfirer on the primary frequency;
6. Shotfirer confirms blast area clearance with WDS Trenching Supervisor

1 minute before the blast

7. Shotfirer sounds blast siren (30 sec duration/30 sec wait)
8. Shotfirer makes final "CHECK CALL" to each nominated Guard
9. Shotfirer makes 10 second call and fires shot.

Immediately after the blast

10. Shotfirer notifies Blast Gaurds "SHOT HAS BEEN FIRED" to remain in position until the "ALL CLEAR HAS BEEN GIVEN";
11. Shotfirer announces "ALL CLEAR"
12. Shotfirer signals 3 short blasts on siren;



Appendix F Instructions for Blast Sentries (Guards)

Shotfirer's Name :

Radio Channel :

Your Blast Guard Number :

Your Blast Guard Name :

Location :

Blast Time :

Instructions

1. Be ready to take your assigned position 10 minutes before the blast. If you have been instructed to advise people of the impending blast, commence your clearance. Make sure machines are already moving out of the blast clearance area.
2. Block access at the 3 minute call (signaled by the shotfirer). Do not let anyone into the blast area. Contact the Shotfirer immediately if the blast area is breached or if you see anyone in the area. For example :

"Blast Guard John, to Shotfirer Dwayne. Stop the blast. The blast area has been breached"
3. Respond to the Shotfirer's radio calls.
If your part of the blast area is secure, respond to the Shotfirer's final blast clearance call using the phrase :

"This is Blast Guard (number) (name), I am at (location), this access is blocked and the area is secure."

Always use your name. Do not use the words "ALL CLEAR"

Appendix G Radio Phrases for Blasting

5 Minute Call (Shotfirer)

“Attention all Personnel, approximately 5 minutes to Blast Time. Blast Guards block your access. All other personnel please maintain radio silence until the blast has been fired and the all clear is given.”

Check Call (Shotfirer)

“Shotfirer to Blast Guard (number) (name), are you in position?”

Check Call Response (Blast Sentries)

“This is Blast Guard (number) (name), I am at (location), my access is blocked”

(Always use your name and your location. Do NOT say “ALL CLEAR” – these words are reserved for after the blast)

Ten Second Call (Shotfirer)

“This is the Shotfirer. The Blast will be fired in approximately 10 seconds”

******* 10 Seconds Radio Silence -> Fire On *******

Blast Fired Call (Shotfirer)

“This is the Shotfirer. The Blast has been fired, please remain in position until the blast has been cleared”.

All Clear Call (Shotfirer)

“This is the Shotfirer. The Blast has been fired and is all clear. Please release the traffic. Blast guards please stand down”.

(Acknowledged by nominated Blast Guards)

Misfire call (Orica Shotfirer)

“Attention all Personnel, a misfire has occurred. Blast guards please remain in position and await instructions”. (Please maintain radio silence / Radio silence is lifted until further notice).

Fume call (Shotfirer or Blast Controller)

To be used if the blast generates visible fumes.

“Attention all blast guards, there are blast fumes moving to the (east). Guard (3) please move away from the site and notify people in the area”.

Abort Blast call (any Blast Guard)

To be used if any blast guard becomes aware of an unsafe condition or someone in the Blast Area or attempting to enter the area.

“Attention Shotfirer - This is Blast Guard (number) (Name). Stop the Blast!”

Appendix I Definitions

Stemming	Backfill on top of explosive column to contain explosive energy
Burden	Distance between rows or distance from front row to free face
MMU	Mobile Manufacturing Unit (Bulk Explosives Truck)
IE / HE	Initiating Explosives / High Explosives (Detonators and Boosters)
MIC	Maximum Instantaneous Charge – Number of kg or holes firing at any instant during the blast
DME	Dept of Mines and Energy (Explosives Inspectorate)
PPV	Peak Particle Velocity (mm/s) – standard unit for measuring vibrations from blasting and other construction activities
Powder Factor	Weight of explosive loaded per cubic metre of rock (kg/bcm)
SWI	Orica Quarry Services Shotfirer's Work Instructions. This document contains the procedures to be used by Orica Shotfirers and their assistants for tasks common to all blasting operations.
SDS	Orica Site Data Sheet. This document lists the blast design parameters to be used for the site. The Orica Shotfirer is obliged by the SWIs to work within the range of values specified on the SDS.

Appendix J Index Mapping to AS2187.2-2006 Appendix 2

The following table lists the recommended components of a Blast Management Plan as detailed in AS2187-2006 Appendix to and maps the Orica Document that contains the specified information.

A2.2 Contents	Source Document
(a) Location of the proposed blasting.	Blast Management Plan Section 1
(b) Description of the proposed blasting.	Blast Management Plan Section 1
(c) Permits/licences required for the project.	Blast Management Plan Section 3
(d) Identification and position of the person responsible for the project including project safety and security	Blast Management Plan Section 3 and Appendix D
(e) Identification and position of person who has given approval to use explosives on the project	Blast Management Plan Appendix D
(f) Key appointments and responsibilities.	Blast Management Plan Section 3 and App D
(g) Shotfirer's details.	Blast Management Plan Section 3
(h) Details of the risk management assessment.	Blast Management Plan Appendix B
(i) Details of adjacent structures or services that influence the blast design.	Blast Management Plan Appendix B
(j) Details of reports, drawings and records consulted.	Blast Management Plan Section 6
(k) Layout plan of the blast including drilling pattern and hole depths.	Job Pack / SDS / SWI Section 3
(l) Detonation sequence/effective charge mass per delay (MIC)/powder factor.	Job Pack / SDS / SWI Section 4
(m) Type of explosive to be used and quantity required.	Job Pack / SDS / SWI Section 3
(n) Method of initiation.	Job Pack / SDS / SWI Section 4
(o) Type of firing equipment and procedures.	Job Pack / SDS / SWI Section 4 & 20
(p) Drilling procedures.	Client to Supply
(q) Explosive loading and charging procedures.	Job Pack / SDS / SWI Section 11,12,13
(r) Explosive storage and handling procedures.	SWI Section 5
(s) Security procedures for the site and the blast, including explosives.	SWI Section 5, 9, 6, 10
(t) Environmental considerations for airblast overpressure, ground vibration.	Risk Assessment / Customer Site Safety Checklist / SDS
(u) Details of communication systems.	Blast Management Plan App D and E / Customer Site Safety Checklist
(v) Warning procedures.	Blast Management Plan App E / Customer Site Safety Checklist / SWI Section 18, 19, 20
(w) Traffic management plan.	Blast Management Plan App E / Customer Site Safety Checklist
(x) Proposed dates and times of blasting.	Jobpack
(y) Details of the exclusion zone.	Blast Management Plan App E / Customer Site Safety Checklist / SWI Section 2, 19,20
(z) Method of notification to owners and occupiers of structures, and providers of services	Blast Management Plan App C
(aa) Influence of weather.	Risk Assessment / Customer Site Safety Checklist

(bb) Loading in poor light conditions or reduced visibility.	Risk Assessment / Customer Site Safety Checklist
(cc) Cessation of explosive-related activities during electrical storms.	SWI Section 6
(dd) Misfire management system.	SWI Section 22
(ee) Post blast assessment and inspection procedures.	SWI Section 23
(ff) Provision for post-blast comments.	SWI Section 24
(gg) Signature spaces for the plan author, shotfirer and person who approves the plan.	Blast Management Plan Front Cover, SDS, SWI Section 3
A3 BLAST RECORDS	
Details of the blast should be taken and maintained, including but not limited to the following :	
(a) Environmental conditions at the time of the blast.	SWI Section 23, Blast Evaluation Report in Jobpack
(b) Monitoring equipment including type, serial number and location.	SWI Section 23, Jobpack records
(c) Details of measurements recorded during the blast.	SWI Section 23, Jobpack records
(d) Details of flyrock or fly.	SWI Section 23, Jobpack records
(e) Details of incidents and complaints.	SWI Section 23, Jobpack records
(f) Comment on the results of the blast.	SWI Section 23, Jobpack records
(g) Proposed modification to the blast plan for future shots.	SWI Section 23, SDS

