BORAL Construction Materials

LINWOOD QUARRY

MINE OPERATIONS PLAN

Location: **Off Ocean Boulevard Road Seacliff Park/Marion**
Private Mines: **3, 4 & 22**
Eml's: **5730, 5731 & 5732**

September 2008

Table of Contents

Executive Summary

Quarrying began at the Linwood site in 1882 when a small quarry was opened in the Brighton Limestone formation to provide raw material for the Brighton Cement Works. By 1892 this pioneering industry became 'The South Australian Portland Cement Company Limited'. Quarry Industries Ltd operated the site from 1939 until 1984, when the company was taken over by Boral Ltd. Boral Resources (SA) Limited has been operating the Linwood Quarry since 1984.

The site is situated approximately 15km SW as the crow flies from the Adelaide CBD in the suburb of Seacliff Park. The mine is open cut with the strike of the ore body running in a north – south direction.

Today the quarry lies predominantly within the Hills Face Zone and Extractive Industry Zone as defined in the City of Marion Development Plan.

Production at the quarry has grown over the site's history to cope with the increasing demand for construction materials in South Australia. Linwood is one of the largest construction material quarries (production and sales) in South Australia and the products it produces are of a high quality. The resource has been described as Adelaide's most valuable resource for the construction industry.

Since its inception, residential housing has progressively encircled the quarry with the planning system having failed to respond effectively to protect these immoveable resources and the potential for conflict with residential neighbours continues to increase every year. However, Boral understands the need to balance operations on the site with the expectations of neighbours and recognises that to achieve this balance, consultation with the communities surrounding the operation, are an important part of this.

For operations to meet normal demand levels, the site is usually operates Monday to Saturday from 5.00am to 5.00pm with blasting frequency on average of once per week. The need to operate at greater hours and at a great intensity can arise according to market demands.

The quarry site infrastructure also includes a significant concrete batching plant (as part of Boral's concrete network) and is licensed by the Environment Protection Authority of South Australia to receive, store and process (by crushing, screening and sorting) waste concrete and asphalt. It contained an asphalt making plant up until December 2001 when it was closed due to concerns from

surrounding residents and due to an opportunity for Boral Resources (SA) to rationalise its production operations. Other operations conducted as part of the Private Mine activities at the site include:

- a wet batching road base plant;
- workshops;
- truck washing facility
- transport vehicle depot for the southern region;
- Licensed weighbridge and office.

1. Introduction

This Mine Operations Plan has been prepared and contains objectives and criteria that are submitted to the Director of Mines for approval pursuant to Part 11B of the Mining Act 1971.

Mining operations are conducted substantively upon Private Mines **3**, **4** and **22** at Linwood Quarry and to a small extent on EMLS 5730, 5731 and 5732. To the extent mining is occurring or has occurred on these EML's this document should also be considered as a program for the mining and rehabilitation of the land within the area of the leases for the purposes of Regulation 42 of the Mining Regulations Act 1998.

Quarrying began at the present site in 1882 when a small quarry was opened in the Brighton Limestone formation to provide raw material for the Brighton Cement Works. By 1892 this pioneering industry became 'The South Australian Portland Cement Company Limited'. Subsequently the site was worked by Quarry Industries Limited and more recently, Boral Resources (SA) Limited, for limestone aggregates which are quarried from the "upper calcareous section of the Tapley Hill formation".

Mawson and Sprigg (1950) established the area around Linwood quarry as the type section for the upper part of the Adelaide System. They reported a total thickness of thirty metres for the Brighton limestone that was overlain by the chocolate slates of the Marinoan series and underlain by the Tapley Hill formation with 'slaty limestone's at the top'. Linwood quarry was given as the type section for the Brighton limestone.

Nixon (1957) mapped and sampled the quarry as it existed at that time and reported on the potential available resource. Further work was undertaken by A.M. Pain in 1969 and is recorded in the Department of Mines (now Primary Industries and Resources), Mineral Resources Review 131.

Today the quarry lies predominantly within the Hills Face Zone and Extractive Industry Zone as defined in the City of Marion Development Plan. The North-western portion of the site is bounded by established residential development, with undeveloped residential and Hills Face Zone land abutting the remainder of the Western boundary. The City of Marion Golf Park that abuts the North-eastern site boundary is operated primarily on land leased from Boral and within PM4 which was previously quarry workings from the original SA Portland Cement Company, with vacant HFZ land to the East and Southeast bounded by Ocean Boulevard. The HFZ land is continuous around the southern perimeter of the quarry with Perry Barr Road forming the southernmost boundary. Most of the vacant HFZ land around the quarry continues to

be used for sheep grazing purposes. Given the encroachment of residential development which has occurred over the years, it is critical that as much vacant land as possible is maintained around the present and potential future quarry operations to protect them from the impacts of such forms of development and allow the resource to be extracted to its fullest extent.

2. Proponent Details

The quarry operator and proponent is Boral Resources (SA) Limited, whose details are as follows::-

ACN 007 516 494.

Address: Boral Resources (SA) Limited
1 Station Place Hindmarsh SA 5007
PO Box 212 Hindmarsh SA 5007

Telephone: (08) 8425 0400
Facsimile: (08) 8340 3010

3. Land Ownership

3.1 Title Details

Private Mine / Tenement	Related Titles
PM 4	CT 5735 / 113 CT 5242 / 170 CT 5242 / 171 CT 5774 / 145 CT 5755 / 333 CT 5755 / 334
PM 3	CT 5541 / 695
PM 22	CT 5745 / 302 CT 5409 / 383 CT 5976 / 239
EML 5730	CT 5409 / 383
EML 5731	CT 5409 / 383
EML 5732	CT 5782 / 237

The total area of the Private Mine and tenement holding comprises 190.65 Ha

3.2 Local Authorities

The City Of Marion Council is the responsible authority governing the area containing the site. The site zoning is as per Table 2 and Appendix 2.

Table 2. Site Zoning

Private Mine / Tenement	Land Zoning
PM 4	HF, Eln
PM 3	HF
PM 22	HF
EML 5730	HF
EML 5731	HF
EML 5732	HF

4. Description of the Environment

4.1 Land Use

The land upon which Private Mines **3, 4** and **22** are located has been continuously mined for 116 years. The Brighton Limestone formation which overlies the current quarry development was first opened in 1882 to provide raw material to the Brighton Cement Works. The land immediately surrounding the quarry was cleared for stock grazing purposes by the property owner.

Today the quarry lies predominantly within the Hills Face Zone (HFZ) and Extractive Industry Zone as defined in the City of Marion Development Plan. The North-western portion of the site is bounded by established residential development, with undeveloped residential and HFZ land abutting the remainder of the Western boundary.

The City of Marion Golf Park (primarily on land leased from Boral) abuts the North-eastern site boundary with vacant HFZ land to the South bounded by Ocean Boulevard. The HFZ land is continuous around the southern perimeter of the quarry with Perry Barr Road forming the southernmost boundary. Most of the vacant HFZ land around the quarry continues to be used by the landowners for sheep grazing purposes. Refer Zoning Map Appendix 2.

The quarry site also contains a significant concrete batching plant and is licensed by the Environment Protection Authority of South Australia to receive, store and process waste concrete and asphalt. Refer copy of EPA Licence Appendix 9. In addition, there is a wet batching road base plant, workshops, a truck washing facility, a transport vehicle depot for the southern region, a licensed weighbridge and office and other infrastructure, all part of mining operations conducted at the site.

4.2 Climate

The climate around the Linwood Quarry consists of hot dry summers and cold winters. The quarry sits between the Noarlunga and Adelaide Airport weather stations. All data has been sourced from the Bureau of Meteorology website.

Rainfall

Average annual rainfall is 621.8mm spread over a 137.2 rain day average per year. Relative humidity usually sits at 50-60%.

Temperature Patterns

Average mean temperatures:
Minimum: 9° C (recorded minimum of -2.6° C)
Maximum: 21 (recorded maximum of 44° C)

Wind Direction and Speed
The location of the quarry is subjected to coastal wind fluctuations with morning winds predominately from the SE/SW with maximum gusts of 40km/h, turning mainly SE in the evenings with maximum gusts of 40 km/hr.

4.3 Geology

General

The sediments in the area of Linwood quarry belong to the Marinoan and Sturtian series of the Adelaidian System. They can be divided into the following main groups, the shales and siliceous blue-grey limestone of the Tapley Hill formation, the buff to brown coloured oolitic limestone's of the Brighton and the chocolate shales of the Marinoan.

Stratigraphy

Tapley Hill Formation

The Tapley Hill formation is a very thick sequence of calcareous siltstones and shales. The lower sections are comprised of alternating blue-grey to black silty limestone's and shales. This sequence grades into massive grey-blue dolomitic siltstones and limestones. This upper unit has a measured thickness of 325 metres at Linwood quarry. Within the blue-grey sequence there are occasional interbeds of soft, friable, brown to orange siltstones, most of these interbeds are less than one metre thick but significant bands of up to 30 metres in thickness have been measured within the quarry.

Brighton Limestone

The Brighton limestone sequence at linwood quarry is composed of oolitic dolomite and massive dolomite members with intercolated siltstones. The thickness of the unit varies between 18 and 20 metres.

Marinoan Shales

The Brighton limestone is conformably overlain by a thick sequence of chocolate coloured shales.

Structure

Generally the sedimentary sequence has been subjected to a number of phases of folding and shearing. The dominant feature

is a series of north-south trending, near vertical, fold axes with associated planes of shearing. A major near vertical shear zone exists along the western wall of the main pit with the upthrust having occurred on the eastern side and there are a number of associated smaller shear zones. The fold axes plunge to the south.

There is also another set (or sets) of shear zones that transect the rock mass and which generally have a near vertical orientation but often are of limited extent. Displacement in these zones is not large however there has been retrograde alteration of the minerals present making them susceptible to weathering processes.

Fracturing (or jointing) has been associated with the folding and uplift of the rock mass.

Geological Factors Effecting Quarrying

a. The limits of quarrying are defined by district geological units. To the west the Brighton limestone, and to the east the inclusion of major shale bands within the Tapley Hill formation.

b. Siltstone bands within the siliceous limestone sequence of the Tapley Hill formation can reach a thickness of thirty metres. These units are conformable with the siliceous limestone bands and can be expected to persist throughout the full development of the quarry.

c. The surface weathering throughout the area consists of a layer of soil with minor amounts of calcrete and travertine, which overlies a varying thickness of soft yellow to orange silt. The most important factor in the determination of the thickness of overburden, which can extend in patches to a depth of 25 metres, is the underlying rock. Where this rock is fractured due to faulting, or soft due to the intercolation of siltstone bands, weathering may extend to depths of 50 metres below the surface.

d. Weathering is frequently associated with the shear zones; the weathered material is friable and may contain clays making it unsuitable for the production of aggregate and road base materials. Due to the shear zones being unpredictable there is always the potential for contamination of the shot rock. Also present are zones of micro-shear that have not weathered but have a retrograde mineralogy that is unsuitable for aggregate production.

e. Jointing through the rock mass can influence initial breakage of the stone during quarrying and often limit the applications to which some of the rock may be used.

4.4 Geohazards

The risk of earthquakes near Seacliff Park is small and of low magnitude.

4.5 Proximity to Infrastructure and Housing

Immediately abutting the southern boundary of Perry Barr Road lies the now fully developed residential suburb of Hallett Cove. Housing frontages along Perry Barr Road lie approximately 320 metres from the current most southerly development of the quarry.

Not far from the North-western boundary of the site an old worked out section of the quarry is situated close to the established suburb of Marino. While extraction of material from this most northerly part of the old quarry has not occurred for some years, resources do remain and could be further developed at a future time. The company previously successfully objected to a development on the western side and did purchase some land to preserve the buffer zone.

Although unproven, land east of the northern section of the pit in PM22 is still considered as minable reserves for future development if the need arises.

The new residential area entitled "Oceana Estate" to the northeast of the quarry is located approximately 350 metres from the stockpile area, approximately 700 metres from the crushing plant and over 900 metres from the current quarry workings. While the estate is close to the quarry it is separated by buffer land which is being used as a golf course and it is considered that this buffer is adequate.

Substantial resources exist to the west of the current workings. These have not been extracted to date to allow the elevated land to the west to be maintained in that form for as long as possible as a visual buffer. However it can be anticipated that sometime in the future, quarrying of these areas may occur.

The landowner in conjunction with Boral is the applicant for a Mineral Claim which may lead to a further Extractive Minerals Lease over land south east of PM22. If that application

proceeds, an emphasis on working in that area may occur in the shorter term.

The workings have now become visible from the Lonsdale Highway and also some parts of Perry Barr Road (plans are in place to screen these locations in consultation with Hallett Cove Working Group)

All overburden from the operation is currently being placed along the south eastern boundary of PM22 and progressively sculptured to blend in with existing hills and grazing paddocks without affecting the views of the Hallett Cove residents looking to the north. Overburden will continue to be used for screening purposes around the quarry site as required.

Plans illustrating existing infrastructure can be found in Appendix 4.

4.6 Topography and Drainage

Generally the site is undulating with moderately steep hills and valleys draining in a westerly direction. There are no dams and no external discharges of surface runoff to areas outside of the site boundaries. The bottom of the old quarry pit collects and contains quite a large volume of rainfall runoff over the winter months resulting from the extensive catchment area of quarry benches and faces above. The quarry also captures stormwater in two other locations onsite and transfers this to the main dam for filtration and re-use for:

- Dust Suppressant
- Truck wash down
- Wheel wash
- Potential for concrete batching in the future

An illustration of the water recycling network can be seen in Appendix 7.

4.7 Groundwater

The majority of the Linwood Quarry development lies within the Tapley Hill Formation passing upwards in a westerly direction through a band of Brighton Limestone and siltstones. The quarry lies on the western limb of a NE/SW axis trending anticline (Cobb, 1992). Most of the quarried material is classed as siliceous dolomitic limestone. This is confirmed in a well log drilled in 1973 at the north-western edge of the quarry (Smith, 1974). Groundwater is stored in and moves within a fracture system developed in the rock mass which exhibits no primary porosity or permeability. The density of fracturing and the degree of interconnection and openness determines the well's yield and

groundwater salinity impact. Previous pump tests found salinity levels unsuitable for grass watering on the nearby golf course.

Well number **6627/1/1892** was drilled to a depth of 98m in highly permeable rock within the Brighton Limestone and probably the upper portion of the underlying Tapley Hill Formation (Cobb, 1992). Previous tests indicate groundwater salinity levels of over 1400 mg/litre and pH levels of around 7.7. The groundwater well intersects the aquifer at around 75 metres and yields a pumping rate of approximately 13 litres/second. This, together with retained stormwater is sufficient to meet the quarry's estimated annual demand of around 70 Ml. Salinity levels are moderate but provide an adequate amount of useable water for quarry purposes.

4.8 Topsoil

The soil horizon is generally very shallow overlying calcrete or bedrock. The depth of topsoil is of the order of 100 to 300 mm, and it is very difficult to separately strip and collect. Topsoil has previously been stripped and collected but has subsequently been used on the rehabilitation of the mound located northwest of the quarry workings. However there is normally an insufficient depth of topsoil present over the rock and it is not possible to separately collect and stockpile it. In such circumstances which include the areas that will be quarried in the future the limited topsoil is simply included in the shot and removed as part of the overburden stripping, or incorporated into the 'run of mine' material that is crushed.

Within the quarry there are other areas where the soil profile is deeper, but this soil profile usually consists of brown clays grading to black earths and indicate swelling and shrinkage crack movements. These areas of clay can extend downwards to 20 to 30 metres in depth. These areas are separately excavated and dumped as overburden.

If during the quarrying process we come across areas of topsoil greater than the 100 to 300mm and it is possible to separately strip this topsoil from the areas to be quarried, it shall be stockpiled separately for use in the rehabilitation process and this soil will be managed appropriately prior to being used in that process. An area has been set aside for the stockpiling of the topsoil and this area is shown on the photograph in Appendix 13.

4.9 Flora & Fauna

The original vegetation was cleared for stock grazing purposes by early European landowners. As a result the indigenous

vegetation has been completely degraded. These two plants may represent the only remnants of original vegetation at the site. Generally the existing vegetation comprises exotic pasture grasses, associated weeds and olive trees. The only areas of significant vegetation largely comprise of exotic native trees and large shrubs around the golf course and some early screen planting established around the western perimeter of the site. More recent landscape rehabilitation work across the southern end of the site and along the north-western boundary of the quarry have included the planting of species once common to the area. Our knowledge of these plants has been greatly enhanced by the botanical studies and the draft management plan prepared for the nearby Marino Conservation Park.

Due to the earlier clearing of the land for agricultural purposes, very little natural habitat remains. Predominantly grazing sheep are present at the site with some evidence of rabbits, hares, and foxes together with a normal mix of avifauna found about the urban fringe.

4.10 Aboriginal Heritage

There are no previously documented Aboriginal cultural or archaeological sites, objects or remains recorded at Linwood Quarry. The area has been surveyed in the past and no known aboriginal cultural or archaeological sites, objects or remains have been identified.

Upon discovery of any remains at any stage of quarry development, the provisions of the Aboriginal Heritage Act 1988 will be complied with and the Heritage Team of the Division of the State Aboriginal Affairs will be notified as soon as practicable.

5. Description of Operations

5.1 Mode of Operation

Currently operations are worked continuously throughout the year. Major projects and other factors generating changes in market demand will see operations scaled up or down to satisfy requirements.

5.2 Hours and Operation

The hours of operation cover a number of activities on the site and it is proposed to have differing hours for the different activities. The hours of operation are essentially those that were in the approved Development Plan 99/35 for the crushing activities with an amendment for Saturday crushing. The hours during which sales and concrete activities occur have been in existence for a number of years. The hours are clarified below.

Primary Crushing

The site's primary crushing plant, load and haul and sales activity usually operates from 6.30am to 5.00pm Monday to Friday and 6.30am to 4.00 pm on Saturdays.

Secondary Crushing Plant

The secondary crushing plant usually operates from 5.00am – 5.00pm Monday to Friday and 5.00am – 4.00pm on Saturdays.

Sale of Product

Some sales and despatching may occur until 10.00 pm at night Monday to Friday.

Concrete Plant

The normal hours of operation of the concrete plant are between 6.00 am and 4.00 pm Monday to Friday and 6.00 am to 12 noon on Saturday. However earlier starts will occur on a regular basis to meet market demands, particularly in the summer months.

Maintenance Work

While this is normally carried out during regular hours on occasions work may need to be undertaken after hours, on Sunday's and Public Holidays.

Generally the site is not worked on Sundays or Public Holidays.

Boral's operating (crushing and Sale) hours may be extended periodically in order to meet industry demands, provided that the approved environmental objectives (as stated in this Document) are achieved and the local community has been notified and/or

consulted of the proposed extended hours in advance (including the duration, proposed working hours, etc.)

At any time of extended working hours the noise levels being generated from the site will be maintained within the EPA and legislative guidelines.

5.3 Access to Site

Currently the only access to site is via Clubhouse Rd in Seacliff Park, this allows access to Lonsdale Highway and Brighton Road which is a significant north / south arterial route within inner metropolitan Adelaide. At present the majority of deliveries from the quarry service areas north of the entrance road.

There has been some discussion about establishing an alternatate access point onto Lonsdale Highway which cannot proceed until it can be justified commercially. Illustrations of the Clubhouse Rd / possible Lonsdale Hwy intersections can be seen in Appendix 8.

5.4 Materials to be Recovered

The material extracted from Linwood Quarry is a sedimentary rock type of the upper part of which is referred to as the Brighton Limestone. This overlays the Tapley Hill formation which has a very thick sequence of calcareous siltstones and shales grading into a sequence of massive siliceous blue- grey dolomitic siltstones and limestones.

The materials recovered are crushed and graded to service internal and external customers for purposes including:

- Asphalting and Sealing
- Concrete
- Base materials for construction
- Revetment rock
- Drainage

5.5 Waste Volume Estimates

Due to the inherent seams of weathered shales throughout the pit prediction of waste removal can at times be difficult to estimate; therefore waste volumes have been calculated using historical survey data of the overburden stockpile to best reflect annual removal. It is predicted with the current development phase waste volumes will steadily decrease once:

- the southern hill development reaches it's outer design limit
- a section of low grade material within the pit is removed

Extraction can then be concentrated on higher grade material at depth.

A predicted estimated of waste removal annually can be seen in Table 3.

Table 3: Annual Waste Removal Volumes

Stage	Total Annual Extraction (m3)	Predicted Annual Waste (m3)
1 Years	525,000	210,000
2 Years	525,000	210,000
5 Years	525,000	180,000
10 Years	475,000	95,000
30 Years	475,000	47,000

As at June 2007

The south western overburden spoil dump has become visible from the south along Perry Barr Road, progressive shaping and grassing of the heap has begun and continual remediation of the completed areas of the spoil dump will continue.

5.6 Type of Operation

Quarrying at Linwood will use the existing open-cut method of excavation continuing the stepped face and bench profile commonly observed at most hard rock quarries.

The bench heights vary but are of the general order of 12 to 15 metres high with berm widths varying from 5 to 25 metres depending upon the location of the face.

The quarrying process consist of drilling holes of either 89 or 102 mm in diameter the full depth of the face on a pattern that optimised the drilling and blasting effort. These holes are designed using laser profiling and bore tracked after drilling to ensure that they are aligned correctly and if not they are redrilled. The holes are loaded with explosives and the shot fired. After the firing the shot is evaluated with respect to noise and vibration, the breaking of the rock and the throw of the rock. A report is finalised and forwarded to PIRSA.

The explosives used vary from shot to shot depending upon the conditions. The majority of holes use ANFO but for wet holes bulk emulsions are used. The explosives are generally single

primed and use a Nonel detonation system. As different explosives become available trials are undertaken to determine if there are any benefits in terms of noise and vibration reduction to be gained from using the new explosives or systems.

5.7 Sequence of Operation

This section should be read in conjunction with the attached plans: - (Refer Development Plans Appendix 10.)

- Plan – 1 EXISTING DEVELOPMENT – May 2007
- Plan – 2 PROPOSED DEVELOPMENT TO – 2011
- Plan – 3 PROPOSED DEVELOPMENT TO – 2017
- Plan – 4 PROPOSED DEVELOPMENT TO – 2037
- Plan – 5 TYPICAL CROSS – SECTION
- Plan – 6 FUTURE DEVELOPABLE RESERVES

Based upon the known geology of the site, quarrying on the upper southern benches has reached its proposed 30 year southern pit limit, currently development continues east towards the boundary of PM22 to open up this corner and allow extraction on the lower benches.

The mound of second grade material in the central part of the pit will continue to be extracted and eventually link what is essentially now two pits to form one large open cut. The western benches have been quarried back design and a suitable profile for future backfilling and landscape rehabilitation is underway.

The eastern bench is currently mined to its existing design, rehabilitation of the upper two benches at the Northern end of the old pit is scheduled, however the southern end of the will remain pending the outcome of the mineral claim to extract further to the east. Reference should be made to Plan 6 in Appendix 10.

5.8 Explosives

Explosives and drill and blast at Linwood Quarry is a key environmental objective and this section should be read in conjunction with Part 6.1.3 of this document "Potential Impact Event – ***Blasting (Noise, Dust and Vibration)"***

Current magazine licenses held onsite and their capacities are listed in Table 4.

The magazines at Linwood are, from time to time, used as a source for other Boral sites.

Table 4 – Explosive Magazine Detail

License Number	Type
74528	Detonator
74515	Explosives
75115	Explosives
74545	Explosives

A typical blast pattern will consist of holes 89 mm in diameter and up to 15 metres in depth. Each hole is charged with a primer at the base. The primer is generally of an emulsion type such as Powergel 'buster' or similar. The remainder of the hole is loaded with an ammonium nitrate fuel oil (ANFO) mixture or bulk emulsion during the wet periods. Holes are finally stemmed with an aggregate product. Aggregate stemming has been found to help in the reduction of airblast overpressure by giving superior charge confinement.
Detonation uses a non-electric system such as Nonel or similar, with electric initiation using millisecond delays. To minimise ground vibration and airblast overpressure, the maximum instantaneous charge is kept as low as possible by firing 1 hole per delay number where possible.

5.9 Silt Retention

Existing sumps, silt traps and water storage dams are illustrated in the water recycling diagram in Appendix 7.The main storage of water is located within a non-operational part of the existing workings and all other catchment areas within the lease either flow or pump water to this location. All smaller catchment areas are regularly excavated to maintain design capacity; this is performed on a as required basis. The current water clarification treatment is efficient in capturing sediment laden water.

A premix concrete batching plant is located within the quarry that contains wash-out pits used to collect waste concrete washed out of the bowls of trucks returning to the plant. Accumulated material from this pit is periodically removed to an overburden dump area.

The company actively pursues water reduction and recycling onsite, silt management is an ongoing part of achieving best practice in this area.

5.10 Stockpiles

At Linwood quarry there is very little topsoil of any consequence. Generally it is a red-brown clay overlying calcareous siltstones and shales. This material is classified as overburden and is

stripped and removed to existing dump sites located to the southwest and eastern sides of the quarry. Some overburden is placed into a screening embankment that is progressively being rehabilitated along the western side of the quarry.

Stockpiles of pre-crushed materials are placed at various locations
within the main quarry development area. They comprise primary crushed rock for later processing, second grade material, waste concrete and waste asphalt.

Saleable product stockpiles contain a range of final processed materials ready to be loaded and transported by road trucks over the weighbridge and delivered to construction sites at various locations. Final product stockpiles are mostly located within a gully area situated on the north-eastern side of the quarry. Saleable products are constantly replenished by internal haul trucks tipping more material from loading ramps accessed by a road located above the stockpiles.

The shape of pre-crushed and final product stockpiles, which are generally located within the quarry development area, is usually determined by the particular product's natural angle of repose and the tipping location. Typically they are often cone shaped.

Overburden stockpiles are formed by the large dump trucks tipping material in designated areas. They are continuously compacted by the heavy dump trucks and have a flat top. The sides are generally at an angle of repose. Upon completion of dumping, overburden stockpiles are graded and shaped to form transitional slopes that blend into the adjacent landform as much as possible. They are usually sown with grass and or local native plants, preventing the possibility of surface erosion.

It is not practical to provide details of the size or height of the many different stockpiles as they are in a state of constant change.

5.11 Processing Plant

A completely new processing plant was commissioned in November 1987. The primary, secondary/tertiary, and quaternary sections of the crushing plant can each be run independently.

Primary Section

The primary section is capable of producing up to 550 tonnes an hour and discharges a feedstock in three grades of stone into a reclaim system which feeds the secondary/tertiary section. A

1500mm x 6000mm scalping feeder feeds the 54" x 45" single toggle primary crusher.
Pre and post primary scalpings are conveyed to kidney shaped stockpiles on pivoting stacking conveyors. Stockpiles are capable of holding in excess of 1500 tonnes each.

Secondary/Tertiary Section
This section is designed to operate at 300 tonnes per hour. It has the capacity to produce 65mm metal, 50mm ballast, 40mm aggregate and sand (-5.00mm), together with feedstock for the quaternary section. One of three grades of material may be selected from the reclaim system and fed to the secondary gyratory crusher. One 54" and one 45" rotary cone crushers comprise the tertiary section.

Quaternary Section
This section has the capability to produce quality shaped aggregates, with the facility to recirculate the larger products to create smaller sized aggregates as required (7mm, 5mm etc). Feedstock from the secondary/tertiary section is fed to the Vertical Shaft Impactor (VSI) crusher, and is then sent for final sizing over 3 screens.

Water Supply
Water usage in the quarry is taken from a groundwater supply located slightly south of the weighbridge. (Refer to section 4.7 Groundwater) and from the stormwater retained on the site.

5.12 Other Services

Electricity:
An 11kV overhead mains supply provides power to the quarry, entering the property from Clubhouse Road, at the northeast corner of the site; the service line follows the quarry entrance road and goes past the weighbridge. This service line is contained within a registered easement to the Electricity Trust of South Australia.

Water:
SA Water provides a mains water supply to the weighbridge and concrete batching plant.

Telephone: A telephone service is provided to the weighbridge and concrete batching plant.

5.13 Mobile Equipment

The quarry and crushing plant are serviced by a range of mobile equipment which may include all or some of the following:-

Machine	Make	Model	Year	Qty
Excavator	CAT	8520	2002	1
Loader	Liebherr	L580	2004	1
Loader	CAT	980G	2004	1
Loader	CAT	966E	1988	1
Truck	CAT	773B	1986	1
Truck	CAT	773E	2003	1
Truck	CAT	769C	1985	1
Truck	CAT	769C	1985	1
Water Truck	CAT	769C	1987	1
Skidsteer	CASE	1845C	1995	1
Grader	John Deer	670A	1985	1

Load and haul from the quarry pit is achieved using an excavator and the two CAT 773B dump trucks.

In addition, there are the usual truck movements from vehicles transporting finished products from the site. These are currently up to 300 movements per day but this could increase in times of high market demand.

5.14 Waste Concrete and Asphalt

The site is licensed to accept and reprocess waste concrete and asphalt. The waste concrete and asphalt is processed and crushed to produce either aggregates or rubble and the asphalt is reprocessed to provide a crushed product for direct sale or inclusion in the manufacturing of asphalt. The acceptance of this product is subject to a number of checks and inspections to ensure that only concrete or asphalt waste is being returned.

The crushing and reprocessing is usually undertaken as a separate process from the main crushing process and is subject to an EPA licence.

The final product is handled in the same manner as other products.

6. Environmental Objectives and Criteria

Risk Assessment Matrix Key

For the purposes of risk assessment the following matrix has been used as reference for the purpose of understanding the likelihood and consequence of a potential impact event.

Consequence / Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost Certain (5)	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
Likely (4)	MEDIUM	MEDIUM	HIGH	HIGH	EXTREME
Possible (3)	LOW	MEDIUM	HIGH	HIGH	HIGH
Unlikely (2)	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH
Practically Impossible(1)	LOW	LOW	LOW	MEDIUM	MEDIUM

6.1 Potential Impact - *Noise (other than Blasting)*

The quarry and its operations sit within the City of Marion with some aspects of the quarry operations within 350m of the suburb of Marino to the North East including the new residential area entitled "Oceana Estate"(Refer to Section 4.5), and the Hallett Cove residents are 320m to the south. Additionally any activities on the site in relation to any extension of hours need to comply with the noise levels and policy as set out below.

In accordance with the Environmental Protection (Industrial Noise) Policy maximum allowable levels are defined as follows:

Description of area in which the Noise source is situated	Maximum permissible noise levels dB(A) 7.00am – 10.00pm	10.00pm – 7.00am
Rural or Predominately Rural	47	40
Urban Residential	52	45
Urban residential with some commerce, or with a school, hospital or the like	55	45
Urban residential with some manufacturing industry or with some place of public entertainment or place of public assembly or a licensed premise	58	50
Predominately commercial	65	60
Predominately Industrial	70	70

The current EPA license 1187 section 4 (325-33) describes Linwood Quarry by way of noise limits as "Urban residential with some manufacturing industry or with some place of public entertainment or place of public assembly or a licensed premise"

Events which may impact on prescribed limits:

- Crushing Plant
- Excavation
- Blast Hole Drilling
- Rock Breaking
- Concrete Batching Plant
- Traffic
- Background noise levels from Lonsdale highway

Control and Management Strategies

- Establish bi-annual noise monitoring through a mutually agreed licensed noise expert at both the north western boundary (Marino- Jervois St) and southern boundary at Perry Barr Road Hallett Cove.
- Report levels to PIRSA as per the testing frequency
- Analyse and identify major sources of noise
- Adhere to existing noise levels for existing EPA licence
- For any exceedance, determine remediation strategies
- Manage the impacts of all blast hole drilling and rock breaking within the quarry
- Maintain man made acoustic mound between Marino and the operation
- Low frequency reversing alarms on all quarry vehicles

Stakeholders

Key stakeholders affected by noise are residents in both Marino and Hallett Cove.

Risk Assessment / Likelihood of severity of Consequences

Likelihood - unlikely
Consequence - minor.
Potential Impact is considered to be medium.

Objective

Compliance with maximum permissible noise levels imposed by the Environment Protection (Industrial Noise) Policy 1994.

Measurement Criteria

The noise levels emanating from the operation will be monitored by a noise expert bi-annually (or as required) at the specified monitoring locations to demonstrate that noise from the site do

not exceed at any time the Environment Protection (Industrial Noise) Policy 1994 for a residential area with some manufacturing industry, currently 58dB maximum between 7.00am – 10.00pm and 50dB between 10.00pm – 7.00am.

Noise measurements will be undertaken during a 24 hour period consisting of:

- Noise logging to provide a continuous measure of the overall noise levels adjacent to the residences
- Manual noise measurements to determine the contribution of noise from the operations at the quarry to the overall noise levels logged. The measurements will taken by a trained representative of the mutually agreed noise expert at the measurement location for the entire 24 hour period.
- A report with the findings shall be submitted to PIRSA upon completion.

A complaints register is maintained detailing any noise complaints received (other than blasting) and noise monitoring is undertaken on an "as required basis" in response to these complaints. If it is concluded that the source of the noise is the quarry or the operations within the quarry, a noise improvement program will be submitted and actioned and additional measurements made to prove that the noise is below the permissible noise levels.

6.2 Potential Impact – *Dust (other than blasting)*

The near coastal location of the quarry experiences predominantly on shore south westerly winds in the mornings turning south easterly in the evenings throughout most of the year with maximum average gusts reaching 40 km/hr. During dry windy conditions some dust is generated from the adjacent grazing land.

Dust generation within the quarry is from

- Truck haulage and excavation
- The crushing plant
- Saleable product stockpiles
- Sales dispatch areas
- Access road into the quarry (up to 200 truck movements per day)
- Rehandling of materials (aggregates, rubbles and sands)
- Mud 'carry back' onto residential roads
- Blast hole drilling

- Processing waste concrete

It is a requirement of the sites existing EPA license 1187 Part 6.1that 'the licensee must take such measures as are reasonably necessary to prevent or control; the generation of dust.... Within the depot.'

Potential Impacts arising from dust generation consist of:

- Nuisance dust leaving the site

Control and Management Strategies

- Stripping topsoil and overburden can generate dust if carried out during the dry summer months. Such operations are infrequent and usually can be scheduled for completion whilst the soil moisture content allows minimal dust generation.
- Main haul roads and product stockpile loading areas are located within the quarry development and away from residential premises. These roads and loading areas are regularly watered during dry windy conditions using a water spray truck and bore water available at the site.
- The primary crusher raw material feed hopper is roofed, enclosed on three sides and has directional fine water sprays to minimise dust generation during tipping operations.
- Conveyers are covered and product transfer points are fitted with fine water sprays. The final crushing and screening sections of the plant contain a dry dust collection system ("bag house") that is ducted to all crushers, screens, bins and conveyor transfer points.
- Product stockpiles are located within the general quarry development area. High-pressure sprinklers are used to control dust generation daily conditions, supplementing the watering of trafficked areas by the water truck.
- Shed erected over Pugmill feed bins
- Timed water sprinklers on quarry access Road into the quarry using recycled water
- Compulsory automatic truck wash before leaving quarry site
- High pressure water canon erected on water truck to wet down unreachable dust sources
- Real time dust monitoring within the quarry with an aim to erect real time dust monitoring network inside and at each end of the quarry measuring PM10 with automatic alarm detection during excessive dust events

- Personal dust monitoring for employees
- Equipment operators to work in enclosed air-conditioned cabins
- Training of employees to improve awareness of dust management
- Static depository dust measurement as per AS 2724 Part1
- Regular communication with residents either formally through the working groups or informally over the phone.

Stakeholders
Key stakeholders affected by dust are employees and residents in the suburb of Marino.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – likely
Consequence – minor.
Potential Impact is considered to be Medium.

Objective
Mitigate dust impacts to a reasonable level for employees and nearby residents

Measurement Criteria
The dust levels emanating from the operation, continuously measured at specified monitoring points outside the operations boundaries using DustTrak real time technology (or as mutually agreed) in accordance with relevant standards.

The criteria will be measured in two stages:

1. PM10 does not exceed 50 $\mu g/m^3$ on more than 10 days per year for the first two years (upon completion of real time monitor network)

   (The standard NEPM air quality level for fine particle PM10 is 50 µg/m3 averaged over a 24 hour period with five accidence days allowed per year)

2. A commitment to improvement after the initial two year period

If at anytime, dust monitoring exceeds the above levels, then Boral will investigate the source of the dust. If it is concluded that the source of the dust is the quarry, a dust improvement program will be submitted and actioned.

In the case of a 24 hour average exceedance Boral will notify PIRSA in writing.

6.3 Potential Impact – *Blasting (Noise, Dust and Vibration)*

The quarry currently blasts approximately two to three days per month or 30 blast day's per year, with all blasts monitored and recorded in accordance with AS2187.2. Controlling the burden and spacing between drill holes, ensuring adequate stemming of explosives in the holes, using laser profiling to plot the new quarry face and bore tracking the drill hole for alignment, avoids overcharging with explosives.

Quarry blasting is regularly monitored and indicates that the frequency of ground vibration levels is within the accepted guidelines.

Potential Impacts arising from blasting;

- Airblast overpressure
- Ground vibration
- Dust
- Fly rock

Control and Management Strategies

Significant attempts have been made to reduce the impact blasting has on the community particularly in the suburb Hallett Cove, these include:

- Reducton of hole size and pattern spacing to optimise shot and minimise the impact of the blast
- Extensive internal blast management plan with quarry manager sign-off which includes:
  - laser profiling all shots
  - bore tracking drill holes
  - Blasting software for blast timing design pre blast
  - Video recording of all blasts
  - Technical support on hand with explosives provider
- Blasting at the same time on all blasting days
- Minimise blasting on days with a northerly wind to minimise dust impacts in Hallett Cove
- Establishment of Hallett Cove Working Group as a forum to communicate with the residents and the relevant governing bodies (i.e.: PIRSA, EPA etc)
- Notification of blasting 24 hours prior to blasting via email
- Phone notification 30 minutes prior to blasting
- Resident blast rating sheets
- Expanded blast monitor network inclusive of four permanent monitors and one roving monitor
- Ikon electronic detonation trials
- Blast timing trials in different areas within the quarry
- Reduced Maximum Instantaneous (MIC)

- Blasting will only occur during the hours of 10.00am and 4.00pm Monday to Friday. No blasting will occur on Saturdays, Sundays or public holidays.

Stakeholders
Key stakeholders affected by blasting are predominately residents in the suburb of Hallett Cove and at the south western tip of Marino.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – Almost Certain
Consequence – Moderate.
Potential Impact is considered to be High.

Objective
No unacceptable public health and /or nuisance impacts from airblast, flyrock and ground vibration caused by blasting undertaken in the quarry.

Measurement Criteria
All blasting at the site will be monitored for noise and ground vibration levels at appropriate monitoring points on or as close to the quarry boundary as possible. Four monitors will aim to form part of this network and their location will not change (refer to blast monitor locations in Appendix 12).

Additional monitors are available to be located in individual residences upon request and are normally located in one or more residences. They provide an indicative reading of the noise and vibration at that residence.

The criteria in relation to air-blast overpressure and ground vibration that we undertake to meet is the criteria set out in the current standard AS2187.2 (2006), Appendix J. The criteria used is that which applies to limit the impact of blasting from the point of view of human comfort rather than the less stringent limits set to limit damage to structures including houses.

The criteria are set out in Tables J4.5 (A) and J5.4 (A) in Appendix J of AS2187.2 (2006) and the values that will be applied are those values applying to a **Sensitive Site**.

Monitors established within the quarry boundaries will be used to measure the levels of air-blast overpressure and ground vibration and if the readings are below the lower limits set out in the tables referred to above, then that blast will be taken to comply with the standards. If the readings are higher than the

lower limits then we shall use an independent technical expert acceptable to PIRSA to extrapolate the actual readings we have, to provide an estimated value for the readings applying at the nearest residences which are the sensitive sites. Actual readings from specific residence if available will be used to assist in the extrapolation process. Where the extrapolation process indicates that the noise or vibration levels would definitely be over the limits then that blast will be taken to have exceeded the limits.

Achieving the criteria in the Australian Standard AS2187.2 – 2006 (qualified in one part below) as measured at the **Sensitive Sites** will confirm the meeting of this objective.

The critera are as follows:

- The Peak Sound Pressure level of 115dBL for 95% of the blasts in a year and a maximum limit of 120dBL. (Table J5.4(A)AS2187.2)

- A maximum peak component particle velocity of 5mm/s for 95% of the blasts per year and a maximum of 10mm/s. (Table J4.5(A) AS2187.2-2006)

Records of the blast monitoring are kept on site and also forwarded to PIRSA/CIM and the relevant Inspector of Mines within 24 hours of the blasting. (An example of a blast monitoring record is attached and a photograph of the set blast monitoring points within the quarry is contained in Appendix 12).

If at anytime, blast monitoring exceeds the above levels at the Sensitive Sites, then Boral will investigate the blast and implement a blast improvement program .

Complaint records related to blasting are kept on site. All complaints from the public related to blasting at the quarry are documented and investigated by the Quarry Manager and/or Operations Manager and the records of any actions resulting from these investigations are maintained.

6.4 Potential Impact – *Visual Effects*

The quarry up until recent years has been visually hidden from the surrounding community and passing traffic, with development to the south the quarry has become visible from parts of Perry Barr Road to the south and Lonsdale Highway to the east.

Widening of the main quarry workings to its eastern limit and continual addition to overburden stocks will increase visibility.

Control and Management Strategies

- Progressive screening of the quarry and overburden dump from Perry Barr Road will be undertaken from April 2008 onwards. The visualisation of this work is shown in Appendix 11
- Screening of other high visibility areas with mounding and trees
- Continual rehabilitation of upper benches when terminal faces are reached will be done
- Progressive sculpting and seeding of the overburden dump will be undertaken
- All complaints related to visual impacts from the operations will be investigated, issues reviewed and strategise implemented to reduce the visual impact.

Stakeholders

Key stakeholders affected by the visual effects of the quarry are residents in the suburb of Hallett Cove and Marino. Boral will work with the residents to ensure that any proposed screening and rehabilitations works is balanced and in keeping with the expressed desire of the residents to retain their views to the sea.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – unlikely
Consequence – minor.
Potential Impact is considered to be Low.

Objective

The quarry operations will not be visible to residents of Hallet Cove and Marino unless screening would impact on sea views of residents.

Measurement Criteria

Records of visual inspections and photographs taken annually from vantage points on Perry Barr Road and Lonsdale highway will be made to demonstrate the progressive screening of the operations at the site.

The photographic points are shown on a map shown in Appendix 13.

6.5 Potential Impact – *Vegetation Clearance and Disturbance*

No impacts as there is no remnant vegetation is located on the existing leases. The lease is surrounded by grazing land. On the basis that no impacts have been identified, no objectives and/or measuring criteria have been set.

If a complaint is received, issues will be reviewed and strategies implemented to reduce the impact.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – Practically impossible
Consequence - Insignificant
Potential Impact is considered to be Low.

Objective
None set as no impact has been identified.

Measurement Criteria
None Set

6.6 Potential Impact – *Habitat Clearance or Disturbance*

Following on from the comments above in respect of the lack of native remnant vegetation and well established grazing on the surrounding land, no fauna, rare or endangered species have been identified within the quarry area or surrounding areas within the lease boundaries. As no risk has been identified, no objectives and/or measurement criteria have been set in respect to Habitat Clearance and Disturbance.

Objective
None set as no impact has been identified.

Measurement Criteria
None Set

6.7 Potential Impact – *Weed and Pathogen Management*

Encroaching olive trees from the western boundary are a constant threat, eradication through the relevant authorities is continuing.

Control and Management Strategies
The following strategies will be undertaken to meet the objective set out below.

- All equipment used in the quarry will remain within the working areas.
- Periodic inspections of the quarry site under our control will be made to identify any introduced weed or pathogen.
- If any weed and/or pathogen are identified, they will be eradicated and records kept of this program
- All complaints related to introduced weed and plant pathogens and their spreading caused by the quarrying operations will be investigated.

Stakeholders
Key stakeholders affected by the spread of the weeds are residents in the suburb of Hallett Cove and Marino, and the land owner.

Risk Assessment / Likelihood of severity of Consequences
Likelihood – unlikely
Consequence – minor.
Potential Impact is considered to be Low.

Objective:
No new or introduced weed and pathogen species will be introduced within the mine site and the surrounding area uner our control as a result of the quarrying operations.

Measurement Criteria
Flora surveys will be taken annually to prove that weed and palnt pathogens levels are at or below the levels of the surrounding areas (if any weed and/or pathogens are identified during inspections)

6.8 Potential Impact – *Silt and Stormwater*

There is no environmental impact of any significance relating to this aspect at Linwood quarry. The quarry has two small silt dams as part of its water recycling network, removal of silt build

up is done on an as per needs basis. Most of the surface runoff drains into the quarry pit areas.
Beyond the quarry area the existing grassed pastures and slopes remain a stable landform exhibiting no erosion problems.
A premix concrete batching plant is located within the quarry that contains wash-out pits used to collect waste concrete washed out of the bowls of trucks returning to the plant. Accumulated material from this pit is periodically removed to an overburden dump area.
A large volume of stormwater enters the site adjacent to the front entrance gates, being runoff from Clubhouse Road. This water is collected in the quarry entrance road stormwater drainage system.

Control and Management Strategies
Stormwater entering the site via the Marion Council – Clubhouse Road catchment is captured and settled onsite and soon to be pumped into our existing water recycling network. All remaining stormwater captured onsite is stored for re-use as a dust suppression or the truck wash.
Runoff from stockpiles will be directed into the pit.

Stakeholders
Council – re-use of recycled water for the golf course.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – unlikely
Consequence – minor.
Potential Impact is considered to be Medium.

Objective
Site and storm water (including stockpile areas and roadways will be captured and retained within the quarry site.

Measurement Criteria
A survey of the boundaries will be made initially to identify any potential discharge points and after a significant rainfall event and in any case annually these points will be checked to ensure that no silt is leaving the site.

A significant rainfall event is one which by its intensity or duration has the potential to cause erosion. To give some guidance a 15 minute down pour of 12 to 15 mm or 30mm over night are indicative of a significant rainfall event.

6.9 Potential Impact – *Erosion*

The potential for erosion on the site is very limited. There are several reasons for this and they are:

- Within the quarry the areas are almost exclusively hard rock where no erosion can occur.
- The water flows are in towards the bottom of the pit which eliminates the opportunity of sediments being transported off site.
- The paddocks are stable and have been stable for many years minimising erosion from this source.

There is a minimal potential for erosion on the site and does not present a risk on this site. On the basis of this we have not included an objective and/or criteria on this impact.

Objective
None set as no impact has been identified.

Measurement Criteria
None Set

6.10 Potential Impact – *Topsoil Management*

As discussed in section 4.8, the skeletal topsoil layer is generally so thin that it cannot be separately stripped and stockpiled. In these circumstances which we believe will encountered in the future development of the quarry the topsoil is included in the shot and is usually either included in the 'run of mine' material carted to the crusher or excavated together with overburden and placed into either specific rehabilitation areas or existing overburden dumps.

Control and Management Strategies

If we encounter during the quarrying process areas of topsoil greater than 100 to 300 mm in depth and it is possible to strip this topsoil, it shall be separately stockpile ahead of the quarrying activities and the topsoil stockpile managed appropriately prior to being use in the rehabilitation process. Any such stockpiles will be stabilised and monitored for any loss of soil and for weed or pathogen infestations. If any weed/pathogen are identified, stockpiles will be sprayed and then monitored to ensure the weed is eliminated. The area set aside for this stockpiling is shown on the photograph in Appendix 13.

Stakeholders
Key stakeholders affected would be residents and landowner.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – unlikely
Consequence – minor.

Potential Impact is considered to be medium.

Objective
The quality and quantity of all available topsoil will be preserved.

Measurement Criteria
Constant monitoring and measurement of any topsoil stockpile areas for erosion.

6.11 Potential Impact – *Waste Management*

There ar several broad areas that involve the management of waste products within the operation.

Normal Quarrying Operations
Quarrying and crushing processes create two direct waste products, overburden and crusher dust. These materials both originate from the same geological structure as occurs naturally at the site. Overburden is disposed of as described elsewhere in this text. Crusher dust is a by-product of the crushing process and is captured within the dust collection system of the plant. The dampened dust is then collected from the plant and placed into overburden dumps and covered.

Other Waste Products
Other waste products generated as a result of quarrying and crushing processes include:-

a) Waste Oil
b) Scrap Steel
c) Used Tyres
d) General Waste

These are collected on site in an appropriate manner and disposed of in accordance with the EPA licence conditions.

Concrete Plant Waste
The concrete plant operation generates waste concrete which comprises aggregates, sand, cement and flyash. This material is dug out from the collection bays and disposed of in the overburden stockpile or mixed in with the blasted material.

Solid Concrete and Asphalt Waste
The site EPA licence (Appendix 9) allows for the receival, storage and processing of waste concrete and asphalt. All steel reinforcement from concrete processing is sold as scrap and all by-products of recrushing are sold into the construction materials market.

Control and Management Strategies

Existing site management procedures ensure these items of waste are disposed of responsibly. Waste oil is placed into a single storage facility that is regularly emptied by a licensed contractor and waste tracking forms are retained on-site. Scrap steel is stockpiled and occasionally sold to waste metal merchants. Used tyres are sold or returned to the supplier. General waste is disposed of in mobile garbage bins and removed weekly as part of the normal local council rubbish collection.

Records are kept of regular waste removal and disposal as required.

Stakeholders
Land owner and surrounding Residents.

Risk Assessment / Likelihood of severity of Consequences

Likelihood – unlikely
Consequence – minor.
Potential Impact is considered to be Medium.

Objective
No contamination and pollution either on or off site caused by waste products and hazardous material

Measurement Criteria
Regular wase disposal from the site (putrescible waste, oil, tyres, hazardous materials, etc.) are disposed of in accordance with EPA requirements.

Records are maintained of waste (asphalt and concrete) receival, storage and processing in accordance with the EPA licence (a copy of which is attached in appendix 9)

6.12 Potential Impact – *Groundwater*

Groundwater is 75 meters below the surface and approximately 20 metres below the current and final pit floor level. Fuel and other hazardous materials have been stored in accordance with the current legislative requirements and it is considered that groundwater cannot be affected by the operations. Therefore no objectives and measuring criteria related to potential impacts to groundwater have been set.

The Bore Details are contained in Appendix 14.

Control and Management Strategies
None

Stakeholders

None

Risk Assessment / Likelihood of severity of Consequences

Likelihood – Practically Impossible
Consequence - Insignificant
Potential Impact is considered to be Low.

Objective
None set as no impact has been identified.

Measurement Criteria
None Set

7. Emergency / Contingency Plans

Contingency and Emergency plans have been drawn up to cover a number of potential events that could occur on the site and impact on the public or the environment. The following hazards/events have been identified and specific plans drawn up to manage these hazards in the unlikely event that they occur.

A copy of the emergency Procedures is attached in Appendix 15.
The following situations have been addressed in the Emergency Procedures.

1. Medical Emergencies
2. Fire
3. Threats to Business or Personnel
4. Bomb Threat
5. Flood
6. Structural Damage
7. Spillage
8. Explosion

The management strategies for each of these contingencies is covered in the Procedure.

Objective
Operations on the quarry will be undertaken in a manner to minimise the impact on the environment and on public health and safety.

Measuring Criteria
No deaths, injuries to the public or impacts on 3rd party property and environment as a result of the quarry operations undertaken at the site.

Control and Management Strategies
Addressed in the Procedure

Stakeholders
Employees, residents and local council

Risk Assessment / Likelihood of severity of Consequences

Likelihood - Unlikely
Consequence - Major
Potential Impact is considered to be Medium.

8. Compliance Monitoring and Reporting

The program for measuring the achievement of objectives and effectiveness of strategies is detailed below.

6.1 Potential Impact - *Noise (other than Blasting)*

Objective

Compliance with maximum permissible noise levels imposed by the Environment Protection (Industrial Noise) Policy 1994

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
Environment Protection (Industrial Noise) Policy 1994 for a residential area with some manufacturing industry, currently 58dB maximum between 7.00am – 10.00pm and 50dB between 10.00pm – 7.00am.	Bi-annually or as required	Quarry Manager	Results to Operations Manager and State Manager	Report when completed will be provided to PIRSA

6.2 Potential Impact – *Dust (other than blasting)*

Objective

Mitigate dust impacts to a reasonable level for employees and nearby residents

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
PM10 does not exceed 50 $\mu g/m^3$ on more than 10 days per year for the first two years (upon completion of real time monitor network)	Continually when real time monitoring is completed	Quarry Manager	Results to Operations Manager and State Manager	In the case of a 24 hour average exceedance Boral will notify PIRSA in writing.

6.3 Potential Impact – *Blasting (Noise, Dust and Vibration)*

Objective

No unacceptable public health and /or nuisance impacts from airblast, flyrock and ground vibration caused by blasting undertaken in the quarry.

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
• The Peak Sound Pressure level of 115dBL for 95% of the blasts in a year and a maximum limit of 120dBL. (Table J5.4(A)AS2187.2) • A maximum peak component particle velocity of 5mm/s for 95% of the blasts per year and a maximum of 10mm/s. (Table J4.5(A) AS2187.2-2006)	All shots will be monitored	Quarry Manager	Results to Operations Manager and on a monthly basis to the State Manager	Records of the blast monitoring will be kept on site and also forwarded to PIRSA/CIM and the relevant Inspector of Mines within 48 hours of the blasting. (An example of a blast monitoring record is attached in Appendix 12).

6.4 Potential Impact – *Visual Effects*

Objective

The quarry operations will not be visible to residents of Hallet Cove and Marino unless screening would impact on sea views of residents.

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
• Records of visual inspections and photographs taken annually from vantage points on Perry Barr Road and Lonsdale highway will be made to demonstrate the progressive screening of the operations at the sit)	Annually	Quarry Manager	Copy of Photographs to Operations and State Manager	Part of annual Compliance Reporting to PIRSA

6.5 Potential Impact – *Vegetation Clearance*

Objective

As no impact has been identified, no objective has been set.

6.6 Potential Impact – *Habitat Clearance or Disturbance*

Objective

As no impact has been identified, no objective has been set.

6.7 Potential Impact – *Weed and Pathogen Management*

Objective:

No new or introduced weed and pathogen species will be introduced within the mine site and the surrounding area uner our control as a result of the quarrying operations.

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
Flora surveys will be taken annually to prove that weed and palnt pathogens levels are at or below the levels of the surrounding areas (if any weed and/or pathogens are identified during inspections)	Annually	Quarry Manager	Operations and State Manager	Part of annual Compliance Reporting to PIRSA

6.8 Potential Impact – *Silt and Stormwater*

Objective

All site and storm water (including stockpile areas and roadways will be captured and retained within the quarry site.

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
A survey of the boundaries will be made initially to identify any potential discharge points and after a significant rainfall event and in any case annually these points will be checked to ensure that no silt is leaving the site.	After a significant rainfall event and annually	Quarry Manager	Operations and State Manager	Part of annual Compliance Reporting to PIRSA

6.9 Potential Impact – *Erosion*

Objective

As no impact has been identified, no objective has been set.

6.10 Potential Impact – *Topsoil Management*

Objective

The quality and quantity of all available topsoil will be preserved.

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
None Set	Annually	Quarry Manager	Operations and State Manager	Part of annual Compliance Reporting to PIRSA

6.11 Potential Impact – *Waste Management*

Objective

No contamination and pollution either on or off site caused by waste products and hazardous material

Measurement Criteria

Regular wase disposal from the site (putrescible waste, oil, tyres, hazardous materials, etc.) are disposed of in accordance with EPA requirements.

Records are maintained of waste (asphalt and concrete) received, storage and processing in accordance with the EPA licence (a copy of which is attached in appendix 9)

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
Regular wase disposal from the site (putrescible waste, oil, tyres, hazardous materials, etc.) are disposed of in accordance with EPA requirements. Records are maintained of waste (asphalt and concrete) received, storage and processing in accordance with the EPA licence (a copy of which is attached in appendix 9)	Annually	Quarry Manager	Operations and State Manager	Part of annual Compliance Reporting EPA and PIRSA

6.12 Potential Impact – *Groundwater*

Objective

As no impact has been identified, no objective has been set.

Stakeholder Consultation

Criteria	Frequency of Monitoring	Responsibility for Monitoring	Internal Reporting	External Reporting
• Communicate blasting and dust data collected • Facilitate Open communication • Forum to raise issues • Opportunity to influence operations • Identify opportunities to participate with Boral in future projects	Held every 3-6 months and as required.	Operations and State Manager		Regular meetings with both Marino and Hallett Cove working groups reporting on the issues

9. Stakeholder Engagement / Consultation

The continuing encroachment of residential development and activity on the Boral Linwood Quarry has meant that many more persons have (often unavoidably) some impacts from aspects of quarrying activities. In this context,
Boral Linwood Quarry recognises the importance of stakeholder involvement to the sustainable development of the business. At key quarry sites a significant commitment has been made to effectively engage with stakeholders using the national Boral "Community Liaison Group Model"

Stakeholders with an immediate interest in the quarry and or over neighbouring land at Linwood were invited to form two distinct and independent community groups both with there own unique issues, these being:

- Linwood Community Working Group (Marino)
- Linwood Community Working Group (Hallett Cove)

The Working Groups comprise delegates from the Environmental Protection Authority (EPA), Primary Industry and Resources SA (PIRSA), relevant council members, local community representatives and Boral staff.

The objectives of the community working groups are to:

1. **facilitate open communication** – creates a forum for discussion and exchange information on topics related to the Boral quarry and our neighbours;
2. **create a forum to raise issues** – acts as a "structured" communication link between Boral, the community and other stakeholders;
3. **provide an opportunity to influence operations** – assists in identifying and addressing local issues and concerns relating to the Boral Quarry and our neighbours;
4. **provide an effective vehicle** to communicate important information regarding Boral quarry operations;
5. **Identify opportunities** to partner with Boral on community projects - builds relationships between Boral, the community and stakeholders to achieve mutual beneficial outcomes.

Linwood Community Working Group (Marino)
The group was initially established in mid to late 1990's in reaction to the Boral Marino Asphalt Plant that was located at the Linwood quarry