



BORAL – Peppertree Quarry
ANNUAL ENVIRONMENT MANAGEMENT REPORT
January 2016 – December 2016

Prepared for:

Boral Resources (NSW) Pty Ltd

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Boral Peppertree Quarry Annual Environmental Management Report (Jan 2016 – Dec 2016)

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Commonly Used Abbreviations and Acronyms

AEMR	Annual Environmental Management Report
AHMP	Aboriginal Heritage Management Plan
AMC	Aboriginal Management Committee
ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
AS	Australian Standard
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPL	Environment Protection Licence
DO	Dissolved Oxygen
DP&E	Department of Planning and Environment
Ha	Hectares
HSE	Health, Safety and Environment
HSEQMS	Health, Safety, Environmental Management System
HVAS	High Volume Air Sampler
kL	Kilolitres
LOR	Limit of Reporting
mgbl	metres below ground level
NATA	National Association of Testing Authorities
NBMP	Noise and Blast Management Plan
NSW	New South Wales
NTU	Nephelometric Turbidity Units
O&G	Oil & Grease
PIRMP	Pollution Incident Response Management Plan
PM ₁₀	Particulate Matter (10 microns in diameter)
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
RL	Reduced Level
SEAT	Site Environment Assessment Tool
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
µg/m ²	micro grams per square metre
µg/m ³	micro grams per cubic metre
WMP	Water Management Plan

1.0 INTRODUCTION

Peppertree Quarry (the Quarry) is owned and operated by Boral Resources Pty Ltd (Boral). The hard rock quarry is located south-east of Marulan in the NSW Southern Tablelands, approximately 175 km south-west of Sydney (refer to Figure 1).

The Quarry was first granted planning approval in March 2009 under Part 3A of the Environmental Planning and Assessment Act 1979 following the preparation and display of an Environmental Impact Assessment. The project has since been the subject of four separate modification applications which were approved in March 2009, November 2011, October 2012 and most recently in August 2016.

The Quarry has an identified resource area of approximately 250 million tonnes, which dependent upon extraction rates, would allow quarrying for 70 years or more over an area of approximately 104 hectares (ha), within a 650 ha parcel of land.

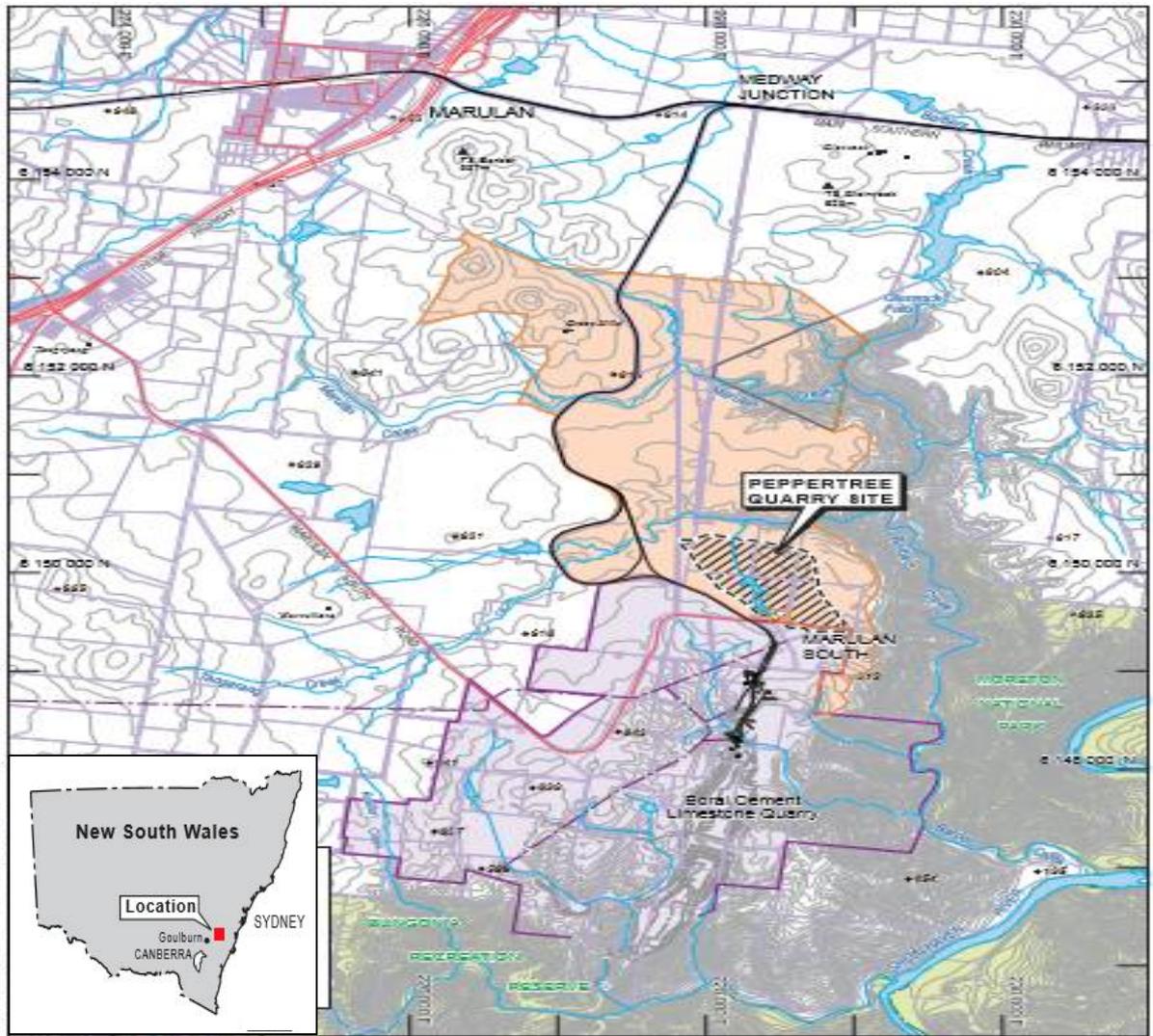
All quarry products and materials (graniodorite aggregate products and manufactured sand) are transported by rail to a number of Boral rail terminals for distribution by trucks into the Sydney metropolitan area.

This Annual Environmental Management Report (AEMR) provides a summary of the Quarry's activities, environmental performance, statutory compliance and community relationships between the period of 1st January 2016 to 31st December 2016 (the reporting period).

The AEMR has been prepared in accordance with the requirements of the Project Approval 06_0074 (Condition 10 - Schedule 5), which requires:

- Details on works (including rehabilitation) conducted in the previous calendar year and the proposed works planned for the next 12 months;
- A review of monitoring results and community complaint records;
- A review of compliance with statutory requirements in relation to specified limits, plans, programs and performance criteria;
- A summary of corrective actions required to address any non-compliances identified during the AEMR reporting period;
- Reporting monitoring results with an analysis of trends from previous years' results;
- A review of discrepancies between predicted and actual environmental impacts and an analysis of the potential cause of any significant discrepancies; and
- Measures to be implemented in the next 12 months to improve environmental performance.

Figure 1: Peppertree Quarry Location Map



- | | | | | | |
|---|------------------------------------|---|------------------------|---|----------------|
|  | Boral Peppertree property boundary |  | National Park, Reserve |  | River or creek |
|  | Boral Cement property boundary |  | Dam |  | Main road |
| | | | |  | Railway |

1.1 REGULATORY FRAMEWORK

The Quarry operates under a number of regulatory approvals and licences which are summarised in the following Sections of the AEMR.

1.1.1 Planning Approval and Modifications

The initial Project Approval (06_0074) was granted by the Minister of Planning under Part 3A of the *Environment Planning and Assessment Act 1997* (EP&A Act) in February 2007. The Project Approval has since been the subject of the following four modifications:

- Modification No. 1 (2009), approved for exploratory blasting and test pitting in order to verify the design of the processing plant;
- Modification No. 2 (2011), approved for the construction of a new rail line rather than use the existing rail facilities to the Limestone Mine;
- Modification No. 3 (2012), approved the construction of a high voltage power line from an existing substation to the processing plant and to provide a rail siding near the junction with the Main Southern Railway Line; and
- Modification No. 4 (2016), approved the extension of in-pit operating hours and the establishment of a new overburden emplacement area (Southern Overburden Emplacement). The approved Modification introduced a number of additional Project Approval compliance conditions which are presented in Table 1a.

Overview of Modification No. 4

The building and construction industry in NSW and particularly in Sydney, has seen a great deal of growth during the reporting period. The NSW Government, together with Federal funding, has committed to significant infrastructure projects, including the Badgery's Creek Airport, new rail lines, and major road construction and upgrading. This has created a significant demand for hard rock aggregates from the main construction material suppliers. Boral is currently, and will be supplying a number of these projects with concrete and asphalt products that required aggregates and sand from the Quarry.

The approval of Modification No. 4 allowed an increase of in-pit operating hours by up to 6 hours per day, 7 days a week in order to meet annual production volumes up to the approved limit of 3.5 million tonnes per annum. The modification also incorporates a proposed new Southern Overburden Emplacement that has been designed as an extension to the existing Eastern Overburden Emplacement and is located entirely within both Boral owned land and the Project Approval boundaries.

A copy of the Project Approval is available on request or can be accessed through the following Boral website:

http://www.boral.com.au/article/marulan_operations_planning_approvals.asp

1.1.2 NSW EPA Environment Protection Licence

The Quarry operations are regulated under a NSW EPA Environment Protection Licence No. 13088 (EPL). The EPL is issued for the scheduled activity of:

- Crushing, Grinding, Separation and Extractive activities for tonnages greater than 2 million tonnes per annum.

No variation or amendment to the EPL has been approved by NSW EPA since September 2013.

A copy of the EPL is available on request or can be accessed through the following Boral website:

http://www.boral.com.au/article/nsw_poela_environmental_reporting.asp

1.1.3 Water Licences

The Quarry maintains a water licence (10WA102701) granted by the NSW Office of Water for the construction and use of a 110ML dam. In addition, a water bore licence (10WA116000) allowing an annual extraction of up to 15 ML. However, as in previous years the Quarry's main dam provided the required operational water supply during the reporting period and no extraction from this bore was necessary.

1.1.4 Regulatory Compliance

The key compliance requirements associated with the Project Approval and EPL are respectively summarised in Tables 1a and 1b with references to the relevant Sections of the AEMR that provide further detail on environmental management, performance and compliance at the Quarry.

Table 1a: Key Compliance Requirements – Project Approval

Compliance Condition	Compliance Requirement (Project Approval - 06_0074)	AEMR Section
Schedule 2: Administrative Conditions		
Schedule 2: Condition 6	No more than 3.5 million tonnes of product to be transported from site in any calendar year.	Section 2.2 (Figure 3)
Schedule 2: Condition 7	All quarry products must normally be transported from the site by rail unless with written approval of the Secretary, quarry products may be transported by road in an emergency or in other limited and exceptional circumstances.	Section 2.9 (Table 4)
Schedule 2: Condition 11	All plant and equipment used at the site must be: (a) maintained in a proper and efficient condition; and (b) operated in a proper and efficient condition.	Note A
Schedule 3: Environmental Performance and Conditions		

Compliance Condition	Compliance Requirement (Project Approval - 06_0074)	AEMR Section
Schedule 3: Condition 1A Revised through Modification No. 4	(a) Prior to the commencement of construction of the Southern Overburden Emplacement Area, an independent registered surveyor to survey the boundary of the emplacement area and submit a survey plan of this boundary to the Secretary; and (b) The Southern Overburden Emplacement area must be clearly marked so that operating staff and inspecting officers can clearly identify its location.	Note B
Schedule 3: Conditions 2, 3, 4 and 5 Revised through Modification No. 4	Prescribes maximum noise limits and receptor locations.	Sections 2.8.1 & 3.5
Schedule 3: Condition 9 & 10	Requires the preparation and implementation of a Noise Management Plan which includes appropriate noise mitigation considerations for compliance with relevant approval conditions.	Section 3.5
Schedule 3: Condition 11 & 11A Revised through Modification No. 4	Table 3 prescribes operational hours for specified quarry activities. Condition 11A has RL restrictions on hours the in-pit crusher may be operated.	Sections 2.3 & 2.7
Schedule 3: Conditions 12 to 16	Requires the preparation and implementation of a Blast Monitoring Program Prescribes with limits and mitigation measures on Blasting Operations.	Sections 2.8.2 & 3.9
Schedule 3: Condition 17	Tables 6, 7 and 8 prescribe Air Quality criteria not to be exceeded.	Section 3.4
Schedule 3: Condition 18	Tables 9, 10 and 11 prescribe land acquisition criteria for particulate matter and dust deposits.	Note C
Schedule 3: Condition 20	Requires the preparation and implementation of an Air Quality Management Plan.	Sections 2.14.1 & 3.4
Schedule 3: Condition 21	Requirement to operate and maintain a meteorological station for the life of the project.	Sections 2.14.3 & 3.3
Schedule 3: Conditions 22 to 30	Surface and groundwater management and monitoring requirements.	Sections 2.13 & 3.7
Schedule 3: Condition 30A Revised through Modification No. 4	Requirements for surface water management for the construction and operation of the Southern Overburden Emplacement Area.	Note B
Schedule 3: Condition 30B Revised through Modification No. 4	Requirements for a compliance audit of the Southern Overburden Emplacement Area construction in accordance with Mod 4 approval.	Note B
Schedule 3: Condition 32A	Requirement to report unexpected encounters with archaeological relics.	Sections 2.15 & 3.11
Schedule 3: Condition 33 to 33A	Species (Flora & Fauna) and habitat management.	Sections 2.5 & 5.0

Compliance Condition	Compliance Requirement (Project Approval - 06_0074)	AEMR Section
Schedule 3: Condition 34 Revised through Modification No. 4	Requirement for the implementation of a Biodiversity Offset Strategy in accordance with Mod 4 approval.	Sections 5.0 & 6.0 (table 22)
Schedule 3: Condition 34A Revised through Modification No. 4	Requires the preparation and implementation of a Biodiversity and Rehabilitation Management Plan for managing native vegetation.	Sections 2.5 & 5.0
Schedule 3: Condition 37	Visual amenity and off-site lighting.	Sections 1.3 (Table 3) & 4.1.1 (Table 20)
Schedule 3: Condition 41	Monitor and minimise waste.	Sections 2.10, 3.10 & 6.0 (Table 22)
Schedule 3: Condition 42 to 45	Emergency and hazard management.	Section 3.12
Schedule 3: Condition 46	Monitoring and reporting of production data.	Section 2.2
Schedule 3: Condition 47	Quarry exit strategy.	Section 5.0
Schedule 4: Additional Procedures		
Schedule 4: Condition 1	Notification of non-compliances with criteria prescribed in Schedule 3.	Section 3.13
Schedule 4: Condition 2 to 5	Requirement for an Independent Review.	Section 6.1
Schedule 4: Condition 6 & 7	Land acquisition considerations.	Note C
Schedule 5: Environmental Management, Reporting and Auditing		
Schedule 5: Condition 1 Revised through Modification No. 4	Implementation of an Environmental Management Strategy.	Section 3.2
Schedule 5: Condition 2 Revised through Modification No. 4	Preparation of Management Plans.	Section 3.2
Schedule 5: Condition 3 Revised through Modification No. 4	Revision of Strategies, Plans and Programs.	Section 3.2
Schedule 5: Condition 4 Revised through Modification No. 4	Requirement for Biodiversity and Rehabilitation Management Plan to be submitted by 28 February 2017.	Note D
Schedule 5: Condition 5 Revised through Modification No. 4	Updating and Staging of Strategies, Plans or Programs.	Section 3.2
Schedule 5: Condition 6 Revised through Modification No. 4	Requirement for adaptive management of project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in Schedule 3.	Section 3.1.1
Schedule 5: Condition 7 Revised through Modification No. 4	Requirement to maintain and facilitate a Community Consultative Committee.	Section 4.2.2
Schedule 5: Condition 8	Requiring for reporting of incidents.	Sections 3.12 & 3.13

Compliance Condition	Compliance Requirement (Project Approval - 06_0074)	AEMR Section
Revised through Modification No. 4		
Schedule 5: Condition 9 Revised through Modification No. 4	Requirement to have environment performance reporting posted on website.	Section 4.2.6
Schedule 5: Condition 10 Revised through Modification No. 4	Requirement for an AEMR to be submitted by end of March each year.	Section 1.0
Schedule 5: Condition 11 Revised through Modification No. 4	Requirement for Independent Environmental Audits.	Section 6.1
Schedule 5: Condition 12 Revised through Modification No. 4	Information and documentation required to be posted on website by November 2016.	Section 4.2.6
Notes:		
Note A: A formal inspection and maintenance program of Quarry plant and equipment has been developed and implemented through Boral's Electronic Asset Management (EAM) program.		
Note B: This condition was not triggered during the Reporting Period. The construction of the Southern Overburden Emplacement Area had not commenced during the Reporting Period.		
Note C: This condition was not triggered during the Reporting Period. No land acquisition was required under Project Approval conditions.		
Note D: A Biodiversity and Rehabilitation Management Plan has been submitted to Department of Planning and Environment for review and approval.		

Table 1b: Key Compliance Requirements – EPA Environment Protection Licence

Compliance Condition	Compliance Requirement (EPL No. 13088)	AEMR Section
Conditions P1.1, M2.1 and M2.2	Dust Monitoring (EPL discharge points 1 to 5).	Section 3.4.1
Condition L1	Requirement to comply with section 120 of the <i>Protection of the Environment Operations Act 1997</i> – prohibition of the pollution of waters.	Sections 3.7 & 3.8
Condition L2 and L2.2	Prescribes maximum noise limits at nominated residential receivers.	Sections 2.8.1 & 3.5
Condition L3 and L3.1	Prescribes blasting criteria.	Sections 2.8.2 & 3.6
Conditions O1 and O2	Activities must be undertaken in competent manner (O1) and plant and equipment must be maintained and operated in a proper and efficient manner.	Note A
Notes:		
Note A: A formal inspection and maintenance program of Quarry plant and equipment has been developed and implemented through Boral's Electronic Asset Management (EAM) program.		

1.1.5 AEMR Distribution

Copies of the AEMR will be submitted to:

- NSW Department of Planning and Environment;
- NSW Environment Protection Authority;
- Water NSW;
- Department of Primary Industries – Water;
- Office of Environment and Heritage;
- Goulburn Mulwaree Shire Council;
- The Peppertree Quarry Community Consultative Committee; and
- Aboriginal Heritage Management Committee.

The report will also be available at the Boral website:

http://www.boral.com.au/article/marulan_operations_environment.asp

1.2 SITE CONTACT DETAILS

Key contacts associated with the management of the Quarry operations, environment, safety and stakeholder relationships are provided in Table 2.

Table 2: Key Contact Details – Peppertree Quarry

Contact Person	Position Title	Contact Details
Angus Shedden	Quarry Manager	Tel: (02) 4841 1701 Email: angus.shedden@boral.com.au
Sharon Makin	Stakeholder and Environment Manager	Tel: (02) 4841 1701 Email: sharon.makin@boral.com.au
Paul Jackson	Stakeholder Relations Manager	Tel: (02) 9033 5215 Email: paul.jackson@boral.com.au

1.3 ACTIONS REQUIRED AT PREVIOUS AEMR REVIEW

Table 3 lists specific actions from the 2015 AEMR to have been undertaken during the 2016 reporting period.

Table 3: Actions Required from 2015 AEMR

2015 AEMR Actions	Status
Finalisation of outstanding actions from the Independent Audit findings.	A summary letter detailing the responses to recommendations provided by the Independent Audit was submitted to the Department of Planning and Environment on 26 th October 2016. The majority of recommendations have been closed-out with a number to be actioned during the 2017 reporting period.
Development and implement a formal maintenance schedule that includes the dams and other water management structures. (Independent Audit recommendation).	A formal maintenance program has been developed and implemented through Boral's Electronic Asset Management (EAM) program. Sediment ponds will be reviewed on an annual basis for stability and requirement for any maintenance.
Implementation of Lighting Audit recommendations (DP&E (Aug 2015) Audit Non-Compliance ID 1.2).	The Lighting Audit identified that the Quarry operations complied with the lighting requirements however recommendations could be implemented to further reduce perceived lighting impacts. The recommendations were the subject of a change management risk review.

2015 AEMR Actions	Status
	The review identified a number of potential safety issues with the implementation of the recommendations. However, any individual concerns or complaints regarding quarry lighting will be addressed.
Action all Non-Compliances (Administrative) identified during DP&E Audit (Aug 2015).	Completed by end of reporting period - refer to Sections 1.3 (Table 3) & 6
Review of chemical storage and bunding.	An annual review of chemical storage is undertaken as part of the Boral HSEQ audit system. A detailed audit was undertaken on bunding on the site and a regular review is now in place, with a specific site checklist. Works were identified to improve bunding associated with the waste oil recycling facility
Full implementation of Groundwater Monitoring Program by completing quarterly monitoring during 2016 (DP&E Audit (Aug 2015) Non-Compliance ID 1.1).	A groundwater monitoring program has been included into the Quarry Water Management Plan. Groundwater was sampled on a quarterly basis during the reporting period with results presented in Section 3.8.4 below.
Development and implement Waste Management Plan.	A Waste Management Plan was prepared during the reporting period with tracking, record keeping and the commencement of waste reduction initiatives (refer to Sections 2.10 & 3.10 below).
Development and implement ongoing maintenance and management plan for fire response equipment required on-site.	Annual audits are undertaken by an independent third party on the fire suppression and emergency response system. A review has been undertaken on the fire response equipment and system with maintenance schedule included in the EAM system.
Continued removal of overburden to the north-east and in-pit crusher to be sited to the next bench level.	Overburden removal and emplacement has continued to the north east during 2016. Due to a change in the mine plan, the in-pit crusher continues to operate on RL 555 and hasn't moved to the next bench level. The next bench level is still being developed.
Review of the Water Management Plan.	Completed as part of Modification No. 4 approval.
Review of weather station data handling, calibration and maintenance procedures	Consultant has been commissioned to undertake continued review of the 2016 and 2017 weather data on a monthly basis to ensure the reliability of the weather station data. Routine maintenance continues to be undertaken on a 2-monthly basis

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2015 AEMR Actions	Status
Undertake Replanting of disturbed areas, hydromulching of overburden embankments and removal of sediment accumulation in Tangarang Creek.	Replanting and hydromulching of the overburden embankment areas in nominated areas has been undertaken. Sediment removal from Tangarang creek is to be discussed with the EPA prior to any works commencing.
Review of the Quarry Aspects and Impacts Register.	Completed in November 2016 (refer to Section 3.1.1 below).
Preparation of 2016 AEMR for submission to DP&E by end of March 2016.	The submission of this AEMR by end of March 2017.

2.0 SUMMARY OF QUARRY OPERATIONS

2.1 OVERVIEW OF QUARRY OPERATIONS

The Quarry extraction operations are conducted through four main stages which involve (refer to Figure 2):

- Topsoil and overburden removal and emplacement;
- Blasting and crushing of raw feed in-pit;
- Final crushing, screening and stockpiling out-of-pit; and
- Loading, transport and distribution.

Overburden is progressively stripped in layers and hauled to dedicated emplacement areas. The exposed rock is then drilled, blasted and loaded into a mobile primary crushing plant which weighs 285 tonnes and measures 12m in height by 25m in length.

The mobile primary crusher is relocatable to areas within the quarry pit as required. This has significant benefits such as reduced fuel consumption and improved air quality compared to conventional fixed crushing plants that require material to be transported greater distances. The mobile crushing plant design also includes a uniquely designed mobile conveying system allows the relocation of crushing operations to new extraction areas further reducing heavy vehicles fuel usage; noise and dust emissions; and exhausts emissions.

Crushed rock from the mobile crushing plant is delivered via conveyors to the out-of-pit processing plant where further crushing, screening and blending is performed to meet various product specifications. The conveyors and processing plant are fully enclosed to control dust and noise.

The final product is then stored in eight silos that have conveyors connected to train loading bins. The loading of product into trains is fully automated and centrally managed from the main control room which monitors the feed and delivery conveyors, crushing and screening plants. Faults are efficiently detected and diagnosed and if required sections of the processing system can be shut down.

Figure 2: Peppertree Quarry Process



2.2 QUARRY PIT OPERATIONS

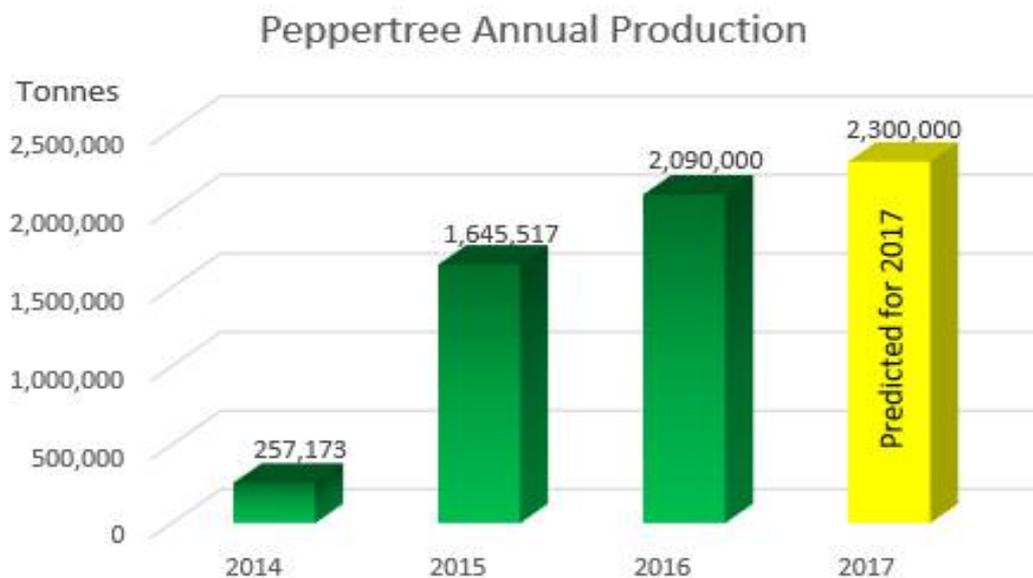
The pit has continued to develop in a south-eastern direction with a further overburden campaign undertaken in 2015 and 2016, with the overburden being emplaced as an extension of the noise bund to the south. Within the next two years, the pit will progress in an easterly direction with the overburden emplacement extending further to the south in accordance with Modification No. 4 approval.

Quarry development to date has comprised the establishment of the initial quarry pit with the overburden used to construct the northern section of the noise bund, construction of Dam 1, rail embankment and the processing plant area.

During the reporting period, the Quarry produced 2,090,000 tonnes of aggregate (ref to Appendix 1) which is a 21 per cent increase of 2015 production (refer to Figure 3). The significant increase in the Quarry production reflects the combination of transitioning from the Quarry's development to full production and the recent upturn of NSW residential and commercial construction activities.

Predictions for the next few years are that economic growth will continue in NSW and the anticipated production for 2017 is of a slight increase to 2.3 million tonnes. However, actual realised tonnage will be dependent on continued market demand and the production levels at other Boral hardrock quarries.

Figure 3: Quarry Production Trends



2.3 HOURS OF OPERATIONS

During the reporting period, Boral sought an extension to the in-pit operating hours which was granted as part of the Modification 4 to the Project Approval. The in-pit operating hours were extended from 7.00am to 5.00am and 7.00pm to 11.00pm – 7 days a week. However, the extended hours will only be utilised on an operational requirement basis and not expected to be routinely conducted.

It should also be noted that all other operating hours remained unchanged. The Project Approval operational hours in accordance with Modification No. 4, permit the following times for specific operations:

In-Pit Operations

Including drilling, extraction, processing, and transfer of material out of the pit:

Any Day – 5.00 am to 11.00 pm

Out-of-Pit Activities

Including processing, stockpiling, train loading and distribution, and maintenance:

Any Day – 24 hrs

Blasting

Monday to Saturday – 9.00 am to 5.00 pm

Sunday and public holidays: Not permitted

Topsoil and Overburden Removal/Emplacement

Any Day – 7.00 am to 7.00 pm

2.4 EXPLORATION

No exploration activities were proposed or undertaken at the Quarry during the reporting period.

2.5 LAND PREPARATION

Land preparation prior to the extraction of rock requires planning and implementation of controls associated with clearing of vegetation; erosion and sediment; preserving cultural heritage; and the stripping, stockpiling and reuse of topsoil and overburden.

As a requirement of Project Approval Conditions, the following Management Plans have been developed and implemented and provide the framework for ensuring land development activities are undertaken in an environmentally and culturally responsible manner:

- Environmental Management Strategy (Condition 1 – Schedule 5. Note: *This has replaced the former Environmental Monitoring Plan*);
- Air Quality Management Plan (Condition 20 – Schedule 3);
- Biodiversity and Rehabilitation Management Plan (Condition 34A – Schedule 3. Note: *This has replaced the former Landscape and Rehabilitation Management Plan*);
- Water Management Plan (Condition 26 – Schedule 3); and
- Aboriginal Heritage Management Plan (Condition 32 – Schedule 3).

Each of the above management plans were revised during the reporting period to incorporate changes associated with Modification No. 4 and to reflect current management practices associated with quarry activities.

During the 2016 AEMR period, a total of 78.8 ha of Quarry land remains disturbed. An attempt was made to rehabilitate approximately 17 ha of overburden embankment through spray grass and hydro mulching, however due to the weather this proved to be unsuccessful. As part of the preparation of the biodiversity and rehabilitation management plan, a review of the rehabilitation practice was undertaken. Topsoil will now be applied to the embankments, with Reseeding and / or replanting to be undertaken in 2017.

Figure 4 presents the locations and total estimated areas of disturbance to the end of the 2016.

Figure 4: Disturbed Areas to End of 2016

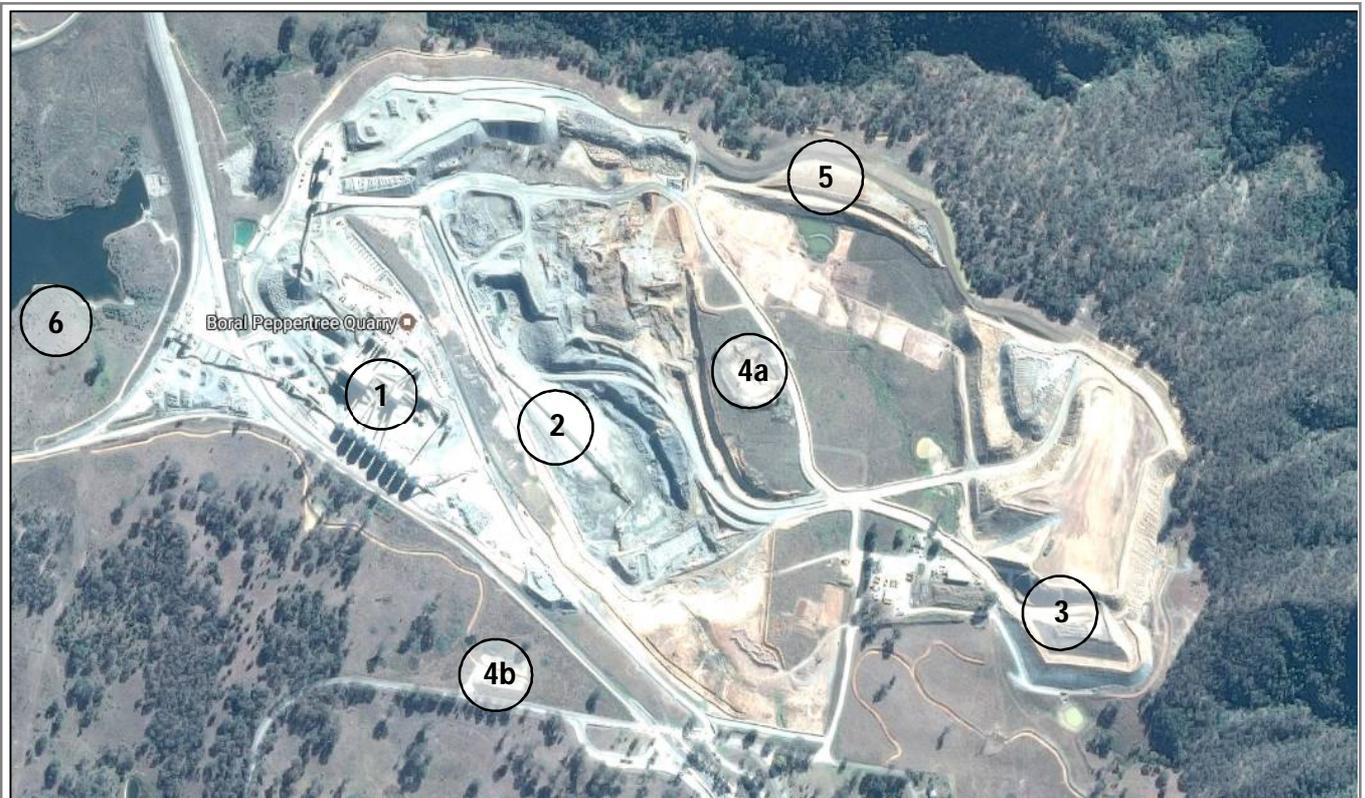


Image Source: Google Earth (February 2017)

LEGEND

Map Reference	Disturbed Area (ha)	Rehabilitated Area (ha)
1: Infrastructure area – (Primary, STO and TLO)	25	Not applicable till end of life
2: Quarry extraction area	35.2	No Rehabilitation in 2016
3: Active overburden emplacement	29	No Rehabilitation in 2016
4: (a) test pit / (b) west pad	2	Not applicable as in quarry area
5: Overburden emplacement / Noise bund	No Disturbance	12.1
6: Dam and creek rehabilitation area	10	10.3
Total area Disturbed / Rehabilitated	101.2	22.4

2.6 CONSTRUCTION

No major construction activities were undertaken at the Quarry during the reporting period.

2.7 CRUSHING

During the reporting period, the mobile primary crusher remained within the 1st bench (RL555) of the quarry pit throughout the reporting period. The ability to relocate the crusher provides for significant reductions in the haulage of materials from extraction areas which in turn results in a lower fuel usage and air emissions (i.e. noise, dust and exhaust). It is expected that the mobile crusher will also remain operational at this location throughout 2017.

2.8 NOISE AND BLASTING

2.8.1 Noise

Condition 10 (Schedule 3) was modified as part of Modification No. 4 and required that a program be developed to undertake attended and unattended noise monitoring at additional receiver locations R4 and R17. It was determined that monitoring at the additions receivers should be done in accordance with the quarterly noise monitoring already undertaken. As Modification No. 4 approval was granted in August 2016, the additional receiver locations were only able to be monitored in October as part of the NBMP quarterly program within the reporting period.

In addition, receiver location R2 came under Boral ownership, as part of the future plans for development of the Marulan south operations. R2 was therefore only monitored for the first three quarters of the reporting period and will no longer be included in future monitoring.

In addition, following a private land acquisition agreement, receiver location R2 became under Boral ownership and was only monitored for the first three quarters of the reporting period and will no longer be included in future monitoring.

In accordance with Condition 2 (Schedule 5) of the Project Approval, the 2012 version of the NBMP was revised and submitted to the Secretary for approval. A Noise Impact Assessment was also conducted during the reporting period which concluded that the proposed activities under Modification No. 4 were unlikely to contribute to any significant change in existing operational or cumulative noise levels at identified sensitive receivers. As such, the revised 2016 NBMP remained substantially consistent with the initial version with additional detail reflecting Modification 4 approval conditions and current quarry activities as of 2016.

The results and a general review of the quarterly noise monitoring program conducted during the reporting period are presented in Section 3.5 below.

2.8.2 Blast Monitoring

All blasts are conducted in accordance with the Noise Blast Management Plan which was revised in October 2016 to reflect Modification No.4 approval conditions and current Quarry operations.

The Quarry conducted 50 blasts during the reporting period by certified contractors. The contractors conduct the blasts under the supervision and approval of the Quarry Manager with consideration to Project Approval and EPL conditions and criteria. Boral's integrated Health Safety, Environment and Quality Management System (HSEQ MS) also includes a specific Standard Procedure for blasting operations which generally aligns with Australian and New Zealand Environment Council's "Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration" (ANZECC: 1990).

Monitoring of overpressure and ground vibrations at four nominated sensitive receptors is conducted during every blast. The monitoring results are published on the Boral website in accordance with EPL requirements and section 66(6) of the POEO Act that requires licensees to publish pollution monitoring data that has been collected as a result of a EPL condition. Neighbours within two kilometres who have requested to be advised are provided with at least 24hrs notice prior to any blasting event.

The results and a general review of blast monitoring conducted during the reporting period are presented in Section 3.6 below.

2.9 MATERIAL PROCESSING

Extracted rock from the pit is progressively processed through the following facilities:

- Primary in-pit mobile crusher and conveyor system;
- Primary Screen and building enclosure;
- Secondary crushing plant and building enclosure;
- Secondary Screen and building enclosure;
- Final product silos; and
- Train loading facility.

Each component of the above processing facilities requires separate material handling infrastructure including conveyors, drives, loop take-ups, feeders and dust controls. The design which includes a purpose built primary in-pit crusher has minimised the need to transport the material from extraction areas to processing facilities which are a normal feature of most hard rock quarries.

The crushing and screening buildings were purpose built to reduce noise and dust emissions with material being transported through fully enclosed conveyors into and out of each building ultimately delivering final product sizes to the enclosed silos.

The train loading system allows for loading of multiple products and blends from the silos. The train loading system is fully automated with product being delivered by conveyors from the silos to the loading bin. All quarry products and materials are transported by rail to one of three Boral sites including, Maldon rail terminal near Picton, St Peters and Enfield terminals for ultimate distribution by trucks into the Sydney metropolitan area. The use of rail as part of the distribution chain significantly reduces impacts and congestion on local and regional road networks.

Project Approval Condition 7 (Schedule 2) requires all product to be transported from Peppertree by rail. Road transportation may be allowed on request to Department of Planning and Environment. During the reporting period, Boral made 4 requests to the Department for road transport of products for the use by adjoining properties and donations to local community groups. The Department approved the requests but with limitations on the transport and tonnage. The approvals are summarised in Table 4.

Table 4: Approval Requests for Road Transport

Date	Group	Material	Trucks	Complete
April 2016	Leichtenberg	Scalps for redressing internal property roads.	250 tonnes	No - approx. 150 tonnes taken as of end of 2016
April 2016	Tallong Focus Group	Scalps and overburden for upgrade of Tallong Memorial Park.	20	No - pending construction works by local contractor
August 2016	Sali	Scalps for redressing internal property roads.	300 tonnes	Yes
November 2016	AgLime	Scalps for dressing of yard area.	3000 tonnes	Yes

2.10 WASTE MANAGEMENT

A Waste Management Plan was prepared during the reporting period supported by the Boral waste management HSEQ MS Standard, both of which commit to best practice of avoidance through to the least preferred disposal option. The implementation of the Plan and Standard provide the framework for:

- Compliance with Statutory requirements;
- Identification, storage, handling, classification and disposal of wastes;
- Minimising waste generation;

- Reuse and recycling of waste wherever practical; and
- Educating and encouraging site employees in achieving the waste hierarchy objectives.

A waste invoice and docketing system is utilised which includes the classification, assessment and management of the Quarry's waste stream in accordance with Project Approval requirements (refer to Table 5).

Table 5: Peppertree Quarry Waste Stream and Management

Waste Stream	Source	Classification	Management
Oil absorbent pads	Oil spills	Solid general waste	General waste bins – filler silo / workshop
Oil filters	Maintenance on vehicles	Solid general waste once oil has been drained	General waste bins – filler silo / workshop
Oily rags / waste	Workshop	Solid general waste	General waste bins – filler silo / workshop
Paper –Investigating recycling options	Office	Solid general waste	General waste bins
Steel	General maintenance and capital works	Solid general waste	Recycled
Cardboard	Packaging	Solid general waste	Recycled
Food scraps	Lunch room	Solid general waste	General waste bins
Plastic / Glass bottles	Lunch room	Solid general waste	General waste bins
Aluminium cans	Lunch room	Solid general waste	General waste bins
Screen mats – Investigating recycling opportunities	Replacement at screens	Solid general waste	General waste bins – filler silo / workshop
Conveyor belt - recycled	Split conveyor belts	Solid general waste	Stored in primary area
Oil drums	Spent oil	Solid general waste	Farm house depot
Tyres	Vehicle maintenance	Solid general waste	recycled

2.11 STOCKPILE MANAGEMENT

Topsoil and overburden is separately stripped and stockpiled for subsequent use on completed batter slopes and bunding as part of ongoing water and sedimentation controls. Overburden is placed directly on the undisturbed ground surface to minimise any impacts to Aboriginal heritage areas.

Stockpiles and overburden placements are appropriately controlled with consideration to location, stability, geotechnical characteristics, slope and height.

Figure 5 shows the location of the following three dedicated stockpile areas being utilised:

1. Scalpings stockpile (material waiting for sale)
2. TLO stockground (capable of holding multiple products for train load out) and
3. Front gate stockground (excess storage as needed)

Figure 5: Dedicated Stockpile Locations



2.12 DANGEROUS GOODS AND HAZARDOUS MATERIALS MANAGEMENT

The Quarry has a Safety Data System (SDS) in place utilising the ChemAlert Program. A Hazardous and Dangerous Goods Register is in place which identifies each chemical stored onsite. The register is electronically filed with a physical copy kept within the Site Office.

In accordance with Project Approval Condition 43 (Schedule 3), all dangerous goods and chemicals are handled and transported in accordance with the AS1940 and AS25956 and the Dangerous Goods Code.

The only Dangerous Goods Licence pertaining to the Quarry is for a 100 kL aboveground double skinned and bunded diesel tank for refuelling locomotives. The WorkCover Notification (NDG200221) is on behalf of an on-site contractor who operates and maintains the refuelling facility. The Contractor's operation and management of the facility is audited on a regular basis for compliance.

2.13 WATER MONITORING

2.13.1 Surface Water Monitoring

The Quarry manages surface water in accordance with a Water Management Plan (WMP) that was revised in November 2016 to incorporate changes associated with Modification No. 4 and to reflect management of surface and groundwater associated with current quarry activities.

Surface water quality is monitored on a quarterly basis at the discharge point of the main storage dam (Dam 1) and at upstream and downstream locations to confirm quarry operations are not adversely impacting the Tangarang Creek Catchment.

The ephemeral nature of Tangarang Creek resulted in water samples from the upstream monitoring location only able to be collected during the second and third quarters of the reporting period. Sampling in all other locations (i.e. Quarry Dam and the downstream monitoring point) was conducted in accordance with the WMP and results with historic trends are presented in Section 3.7 below.

2.13.2 Groundwater Monitoring

In October 2015, 12 groundwater bores were installed with the first sampling event completed on October 2015. During the reporting period, the bores were sampled on a quarterly basis and Section 3.8 below presents results and trends since commencement of sampling up until the end of the reporting period.

The early stages of groundwater sampling will provide baseline data on water levels, flows, and quality. As the groundwater monitoring program generates additional data, long-term trends and analysis will be reported in future AEMRs in accordance with Project Approval Condition 30 (Schedule 3).

2.13.3 Supply of Environmental Flow

In Project Approval Condition 24 (Schedule 3), 10% of the average daily flows into the Quarry Dam No. 1 is utilised in providing environmental flows to Tangarang Creek. The measurement of environmental flows

is undertaken by monitoring of water level variations in Dam No. 1, with a downstream discharge flow meter and referenced against historically calibrated water balance data. Prior to the Quarry operations, flow in Tangarang Creek was extremely dependant on heavy and prolonged rainfall events and the environmental flows provided through Dam No.1 has provided more consistent flows, improving the health of downstream ecosystems.

2.13.4 Potable and Amenity Water

The Quarry has no potable water supply and the Site Office and amenity requirements are met with potable water being imported as required. On-site sewage comprises of a package treatment unit with the treated effluent being pumped to an absorption trench located to the south of the processing plant.

2.14 AIR QUALITY MONITORING

2.14.1 Deposition Dust Monitoring

The Quarry operates an air quality monitoring system in accordance the Air Quality Management Plan (AQMP) of which the 2012 version was revised in October 2016 as part of Modification No. 4 approval. There are three dust deposition gauges used for monitoring of larger dust particles (typically >50µm) that settle out from the air and referred to as depositional dust.

The dust deposition gauges were sampled monthly (+/- 2 days) during the reporting with results comprising of the insoluble (mineralogical) matter and ash residue (organic). The results from each of the three gauges are presented in Section 3.4 below.

2.14.2 PM₁₀ and TSP Monitoring

Two High Volume Air Samplers (HVAS) were operated during the reporting period to monitor the concentration of smaller dust particles (typically <50µm) suspended in the atmosphere. The samples were taken over a 24 hour period every sixth day. One of the HVAS is operated to monitor Total Suspended Particulates (TSP), while the second records Particulate Matter less than ten microns in diameter (PM₁₀). Results for TSP and PM₁₀ from the respective HVAS are provided in Section 3.4 below.

2.14.3 Meteorological Monitoring

An onsite automated weather station monitors barometric pressure, wind speed and direction, rainfall, relative humidity, temperature at 2m and 10m, as well as solar radiation. Data is uploaded to a secure web page on a weekly basis, however the data can be obtained on an hourly basis if required or in the event of a dust incident where wind speed and direction are readily required.

The maintenance and calibration of the weather station data is undertaken by a contractor, in addition a forecasting system via Weatherzone is in place to provide alerts to relevant site personnel on predicted significant weather events such high winds and extreme rainfalls so that appropriate actions and controls can be proactively implemented.

Further to a review of the operation of the onsite weather station in 2015, an air specialist continues to be engaged to review on a monthly basis the data from the weather station to ensure its reliability.

2.15 HERITAGE CONSERVATION

The Aboriginal Heritage Management Plan (AHMP) updated in 2013 was revised in November 2016 to incorporate changes associated with Modification No. 4 and to reflect management associated with current quarry activities.

The AHMP continues to provide the framework for the identification, protection, conservation and presentation of Aboriginal cultural values at the Quarry.

The primary objectives of the AHMP are to identify, protect, conserve, present and transmit the Aboriginal heritage values associated with the land, on which the Quarry activities are conducted.

As required by Project Approval Condition 32 (Schedule 3), the AHMP:

- Identifies the Aboriginal sites that will be conserved and those that will be impacted by quarrying;
- Includes a series of management measures that allow in-situ retention of Aboriginal sites and artefacts during the Quarry's active life time and subsequent rehabilitation (i.e. conservation for future generations);
- Provides management measures designed to off-set the impacts through a combination of Aboriginal community involvement and archaeological excavation;
- Facilitates ongoing consultation and involvement of the Aboriginal communities in the conservation and management of Aboriginal cultural heritage on the site; and
- Describes the measures that would be implemented if any new Aboriginal objects or relics discovered during Quarry activities.

Salvage works continued in concentrated in Areas 1, 2 and 3 (refer to Figure 6) during the first 6 months of the reporting period with the details contained in Section 3.11.

Figure 6: Topsoil Monitoring and Salvage Areas 2014 to 2016



3.0 ENVIRONMENTAL MANAGEMENT AND MONITORING

The Quarry has a comprehensive monitoring program that collects information and data for the assessment of environmental impacts, regulatory compliance and performance against continual improvement objectives. Monitoring is undertaken in accordance with the respective activity specific Management Plans which define the framework for measuring environmental performance and compliance with statutory requirements.

3.1 BORAL INTEGRATED MANAGEMENT SYSTEM

The Quarry is subject to internal conformance requirements with the Boral Integrated Health Safety, Environment and Quality Management System (HSEQ MS) which comprises of the following nine Environmental Standards:

- Environmental Aspects and Impacts;
- Water Management;
- Land Management;
- Waste Management;
- Noise Management;
- Air Management;
- Spill Management;
- Ecosystem and Biodiversity Conservation; and
- Culture and Heritage Protection.

The identification of environmental risks at the Quarry is undertaken in accordance with the HSEQ MS Aspects and Impacts Standard which aligns with Australian & New Zealand Standard AS/NZS 31000:2009 Risk Management - Principles and Guidelines. The Quarry Environment Management Strategy outlines how the Boral HSEQ system is implemented at the site.

3.1.1 ASPECTS AND IMPACTS REGISTER

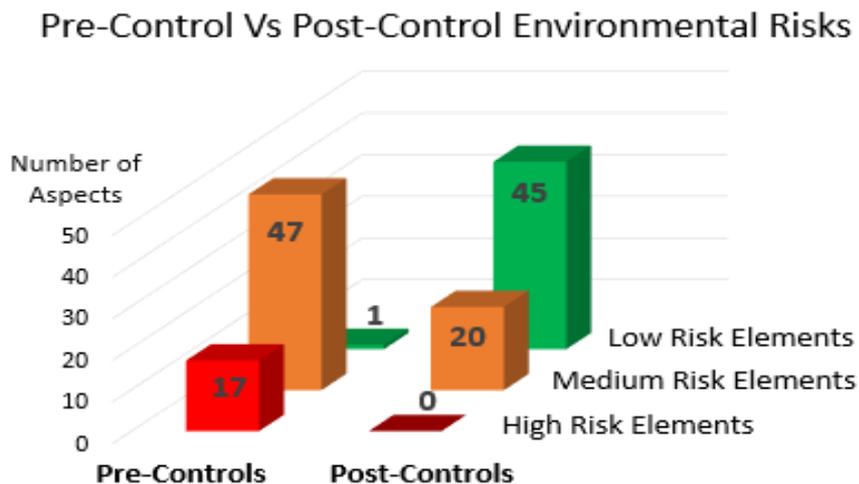
A review of the Quarry Environmental Aspects and Impacts Register was undertaken in late 2016 by a collaboration of Quarry Management, operational employees and environmental advisors. The review included risk assessments on 65 environmental elements associated with the Quarry activities, equipment, materials and products which included:

- Impacts to air quality & generation of dust;
- Noise and blast exceedances;
- Pollution of waters (surface and groundwater);

- Chemical storage and contamination;
- Inadequate erosion and sediment controls;
- Unauthorised disturbance of fauna and flora management;
- Damage of cultural heritage artefacts and areas;
- Inadequate rehabilitation of disturbed areas and
- Deterioration of relationships with community and regulators.

Through the implementation of appropriate engineered, procedural and behavioral controls, the initial ranking of 17 high risk elements was reduced to either medium, low or nil risks (refer to Figure 7).

Figure 7: Aspect and Impacts Risk Rankings



3.2 MANAGEMENT PLANS

In accordance with Project Approval requirements, the Quarry has developed and implemented the following management documents which provide the framework for measuring, monitoring and managing environmental performance and compliance.

Each of the documents listed below were revised during the reporting period to incorporate changes associated with Modification No. 4 and to reflect current management practices associated with current quarry activities.

- Environmental Management Strategy;
- Air Quality Monitoring Plan;
- Noise and Blast Monitoring Program;

- Biodiversity and Rehabilitation Management Plan - (*formerly Landscape and Rehabilitation Management Plan*);
- Water Management Plan and;
- Aboriginal Heritage Management Plan.

Modification No. 4 to the Project Approval introduced a condition for Management Plan Requirements (Condition 2 – Schedule 5). The review of the plans has been in line with this condition.

3.3 METEOROLOGICAL MONITORING

In accordance with Project Approval Condition 21 (Schedule 3), the Quarry continues to utilise the onsite weather station established since the commencement of the quarry development.

The weather forecasting dashboard used to identify potential adverse weather conditions, is also still in place. Without adequate planning and management controls, events such as high winds and extreme rainfall events can disrupt quarry operations and potentially be the cause of material environmental harm.

The forecasting dashboard was proactively used in June 2016 with the prediction of an east coast low occurring along the coast. A similar weather pattern had caused extensive flooding in 2015. With the use of the dashboard information, the movement of the east coast low was able to be accurately tracked and an action plan was triggered which included an audit of the site stormwater management system (ponds, drains and pumps) and the establishment of a call out plan should the potential of flooding arise.

Teams were alerted and brought to site early on the morning of the 5th June 2016 as water started to rise within the pit. All equipment was relocated and unlike the 2015 weather event, no flooding or damage was sustained. Storm water flows across the site were able to be managed.

The triggers for the potential for noise and therefore its management are now being added to the dashboard.

3.4 AIR QUALITY

3.4.1 Dust Management

The Quarry benefits from modern design, engineered controls and procedural protocols in the management of air quality. Design aspects of the Quarry that minimise dust generation include:

- The ability to progressively relocate the primary crusher into the quarry pit with construction of fixed conveyors, which has significantly reduced the haulage of materials from extraction areas. This also results in a reduction of fuel usage and air emissions (i.e. noise, dust and exhaust) due to the reduction in truck movements;

- Reduced dust through fully enclosed conveyors delivering final product sizes to the enclosed silos;
- Use of rail as the primary transport of products eliminates potential for dust from road transport;
- Use of modern technology in monitoring meteorological conditions for proactive management of operations; and
- Purchase of buffer land surrounding prior to commencement of operations.

The range of engineering controls supported by procedures incorporated into the Quarry AQMP, include:

- Covering of conveyors and transfer points;
- Enclosure of crushing and screening plant with dust extraction system fitted;
- Fitting of scrapers for cleaning conveyor belts;
- Dust suppression sprays on the primary crusher and conveyors such as CV199;
- Fitting drills with either water sprays and/or dry dust collection devices;
- Enclosure of train loading facilities;
- Conveyors instead of truck haulage of aggregate from the main pit;
- Haul roads and processing areas to be compacted and suitably constructed;
- Reduction in disturbed areas by progressive rehabilitation;
- Location of primary crusher within the pit rather than processing plant area;
- Containment of aggregate materials within silos limiting the need to stockpile materials;
- Controlling stockpiles of fine material with water sprays;
- Application of dust suppressants in the screening and crushing operations;
- Use of vacuum system and sucker trucks to remove dust build up;
- Use of cool fog systems at key locations (main screenhouse and Train load out);
- Installation and use of a loading cone at the Train load out; and
- Operation of a pugmill at the filler silo to handle fine dusts.

The Boral Electronic Asset Management (EAM) system is utilised to ensure engineering controls are maintained on a regular basis.

3.4.2 Dust Monitoring Program

The Quarry manages an air quality monitoring system in accordance with the AQMP which was revised during the reporting period to incorporate changes associated with Modification No. 4 and to reflect current management practices associated with quarry activities.

The air quality monitoring system comprises of three dust deposition gauges, two side-by-side HVAS and an on-site weather station (refer to Figure 8). Two of the dust deposition gauges (D2 and D3) are located off-site for monitoring of potential impacts on the amenity of the neighboring community. The third (D3) is situated on-site and provides guidance on the effectiveness of controls being implemented in minimising the potential for off-site dust issues.

The dust deposition gauges monitor localised dust levels comprising of particles typically larger than 50µg in size. Samples from the three gauges are collected monthly and the mass deposition rate of settled dust is analysed at a NATA accredited Laboratory.

The two HVAS are located off-site for the measurement of particulate matter less than 10 microns in diameter (PM₁₀) and Total Suspended Particulates (TSP) and are programmed to operate on a continuous 24-hour period on six in seven-day cycle. The HVAS sampler flows are subject to bi-monthly calibration and other parameters calibrated on an annual basis.

Any abnormal results from the dust deposition gauges and high volume samplers are subject to an investigation to determine whether quarry operations have potentially been a contributing factor.

Figure 8: Air Quality Monitoring Locations



3.4.3 Dust Performance Criteria

Deposition Dust Criteria

Condition 17 (Schedule 3) of the Project Approval requires that long term deposited dust emissions do not exceed an annual average criterion of 4 g/m²/month at any neighboring residence or privately owned land.

The criterion allows for consideration towards extraordinary events such as fire incidents and dust storms which may cause exceedances beyond the actual dust contribution of activities associated with the Quarry. To account for such events, the ash content of the monthly deposition gauge samples is also analysed to identify organic matter which would not be typically be representative with the Quarry activities.

PM₁₀ and TSP Criteria

Condition 17 (Schedule 3) of the Project Approval requires that the operation of the Quarry must meet PM₁₀ and TSP criteria presented Table 6 at any neighboring residence or privately owned land.

Table 6: PM₁₀ and TSP Criteria

Pollutant	Averaging period	Criteria
TSP	Annual average	90 µg/m ³
PM ₁₀	Annual average	30 µg/m ³
	24-hour average (short term impact)	50 µg/m ³

3.4.4 Dust Monitoring Results

Deposition Dust Gauge Results

Table 7 presents the monthly results and annual averages during the reporting period from the three dust deposition gauges (D1, D2 and D3). All results were within the Project Approval annual average criterion of 4 g/m²/month for Insoluble Solids.

Figures 9 and 10 present the monthly trends and annual averages respectively of dust deposition and ash content at each of the three monitoring locations. The annual averages were in compliance with Project Approval criterion of 4 g/m²/month for the reporting period.

Table 7: Dust Deposition Results

Sample Identification		Monthly Dust Deposition (Insoluble Solids g/m ² /month)												Annual Average Criteria: (4 g/m ² /m)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
D1	Insoluble Solids	1.0	1.8	1.7	2.4	1.5	3.8	5.4	2.5	2.1	2.6	2.0	2.5	2.4
	Ash Content	0.6	1.6	1.1	2.0	1.4	2.2	2.6	1.9	1.2	1.6	1.5	1.3	1.6
D2	Insoluble Solids	2.0	2.2	2.2	2.4	0.7	2.1	2.5	2.1	2.2	2.2	4.8	5.0	2.5
	Ash Content	1.4	1.5	1.5	1.9	0.4	1.4	1.3	1.2	1.1	1.0	2.2	2.0	1.4
D3	Insoluble Solids	5.7	5.7	4.1	2.1	1.7	1.4	2.9	2.2	2.5	3.0	2.9	8.4	3.5
	Ash Content	1.5	1.8	1.2	1.2	1.0	0.9	1.4	1.1	1.0	1.2	1.8	2.3	1.4

Figure 9: Dust Deposition Monthly Trends

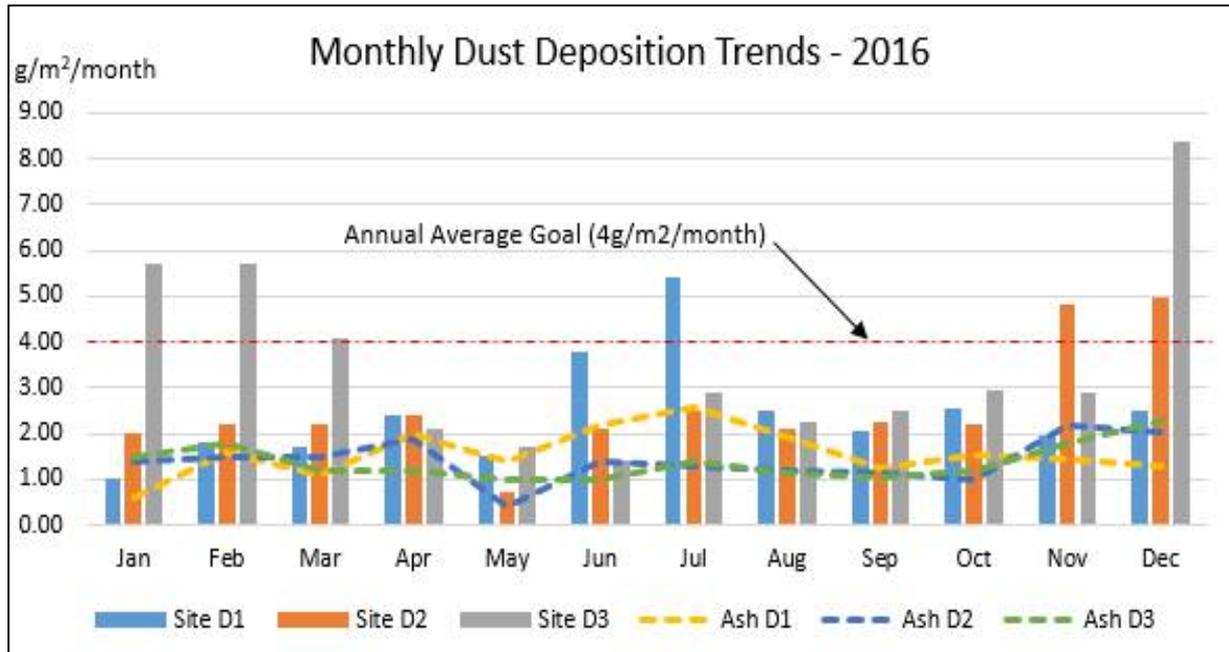
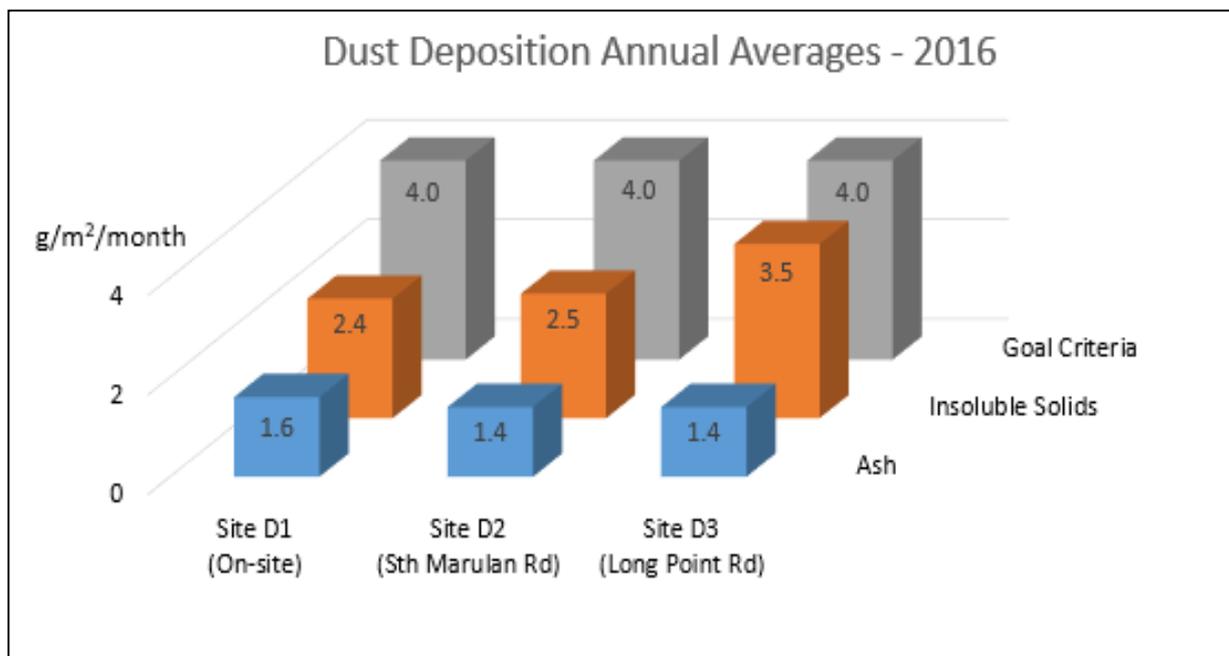


Figure 10: Dust Deposition Results – Annual Averages



HVAS Results

Figures 11 and 12 show that the annual average of TSP and PM₁₀ were 39 µg/m³ and 17 µg/m³ respectively. These were both within the Project Approval criteria of 90 µg/m³ and 30 µg/m³ respectively

On the following two occasions during the reporting period the short-term 24-hour average criteria of 50 µg/m³ for PM₁₀ emissions were marginally exceeded (refer to Figure 12):

- 21/05/16: PM₁₀ recorded as 58.2 µg/m³; and
- 05/12/16: PM₁₀ recorded as 50.7 µg/m³.

On investigation, the PM₁₀ exceedances were not considered representative of previous 24-hours of quarry activities.

Figure 11: TSP 24 hr average trend and annual average results

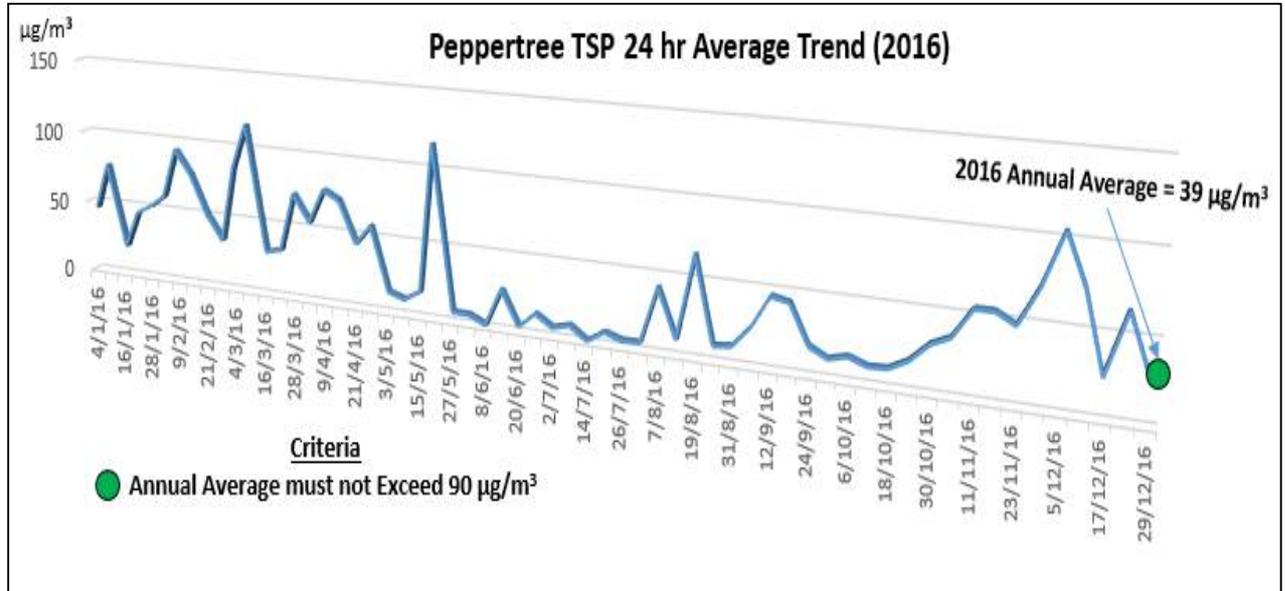
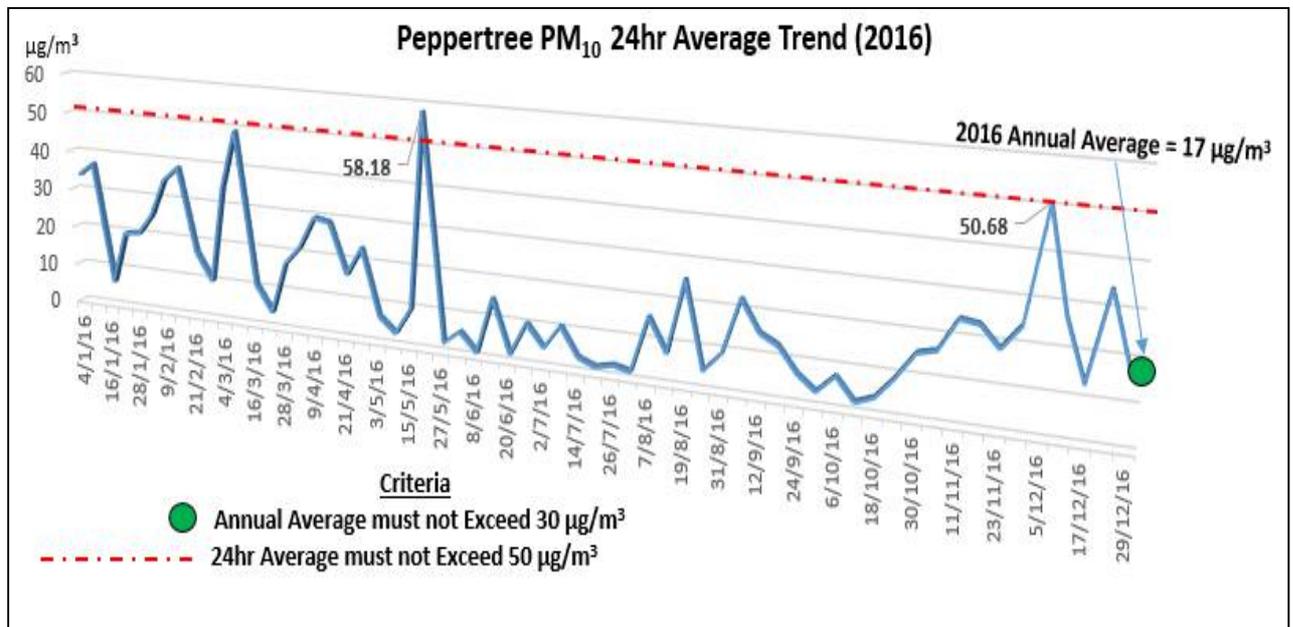


Figure 12: PM₁₀ 24 hr average trend and annual average results



3.4.5 Dust Management – Performance Review

The Quarry complied with the respective Project Approval annual average criteria for dust deposition, TSP and PM₁₀ (refer to Figure 13 (dust deposition), Figure 11 (TSP) & Figure 12 (PM₁₀)). On two occasions, PM₁₀ concentrations marginally exceeded the 24-hr short term average period (refer to Figure 12). Overall, this was an improvement on 2015 results during which PM₁₀ concentrations exceeded the 24-hr short term average period on four occasions.

The dust deposition results for the reporting period were also an improvement on 2015 concentrations which exceeded the Project Approval annual average criteria at dust monitoring location D1. The reducing trend in deposition dust presented in Figure 13 reflects the ongoing improvements in control measures being implemented at the Quarry.

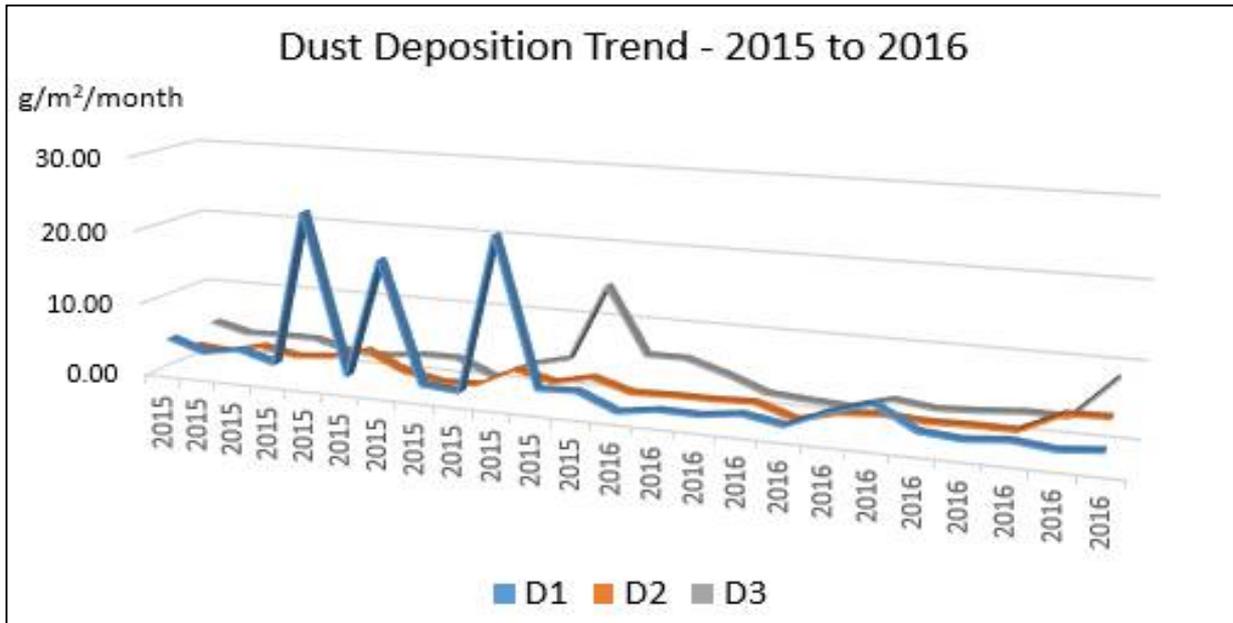
It should be noted, dust deposition results from several months reported comparatively low ash content to the insoluble solids concentrations. This is an indication that the samples are likely to have had high levels of organic matter which is not generally representative of mineralogical based quarry dust. As an example, the December result for D3 reported an insoluble solid concentration of 8.4 g/m²/month, while the ash content was only 2.3 g/m²/month (refer to Table 7 and Figure 9).

This is due to the organic portion (i.e. insects, leaves, bird droppings and algae) of the samples being combusted during laboratory analysis, leaving the mineralogical content as ash. In such instances, the reported ash content can often be more representative of dust from quarry activities than the insoluble solids concentrations.

As such, the reported results for several months of the reporting period are likely to be conservative and actual dust deposition from quarry activities is likely to have been considerably lower.

The Quarry investigates all elevated dust results and could not identify any activities that may have been the source of the two marginal exceedances in PM₁₀ results during the reporting period.

Figure 13: Dust Deposition Trend – 2015 to 2016



3.5 NOISE

3.5.1 Noise Management

The Quarry NBMP provides guidance and procedures for controlling, monitoring and assessing noise impacts through:

- Identification of temporary or infrequent noise-generating activities and/or sources and mitigation actions if required;
- Presentation of applicable noise criteria to employees and contractors via tool box instructions;
- Ensuring all covers are in place and closed at all times when fixed and mobile plant are in operation;
- Notifying all potentially impacted residents on the nature of potentially high noise generating works, the expected noise levels and duration, as well as contact details to raise any concerns;
- Briefing contractors / employees on the noise operational requirements to minimise noise via and regular inspections and maintenance of equipment to ensure optimum working order;
- Informing truck drivers of designated vehicle routes, parking locations, acceptable entry/exit hours or other relevant practices (for example, minimising the use of engine brakes);
- End on end configuration of diesel locomotives which has been shown to be quieter than being paired together;
- Enclosed processing operations;
- Noise cladding on the major crushing building;
- Operations being undertaken within approved working hours;
- Regularly inspection and maintenance of Plant and equipment with consideration to noise management; and
- Routine monitoring of meteorological conditions (including predictive meteorological forecasting) using the on-site meteorological station in liaison with the Bureau of Meteorology.

3.5.2 Noise Monitoring Program

In accordance with NBMP operational noise assessments are conducted on a quarterly basis. During the reporting period noise assessments were conducted in February, May, August and October.

Attended monitoring is conducted during both day and night time periods to enable the measurement of operational noise from quarry activities conducted during the Project Approval permissible hours of operation. Unattended monitoring is generally continuous between the devices deployment and collection measuring noise levels for all assessment periods.

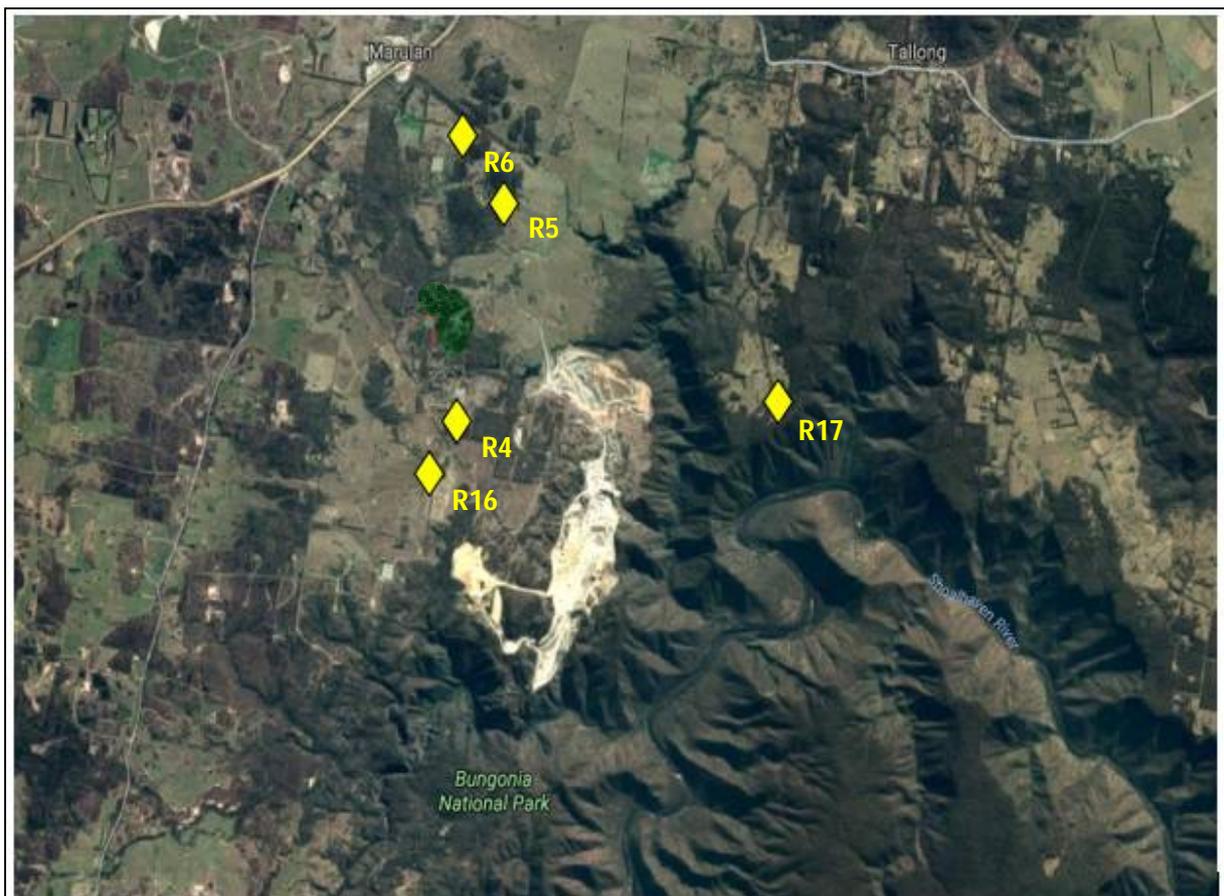
Operator attended noise measurements are conducted at or near the locations specified in Table 4 of Project Approval Condition 4 (Schedule 3). Figure 14 shows the revised receiver locations required to be monitored as part of Modification No. 4.

All noise monitoring events are conducted by suitably trained independent specialists; with due regard to, and in accordance with, the relevant local and international standards for environmental noise monitoring.

The measurement instrumentation used to complete the assessments must comply with the requirements of AS 61672.1 and AS/IEC 60942 with current NATA calibration certificates, with certification at intervals not exceeding two years at the time of use.

Operator attended noise measurements are conducted at times when meteorological conditions are considered suitable as adverse meteorological conditions have the potential to increase noise levels. For example, excessive wind speeds, temperature inversions and rain have the potential to reduce the accuracy and confidence in measured data.

Figure 14: Noise Monitoring Sensitive Receiver Locations



3.5.3 Noise Performance Criteria

Table 8 present the criteria for receiver locations required to be assessed in accordance with Condition 4 (Schedule 3) of the Project Approval and EPL Condition L2.

Table 8: Operational Noise Assessment Criteria

Residential Receiver Locations	Noise Assessment Criteria			
	Day (7am to 7pm) LAeq (15 min)	Evening (7pm to 10pm) LAeq (15 min)	Night (10pm to 7am)	
			LAeq (15 min)	LA1 (1Min)
R5	35	35	35	45
R6	35	35	35	45
R16	41	35	35	45
R4	35	35	35	45
R17	35	35	35	45

Project Approval Condition 4 (Schedule 3) was introduced as part of the Modification 4 approval and requires that the Noise Management Plan “includes a program to characterize and measure low frequency noise (dB(C)) emissions”. Assessment of the low frequency noise was undertaken as part of the October noise monitoring.

3.5.4 Noise Monitoring Results

Table 9 provides a summary of the maximum day and night time noise assessment measurements against the respective Project Approval compliance criteria for LAeq (15 minutes) noise levels (Condition 4 – Schedule 3). The noise measurements were conducted at six locations during the reporting period. Modification No. 4 to the Project Approval introduced additional receiver locations R4 and R17 which were first assessed in October 2016. Receiver location R2 was not sampled in October as the land was acquired and is now under Boral ownership.

The assessment results found that the Quarry LAeq (15minutes) noise levels were in compliance at all receiver locations with the measured results considerably lower than the respective limits prescribed by the Project Approval (refer to Figure 15).

Table 10 provides a summary of the maximum night time noise assessment measurements against the respective Project Approval compliance criteria for measured LA1 (1 minute) noise levels at all receiver locations. The assessment results found that the LA1 (1 minute) noise levels were in compliance at all receiver locations with the averaged levels being considerably lower than the respective prescribed limits (refer to Figure 16).

Low Frequency Noise

Low Frequency Noise was assessed as per the requirements of the Industrial Noise Policy.

The Policy provides modification factors based on the tonal quality of the noise measured thereby assessing the presence of low frequency noise.

Tonal, low frequency, impulsive and intermittent noise characteristics were not present in the quarry noise emissions.

Table 9: Noise Assessment Results (LAeq (15min))

Residential Receiver	Assessment Dates (2016)	Noise Level Assessment (LAeq (15min))		
		Compliance Criteria	Measured Noise Levels dB(A)	Compliance with Criteria
Receiver 2	Feb	Day: 39 Night: 35	22 / 17 / 20 27 / 26	Yes Yes
	May	Day: 39 Night: 35	31 / 28 / 33 28	Yes Yes
	August	Day: 39 Night: 35	24 / 25 / 26 32 / 33 / 34	Yes Yes
	October	Day: 39 Night: 35	Land acquired during the reporting period and under Boral ownership.	
Receiver 5	Feb	Day: 35 Night: 35	21 / 19 / 18 31	Yes Yes
	May	Day: 35 Night: 35	26 / 25 / 26 26 / 26	Yes Yes
	August	Day: 35 Night: 35	32 / 30 / 32 34 / 33	Yes Yes
	October	Day: 35 Night: 35	27 / 21 / 22 28 / 28	Yes Yes
Receiver 6	Feb	Day: 39 Night: 35	22 / 24 / 28 28	Yes Yes
	May	Day: 35 Night: 35	31 / 33 / 32 30	Yes Yes
	August	Day: 35 Night: 35	29 / 30 / 31 34	Yes Yes
	October	Day: 35 Night: 35	31 / 28 / 30 31 / 31	Yes Yes
Receiver 16	Feb	Day: 41 Night: 35	24 / 25 / 31 34 / 33	Yes Yes
	May	Day: 41 Night: 35	30 / 23 / 23 / 20 24	Yes Yes
	August	Day: 41	22 / 25 / 25	Yes

		Night: 35	21 / 20	Yes
Receiver 4	October	Day: 41	26 / 26 / 28	Yes
		Night: 35	24 / 25	Yes
Receiver 4	October	Day: 35	22 / 25 / 25	Yes
		Night: 35	26 / 26	Yes
Receiver 17	October	Day: 35	23 / 17 / 15	Yes
		Night: 35	26 / 25 / 23 / 22	Yes

Figure 15: Off-Site Noise Level Trends (LAeq 15) - 2016

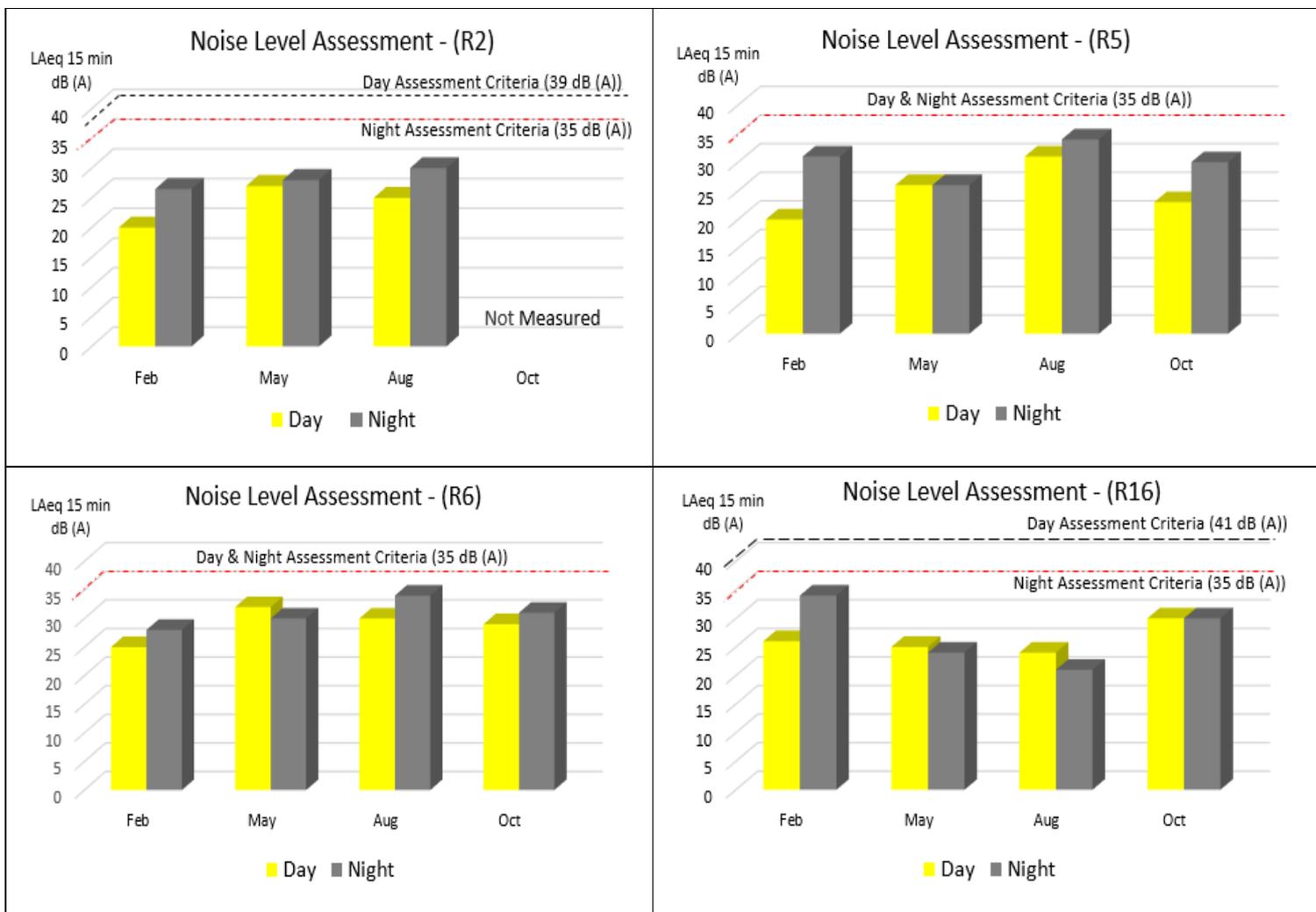
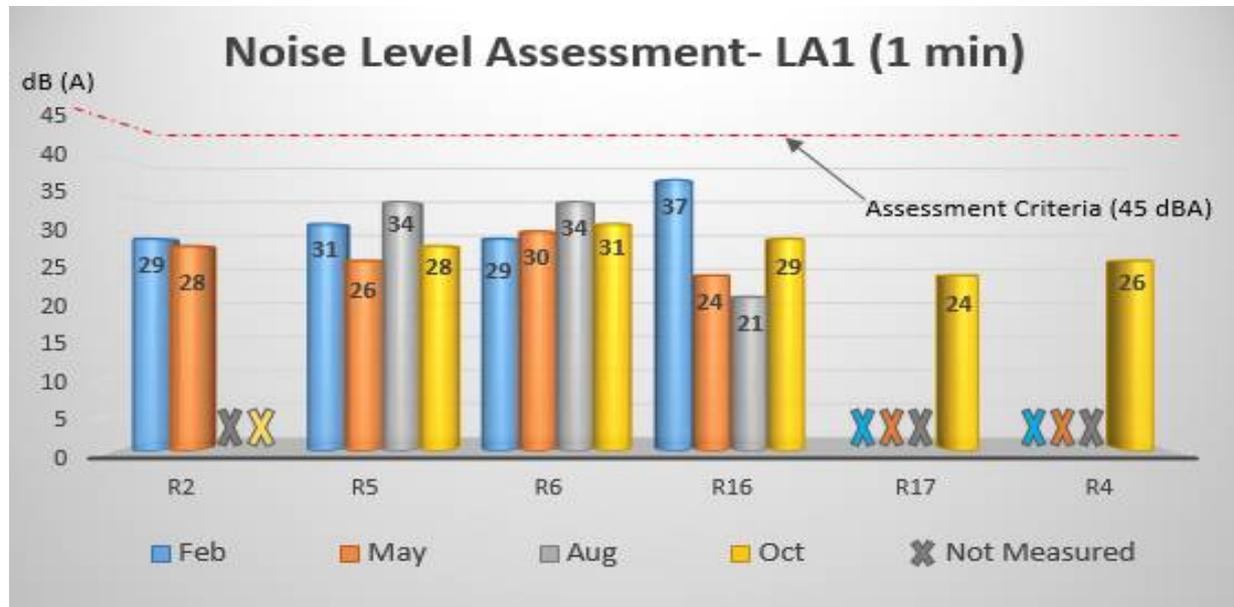


Table 10: Noise Assessment Results (LA1 (1min))

Residential Receiver	Assessment Dates (2016)	Noise Level Assessment (LA1 (1min))		
		Compliance Criteria	Measured Noise Levels dB(A)	Compliance with Criteria
Receiver 2	Feb	45	29 / 28	Yes
	May	45	28	Yes
	August	45	No Measurement	-
	October	45	No Measurement	-
Receiver 5	Feb	45	31	Yes
	May	45	26 / 26	Yes
	August	45	34 / 33	Yes
	October	45	28 / 28	Yes
Receiver 6	Feb	45	29	Yes
	May	45	30	Yes
	August	45	34 / 34	Yes
	October	45	31 / 31	Yes
Receiver 16	Feb	45	38 / 36	Yes
	May	45	24	Yes
	August	45	21 / 20	Yes
	October	45	24 / 34	Yes
Receiver 4	October	45	24	Yes
Receiver 17	October	45	26	Yes

Figure 16: Noise Level Trends (LA1, 1minute) - 2016



3.5.5 Noise Management Performance Review

The noise assessment conducted during the reporting period found that noise levels at all receiver locations for both LA1 (1 minute) and LAeq (15 minutes) were in compliance with respective Project Approval criteria. In most of the monitoring events the measured noise levels were considerably below Project Approval criteria. Furthermore, there have been no exceedances of LA1 (1 minute) or LAeq (15 minutes) since the Quarry was granted planning approval.

The independent specialist conducting the quarterly noise assessment program during the reporting period concluded that:

“Daytime site noise emissions associated with quarry operations continue to comply with the relevant LAeq (15 minutes) operational noise impact assessment criteria contained in the Project Approval and EPL, at all receptor locations.

Night time site noise emissions comply with the relevant LAeq (15 minutes) and LA1 (1 minute) operational noise impact assessment criteria contained in 06 Project Approval and EPL, at all receptor locations.”

The independent specialist noted that during the October measurements quarry noise emissions generally remained inaudible at all receptor locations. However, at Receiver 17 and at the neighbouring property (a Boral owned property) an “industrial” noise was audible. Comparison of the measurement data to quarry site records indicated that no activities were being conducted at the time the industrial

noise was identified. In-pit and out-of-pit activity was not in progress; the secondary, tertiary and quaternary crushing plant was not in operation.

In accordance with the independent specialist's recommendations, Boral will in 2017 continue to investigate the other "industrial" noise emission identified during this monitoring round, with the aim of confirming the sources origin and confirming that it is not associated with quarry operations.

3.6 BLASTING

The Blast Management Plan (BMP) for Peppertree Quarry was revised during the reporting period as part of Modification No. 4 approval. In addition, a comprehensive Blast management protocol is in place for all blasting operations in Boral.

Measures that are implemented to ensure compliance with the blast criteria prescribed Project Approval Conditions 12 to 16 (Schedule 3) include the following:

- Blast design;
- Explosive loading, initiation hook-up and firing;
- Training of personnel involved in blasts;
- Avoidance of concurrent blast events with adjoining mines;
- Blast notifications to neighboring residents;
- Blast exceedance protocol and a community complaints procedure;
- Ensuring blasts are only conducted in accordance with the hours of operation prescribed by the Project Approval;
- Monitoring of overpressure and ground vibration; and
- Real-time measurements of meteorological conditions to identify conditions which may trigger the need to modify or postpone blast operations.

3.6.1 Blast Monitoring Program

In accordance with the BMP, monitoring is undertaken at four locations as presented in Figure 17. As part of every blast air-blast overpressure and ground vibration is monitored for compliance verification with the relevant assessment criteria in the Project Approval.

For the purposes of blast emission monitoring, the Quarry maintains a Blast Design and Emissions Record for each blast event in a suitable format guided by the requirements of AS 2187.2-1993.

At the commencement of quarry construction, blasting was limited to the development of the pit and was infrequent. Manually operated blast monitors were used and placed at nominated locations prior to blasting and collected after the event. The blast monitoring system now comprises remote monitors

that are in continuous operation with results able to be reviewed online through a restricted access website.

Blasting reports are prepared and made available after each blast ensuring any exceedance can be investigated and reported in a timely manner. Individual blast design records are maintained to assist in the design and optimisation of future events, planning and control of blasting emissions and to provide a traceable system of documentation in case of accident or complaint.

Figure 17: Location of the Four Blast Monitors



3.6.2 Blast Performance Criteria

Conditions 12 and 13 (Schedule 3) of the Project Approval requires that air-blast overpressure and ground vibration should not exceed the criteria in presented Tables 11 and 12 respectively at any residence on privately-owned land.

Table 11: Air-blast Overpressure Impact Criteria

Air-blast overpressure (dB Lin peak)	Allowable Exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

Table 12: Ground Vibration Criteria

Peak Particle Velocity (mm/s)	Allowable Exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

3.6.3 Blast Monitoring Results

Blast monitoring result for over pressure and ground vibration during the reporting period are presented in Table 13. The maximum measurements for over pressure and ground vibration were 110.9 dB (15/09/16 – N.West) and 3.4 mm/sec (24/11/16 – Pace) respectively. The trends for over pressure and ground vibration were at all times below the Project Approval maximums and the 5% allowable exceedance per annum (refer to Figure 18 and Figure 19).

Table 13: Blast Monitoring Results

Blast Date	Ground Vibration (mm/sec) Max Criteria: 10 5% Exceedance: 5				Over Pressure (db – Linear) Max Criteria: 120 5% Exceedance: 115				Compliance
	<u>Monitoring Locations</u>				<u>Monitoring Locations</u>				
	N.West	N.East	Marulan Road	Pace	N.West	N.East	Marulan Road	Pace	
12/01/16	0.0	0.0	0.0	1.0	0.0	0.0	0.0	5	YES
18/01/16	0.0	0.0	0.0	0.1	0.0	0.0	0.0	100.9	YES
21/01/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
28/01/16	0.1	0.0	0.0	0.0	103.6	0.0	0.0	0.0	YES
04/02/16	0.1	0.0	0.0	0.0	104.7	0.0	0.0	0.0	YES
11/02/16	0.1	0.0	0.0	0.0	103.6	0.0	0.0	0.0	YES
22/02/16	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	YES

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25/02/16	0.1	0.0	0.0	0.0	102.3	0.0	0.0	0.0	YES
28/02/16	0.1	0.0	0.0	0.0	103.6	0.0	0.0	0.0	YES
03/03/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
10/03/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
18/03/16	0.0	0.0	0.1	0.0	0.0	0.0	111.2	0.0	YES
24/03/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
31/03/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
08/04/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
14/04/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
21/04/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
28/04/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
06/05/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
12/05/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
19/05/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
26/05/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
02/06/26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
16/06/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
30/06/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
15/07/16	1.4	0.0	0.0	1.2	102.4	0.0	0.0	101.3	YES
21/07/16	0.0	0.0	0.0	1.0	0.0	0.0	0.0	101.7	YES
26/07/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
04/08/16	0.0	0.0	0.0	1.6	0.0	0.0	0.0	103	YES
11/08/16	0.0	0.0	0.0	0.9	0.0	0.0	0.0	101.6	YES
18/08/16	0.0	0.0	0.0	0.8	0.0	0.0	0.0	101.1	YES
25/08/16	0.0	0.0	0.0	1.7	0.0	0.0	0.0	104.2	YES
30/08/16	0.0	0.0	0.0	0.9	0.0	0.0	0.0	103.2	YES
05/09/16	0.85	0.0	0.0	0.0	105.6	0.0	0.0	0.0	YES
15/09/16	1.1	0.0	0.2	0.0	110.9	0.0	97.5	0.0	YES
21/09/16	1.5	0.0	0.0	0.0	103.6	0.0	0.0	0.0	YES

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22/09/16	1.2	0.0	0.0	0.0	104.1	0.0	0.0	0.0	YES
6/10/16	1.5	0.0	0.1	0.0	100.9	0.0	98.1	0.0	YES
14/10/16	1.8	0.0	0.2	0.0	100.9	0.0	100.8	0.0	YES
18/10/16	1.2	0.0	0.2	0.0	106.1	0.0	110.1	0.0	YES
27/10/16	1.5	0.0	0.3	2.3	107.3	0.0	100.8	105.8	YES
8/11/16	1.0	0.0	0.1	0.9	100.1	0.0	101.9	104.4	YES
10/11/16	1.3	0.0	0.1	1.0	100.9	0.0	103.1	101.7	YES
17/11/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	YES
24/11/16	3.3	0.0	0.5	3.4	107.3	0.0	99.1	109.9	YES
28/11/06	0.8	0.0	0.2	1.6	104.7	0.0	103.1	108.3	YES
01/12/16	1.1	0.0	0.2	2.1	105.6	0.0	104.4	106.6	YES
08/12/16	0.8	0.0	0.2	1.3	96.3	0.0	112.5	98.2	YES
15/12/16	1.0	0.0	0.4	1.9	104.4	0.0	102.4	0	YES
20/12/16	0.5	0.0	0.0	0.7	101.5	0.0	0.0	0	YES

Figure 18: Blasting Overpressure Trends

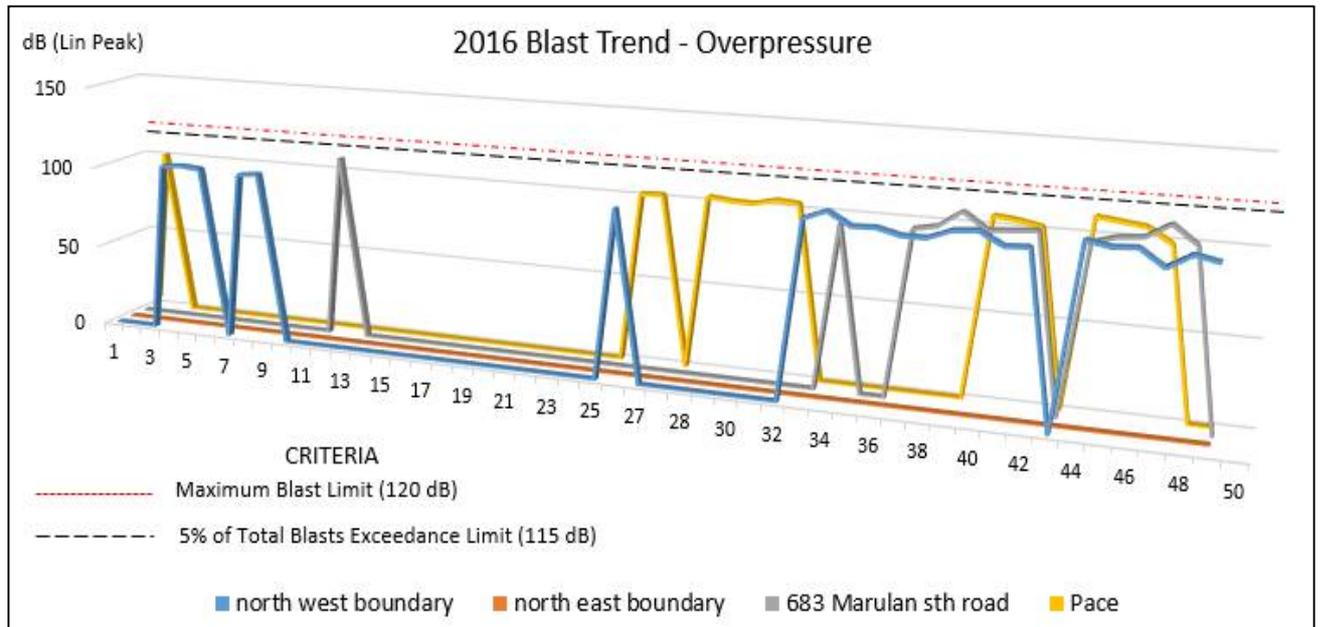
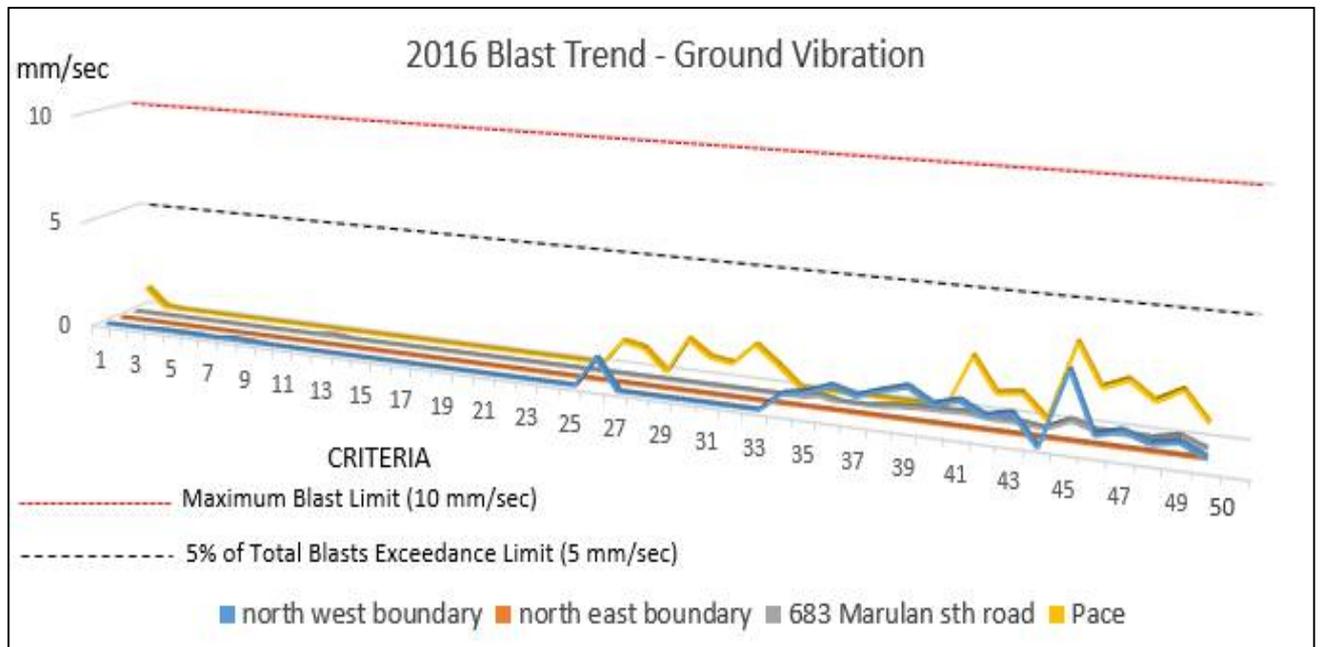


Figure 19: Blasting Ground Vibration Trends



3.6.4 Blast Management Performance Review

The Quarry conducted 50 blasts during the reporting period, all of which complied with Project Approval criteria. The majority of blast monitoring results were significantly below the respective Project Approval criteria for over pressure and ground vibration (refer to Figure 18 and Figure 19 respectively).

All blasts were performed in accordance with the following Environmental Performance Conditions under Schedule 3 of the Project Approval:

- Monday to Saturday with no blasts between 9.00 am and 5.00 pm on Sunday or public holidays (Condition 11);
- Monitored for overpressure and ground vibration levels (Conditions 12 and 13 respectively);
- Best practice considerations associated with safety and minimisation of fumes and dust (Condition 14); and
- Notifications to neighbours and public information (Condition 15).

Since the first AEMR reporting period in 2014, the Quarry has conducted 140 blasts without an exceedance of Project Approval criteria.

3.7 SURFACE WATER

3.7.1 Surface Water Management

Surface water management at the Quarry is conducted in accordance with a Water Management Plan (WMP) that was revised during the reporting period as part of Modification No. 4 approval. A key objective of the WMP is to be self-sufficient with no dependence on external sources.

The WMP provides the framework and guidance for quarry activities to be conducted in a manner that:

- complies with regulatory requirements including water licences, the Project Approval and the EPA Environment Protection Licence (EPL);
- meets the obligations and commitments identified in the Environmental Assessment (ERM, 2006) and the Modification 4 Environmental Assessment (Boral, 2016);
- ensures compliance with relevant environmental legislation;
- minimises dirty water generation by implementation of appropriate erosion and sediment controls;
- maintains water balances for sustainable use and provision of environmental flows to Tangarang Creek;
- protects surface and groundwater quality and availability;
- ensures appropriate water control systems are planned and established prior to commencement of any new quarrying activities with potential to impact water;
- ensures appropriate and representative monitoring is conducted for verification that the WMP is effectively implemented and meeting its objectives; and
- ensures appropriate contingencies and resources for mitigating adverse impacts to surface and groundwater from quarrying activities.

The water management system is managed in order to minimise/mitigate impacts to the flow and quality of surrounding surface water and groundwater systems. This system is based on the following approach:

- diversion of clean water runoff away from site activities;
- containment of potentially contaminating activities within sealed and bunded areas and the inclusion of interceptor systems to contain contamination;
- appropriate storage of potentially contaminating substances;
- retention and treatment of “dirty water” to prevent sediment laden or contaminated runoff leaving the site;

- specific erosion and sediment control systems and monitoring to minimise the development of sediment laden runoff;
- recycling and treatment of all water used in quarrying activities to minimise demand for top-up water from the clean water dams and to minimise the flow of dirty water to the Pit storage;
- release of environmental flows, equivalent to a minimum of 10% of average daily flows, to mimic natural flow patterns; and
- monitoring of surface water and groundwater quality and quantity to confirm the efficiency of the proposed water management system and to ensure there are no detrimental impacts upon groundwater systems or surface receiving waters.

Where practical, a combination of bunds and drains divert run-off from undisturbed areas from the pit and other operational areas to reduce the potential for flooding and pollution of water. All other water within the current quarry footprint is directed to a series of sediment dams located within the pit and around the site to prevent sediment laden or contaminated runoff leaving the site. Sediment traps and settling ponds form part of the site water management system which improves water quality at various points along both clean and dirty water drainage networks.

3.7.2 Surface Water Monitoring Program

In accordance with Condition 29 (Schedule 3) of the Project Approval, the WMP includes a surface water quality program that involves quarterly sampling from Tangarang Creek, Dam 1, upstream culvert, and overflow from any sediment ponds during extreme storm events. (refer to Figure 20).

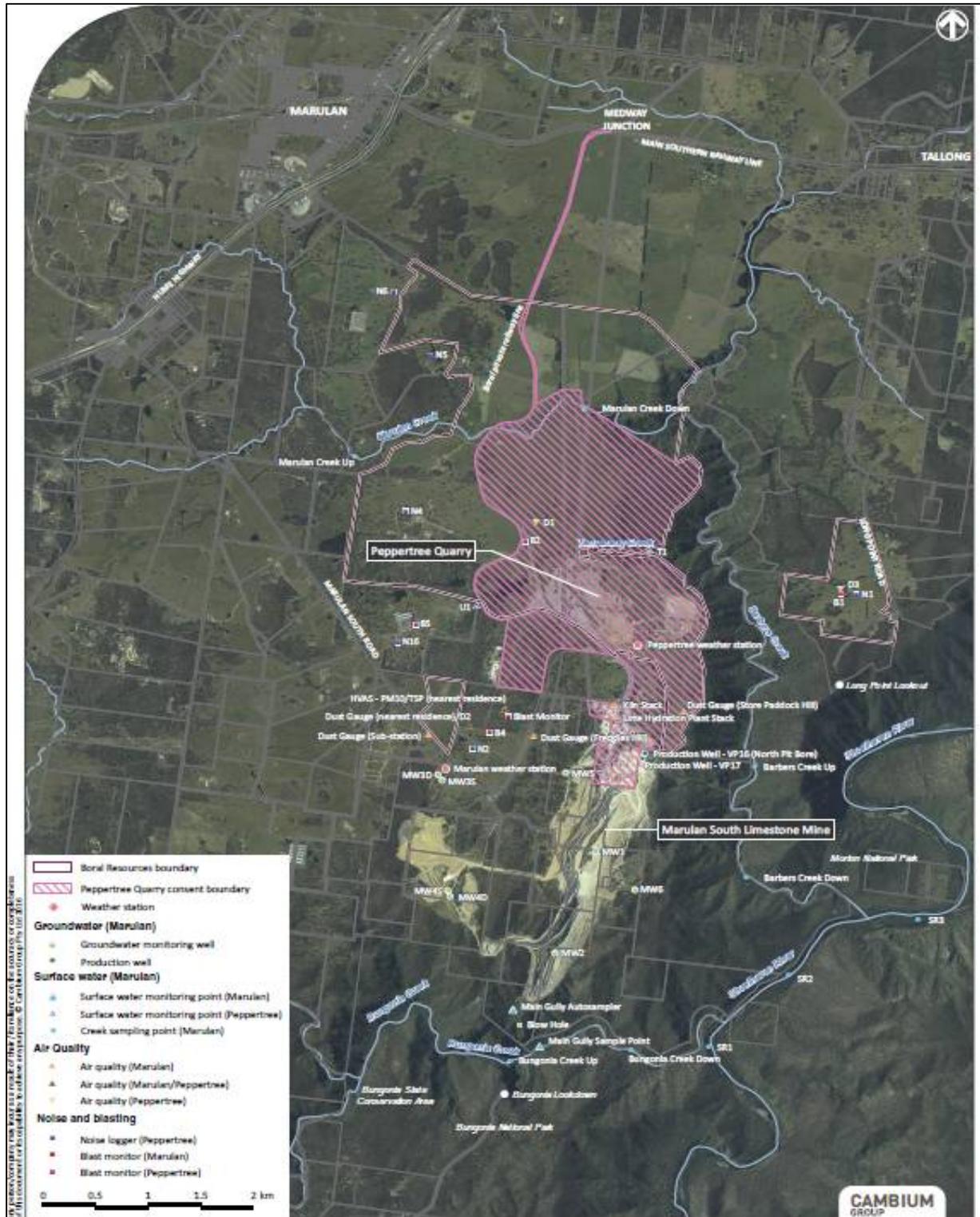
The Quarry's main Dam provides environmental flows into the ephemeral Tangarang Creek and as such downstream water quality is largely representative of the discharges with some minor natural variations from the wider catchment influences.

The suite of parameters analysed for each water quality sample is listed in Table 13.

Table 14: Summary of Creek Water Quality Statistics

Laboratory Analysis		
Total Dissolved Solids (mg/L)	Potassium (K ⁺)	Bicarbonate (HCO ₃)
Total Suspended Solids (mg/L)	Magnesium (Mg ²⁺)	Nitrate (NO ₃)
Turbidity – Laboratory (NTU)	Sodium (Na ⁺)	Nitrite (NO ₂)
TPH C10-C36	Ammonia (NH ₄ ⁺)	Total Nitrogen
Benzo[a]pyrene	Chloride (Cl ⁻)	Total Phosphorous
Naphthalene	Sulphate (SO ₄ ²⁻)	Faecal coliforms (cfu/100mL)
Calcium (Ca ²⁺)		

Figure 20: Surface Water and Groundwater Monitoring Sites



3.7.3 Surface Water Monitoring Performance Criteria

For water quality objectives of aquatic ecosystem protection, ANZECC Guidelines (the Guidelines) recommend that indicators be developed and adapted to suit the local area or region. Trigger values for a large range of toxicants are provided in Table 3.4.1 of the Guidelines.

The Guidelines specify that two years of monthly sampling (24 samples) is sufficient to provide an indication of the local ecosystem variability and to provide a basis for derivation of 'trigger' values appropriate to conditions in a particular creek system. For physical and chemical stressors for slightly or moderately disturbed ecosystems, such as that surrounding the Peppertree Gully, the Guidelines recommend the use of the 20th and 80th percentile values of data as the basis for revised 'trigger' values. This approach is consistent with the recommendations of the Healthy Rivers Commission.

As part of the review of the Water Management Plan in November 2016 and the preparation of the Modification 4 application, proposed trigger levels were developed in line with the guideline recommendations.

Table 14 summarises the proposed trigger values to assess potential impacts on water quality in creeks in the vicinity of the Quarry. However, it should be noted that observations to date indicate that while the water quality in the Shoalhaven River mostly meets the ANZECC ecosystem protection levels, the upstream contributing creeks do not. Therefore, the trigger values in Table 14 are adopted as benchmark goals rather than a performance or compliance criteria.

Table 14: Water Quality Trigger Values

Indicator	ANZECC Default Trigger for Ecosystem Protection ¹	WaterNSW Benchmarks for Catchment Streams	Proposed 'Triggers'
pH	6.5 – 7.5	6.5 – 8.0	6.5 – 8.5
EC (µS/cm)	30 – 350		<1200
Total nitrogen (mg/L)	0.25	<0.25	4.4
Total phosphorus (mg/L)	0.02	<0.02	0.03
Turbidity (NTU)	2 - 25	0 - 25	

¹ Default trigger values for physical and chemical stressors for South-east Australia for slightly disturbed ecosystems (upland river)

The proposed trigger values would be applied as follows for ongoing monitoring in Barbers Creek (both upstream and downstream of any influence from the Quarry):

- If the upper bound for pH, EC, total suspended solids or turbidity is exceeded for a period of three consecutive months downstream of the quarry but is not exceeded upstream of the quarry, this would be the trigger to undertake further assessment of potential sources within the Quarry.

- If the additional assessment finds that the change in water quality may be induced by quarry operations, then further investigation would be required to identify the source of the water quality impact, and review and revise practices to minimise the impact.

This further assessment would include investigation of the potential pathways for water quality impacts within the Quarry area to identify whether the change in water quality is attributable to quarry activities, and the nature of activity that has caused the change.

Environmental Flows

Under DA Condition 24 (Schedule 3), the supply of 10% of daily inflows into the Quarry main dam must be provided as environmental flows to Tangarang Creek.

The release of water from the Quarry dam provides benefit to flow dependent aquatic life-cycle events such as spawning and migration, while also improving water quality and the general health of stream ecosystems. Without the supply of water from the Quarry, Tangarang Creek would only experience flows during significant rain events.

3.7.4 Surface Water Monitoring Results

Table 15 presents the quarterly surface water quality monitoring data collected from the Quarry Dam, and up (when flow is occurring) and downstream in Tangarang Creek. Due to the ephemeral nature of Tangarang Creek, the upstream monitoring point only experienced flows during the second and third quarter sampling events of the reporting period. As the proposed trigger values described in Section 3.7.3 are yet to be confirmed, ANZECC and ADWG guideline trigger values are used to assess the surface water results for 2016.

The results for pH were substantially in the range of ANZECC¹ guideline trigger levels (i.e. pH 6.0 to 8.5) for south-east Australian aquatic systems (refer to Figure 21). The pH level in the Dam were generally higher than upstream Tangarang Creek. The highest pH value of 8.9 reported from the Quarry Dam during the first quarter sampling event of the reporting period was marginally above the ANZECC guideline upper limit of pH 8.5. The ANZECC guidelines suggest pH variations may vary considerably and this result is unlikely to have had adversely impacted the health of the aquatic systems in Tangarang Creek.

Figure 22 shows an increasing trend in Total Dissolved Solids (TDS) during the reporting period. However, the results remained considerable below the ADWG² guideline value of 500 mg/L. ANZECC (2000) provide TDS tolerance level for common livestock with the most sensitive being poultry and most tolerant Cattle for which respective concentrations of up to 2,000 mg/L and 4,000 mg/L are not expected to have any adverse impacts.

¹ Australian and New Zealand guidelines for fresh and marine water quality (ANZECC: 2000)

² Australian Drinking Water Guidelines 2011 (National Health and Medical Research Council and the Natural Resource Management Ministerial Council).

Concentrations of Total Suspended Solids (TSS) were for the majority of the reporting period below 10 mg/L, with the exception of the elevated results reported from third quarter monitoring event (refer to Figure 23). A similar elevated result occurred during the corresponding period in 2015. In August 2015 and the reporting period, significant east coast lows occurred which delivered significant rainfall event causing significant flooding throughout the Quarry catchment area and the elevated TSS results are representative of these two events. Similarly, Turbidity trends were in close correlation with the TSS results and were largely influenced by the east coasty low weather event (refer to Figure 24).

Table 15 presents the results for hydrocarbon and Polycyclic Aromatic Hydrocarbons (PAHs) which were all at concentrations below the Laboratory levels of reporting (LORs).

Table 15: Surface Water Monitoring Results (2016)

Parameter	Dam				Tangarang Ck - Downstream				Tangarang Ck - Upstream			
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
pH	8.9	7.3	7.5	8.5	8.0	7.5	7.8	8.1	No Flow	7.0	7.3	No Flow
Total Suspended solids (mg/l)	<5.0	<5.0	95.0	<5.0	<5.0	6.0	93.0	<5.0	No Flow	16.0	<5.0	No Flow
Total Dissolved solids (mg/l)	359.0	114.0	155.0	176.0	418.0	163.0	180.0	434.0	No Flow	193.0	162.0	No Flow
Ammonia -N (mg/l)	0.1	0.2	0.2	0.0	0.0	0.2	0.1	0.0	No Flow	0.0	0.16	No Flow
Nitrate-N (mg/l)	0.5	0.5	1.1	1.2	0.1	0.6	1.2	0.1	No Flow	0.3	0.1	No Flow
Nitrite-N (mg/l)	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	No Flow	0.0	0.0	No Flow
Sulphate (mg/l)	15.0	<1.0	3.0	13.0	5.0	<1.0	5.0	4.0	No Flow	0.0	0.0	No Flow
Chloride (mg/l)	86.0	12.0	26.0	51.0	124.0	13.0	31.0	132.0	No Flow	29.0	25.0	No Flow
Turbidity (NTU)	11.0	128.0	11.0	4.5	1.4	133.0	17.0	0.8	No Flow	26.0	15.0	No Flow
Calcium (mg/l)	29.0	5.0	15.0	25.0	53.0	8.0	8.0	48.0	No Flow	8.0	18.0	No Flow
Potassium (mg/l)	5.0	5.0	5.0	4.0	2.0	5.0	4.0	1.0	No Flow	4.0	4.0	No Flow
Magnesium (mg/l)	18.0	2.0	6.0	8.0	33.0	4.0	7.0	34.0	No Flow	4.0	7.0	No Flow
Sodium (mg/l)	52.0	7.0	15.0	33.0	74.0	8.0	18.0	74.0	No Flow	9.0	18.0	No Flow
Total phosphorus (mg/l)	0.00	0.6	0.2	0.1	0.0	0.5	0.1	0.0	No Flow	0.1	0.1	No Flow
Hardness (CaCo ₃) (mg/l)	116.0	35.0	61.0	93.0	249.0	38.0	76.0	248.0	No Flow	17	59	No Flow
TKN (mg/l)	0.5	1.3	1.3	1.7	0.1	1.4	1.4	0.2	No Flow	.1	1.4	No Flow
Faecal Coliform (cfu/100ml)	14.0	36,000	180.0	18.0	4.0	38,800	1,200	300.0	No Flow	37,000	640.0	No Flow
TPH C10-C14 (µg/l)	<50	<50	<50	<50	<50	<50	<50	<50	No Flow	<50	<50	No Flow

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Parameter	Dam				Tangarang Ck - Downstream				Tangarang Ck - Upstream			
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
TPH C15-C28 (µg/l)	<100	<100	<100	<100	<100	<100	<100	<100	No Flow	<100	<100	No Flow
TPH C29-C36 (µg/l)	<100	<100	<50	<50	<100	<100	<50	<50	No Flow	<50	<50	No Flow
TPH C10-C16 (µg/l)	<50	<50	<50	<50	<50	<50	<50	<50	No Flow	<50	<50	No Flow
TPH C16-C34 (µg/l)	<100	<100	<100	<100	<100	<100	<100	<100	No Flow	<100	<100	No Flow
TPH C34-C40 (µg/l)	<100	<100	<100	<100	<100	<100	<100	<100	No Flow	<100	<100	No Flow
Naphthalene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Acenaphthylene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Acenaphthere	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Flourene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Phenanthrene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Anthracence	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Fluoranthene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Pyrene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Benzo(a)anthracene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Chrysene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Benzo(b+k)fluoranthene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	No Flow	<2.0	<2.0	No Flow
Benzo(a)pyrene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Indeno(1,2,3-cd)pyrene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow
Dibenzo(a,h)anthracene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	No Flow	<1.0	<1.0	No Flow

Figure 21: pH Surface Waters Trends (2015 - 2016)

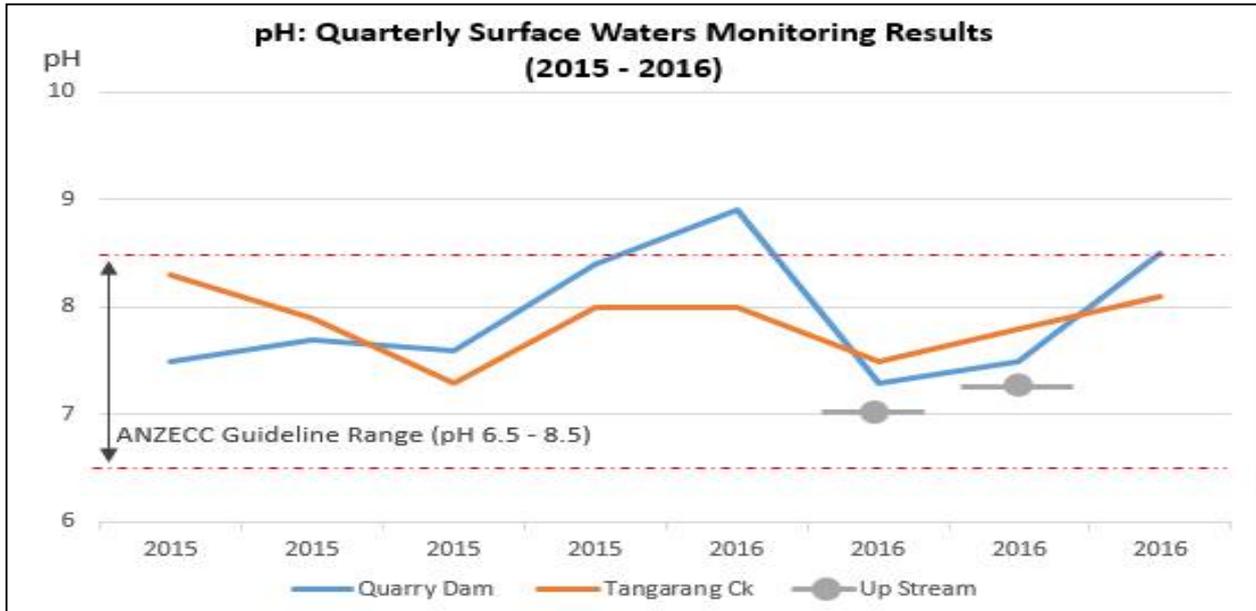


Figure 22: TDS Trends – Quarry Dam Vs Creek

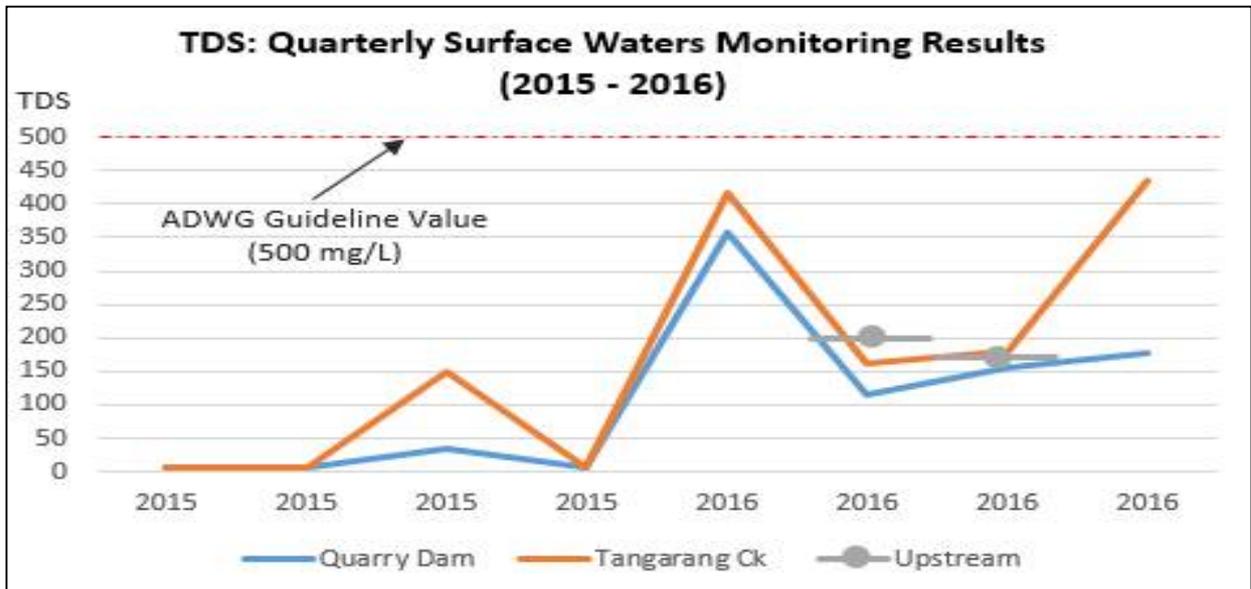


Figure 23: TSS Trends – Quarry Dam Vs Creek

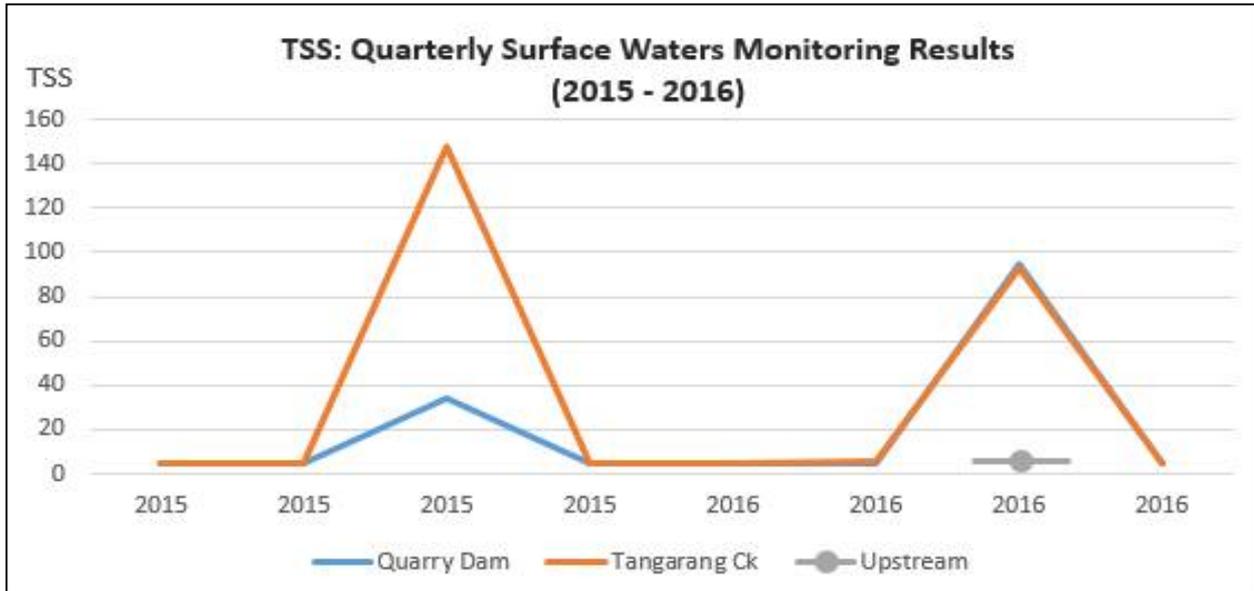
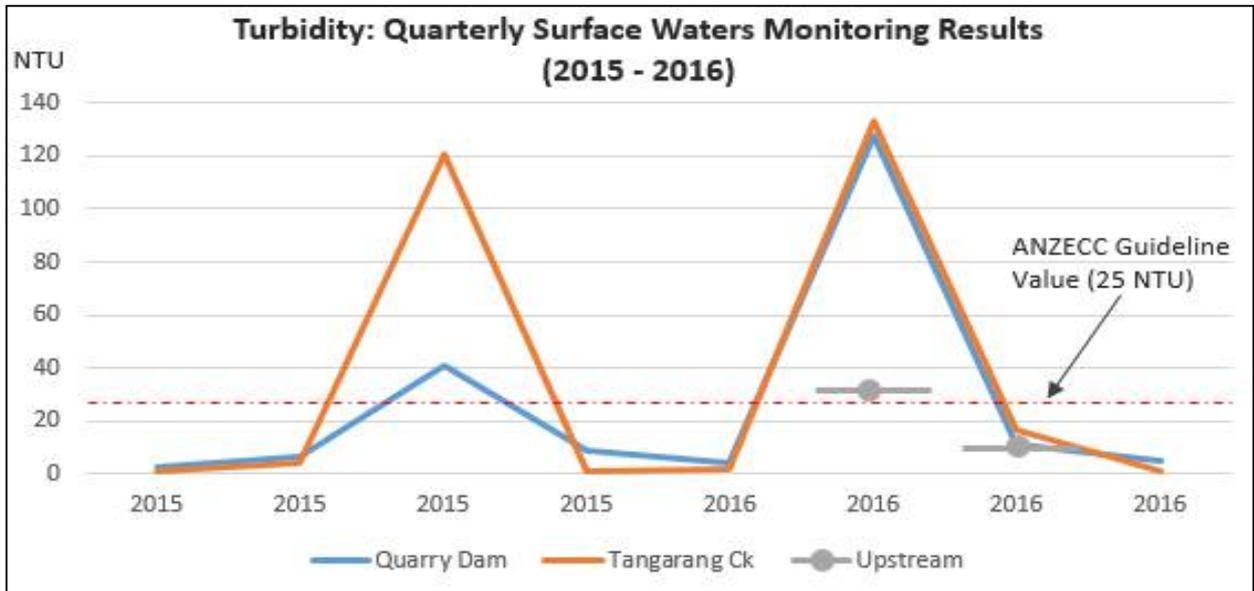


Figure 24: Turbidity Trends – Quarry Dam Vs Creek



Environmental Flows

Under Project Approval Condition 24 (Schedule 3), the supply of 10% of daily inflows into the Quarry main dam must be provided as environmental flows to Tangarang Creek. Table 16 presents the monthly averages of inflow and outflow volumes in comparison to the required 10% of environmental flow requirements. The environmental flows exceeded the 10% requirement in each of the months throughout the reporting period.

Table 16: Environmental Flow Data (2016)

Month (2016)	Inflow (Megalitres)	Outflow Requirement (10%)	Outflow (Megalitres)	Compliance
January	20.7	2.07	2.38	Yes
February	3.80	0.38	5.85	Yes
March	2.30	0.23	10.00	Yes
April	0.00	0.00	13.46	Yes
May	3.10	0.31	5.01	Yes
June	48.40	4.84	13.10	Yes
July	5.00	0.50	18.85	Yes
August	9.10	0.91	21.27	Yes
September	5.00	0.50	18.63	Yes
October	0.50	0.05	16.83	Yes
November	5.90	0.59	16.36	Yes
December	6.40	0.64	3.88 ¹	Yes

1: Level may be impacted by pooling downstream of the slow meter causing higher than usual readings

3.7.5 Surface Water Management Performance Review

The Quarry surface water quality trends are generally consistent with historic results with the exception of TDS, which during the reporting period were increasing (refer to Figure 22). However, the results were generally equivalent to the upstream concentrations suggesting the TDS results trends are largely representative of catchment influences rather than the Quarry Dam.

The pH levels of the Quarry Dam were measured to be slightly higher than upstream levels, however results were substantially within ANZECC trigger levels for south eastern Australian rivers (refer to Figure 21).

TSS and Turbidity were elevated in comparison to the upstream results during the second quarter sampling event. This was likely due to heavy rainfalls throughout the catchment as a result of an east

coast low similar to the one that caused significant flooding around the same time in 2015 (refer to Figure 23 (TSS) and Figure 24 (Turbidity)). However, during the third quarter sampling event, TSS and Turbidity had returned to levels below ANZECC trigger values and comparable with upstream results. Hydrocarbon and Polycyclic Aromatic Hydrocarbons (PAHs) were all at concentrations below the Laboratory levels of reporting (refer to Table 15).

The water quality results during the reporting period were generally consistent with historic trends and upstream results during periods of flow.

In accordance with Project Approval Condition 24 (Schedule 3), environmental flows meeting the 10% average requirement from the Quarry Dam into Tangerang Creek were continuously provided throughout the reporting period (refer to Table 16).

With consideration to water quality trends in comparison to upstream results (when in flow), the Quarry Dam is providing consistent environmental flows to downstream sections of Tangerang Creek that are unlikely to be adversely impacting ecology of downstream systems or potential users in terms of stock watering or irrigation purposes.

3.8 GROUNDWATER

3.8.1 Groundwater Management

Groundwater is managed in accordance with the approved Quarry Water Management Plan (WMP) that was revised during the reporting period as part of Modification No. 4 approval.

Hydrogeological and hydrochemical assessments indicate that the granodiorite unit comprises a low-yielding fractured aquifer with groundwater occurring in localised, discrete and potentially discontinuous fracture zones. The most significant of these zones comprises the water table at the weathered horizon between the overburden and the more competent, underlying granodiorite approximately 15 to 30 m below ground.

Quarterly monitoring of the deep and shallow piezometers drilled into the fractured aquifer is undertaken to identify the potential for any adverse impacts from the Quarry activities. The groundwater monitoring program commenced in 2015 and the reporting period was the first full year of quarterly monitoring. The groundwater monitoring program is designed to generate long-term data from which accurate interpretation of groundwater levels and water quality so that any Quarry activities identified to be potentially causing adverse impacts may be able to be modified.

The WMP includes groundwater management response measures such as hydrogeological assessment, fate and transport modelling and an ecological risk assessment to quantify any potential or actual impacts at identified receptors. The investigation will make recommendations on appropriate actions to mitigate any potential adverse impacts to groundwater through quarry activities.

3.8.2 Groundwater Monitoring Program

The Quarry WMP includes a groundwater monitoring program conducted at least quarterly of five shallow and seven deep piezometers ranging from between 15 m to 100 m in depth (refer to Figure 25). The groundwater monitoring is undertaken in general accordance with AS 5667.11 – 1998 Water Quality Sampling – Guidance on Sampling of Groundwaters.

All laboratory analysis is completed by a laboratory that is NATA accredited for the analytes presented above. All flow gauging equipment is checked and re-calibrated in accordance with suppliers' recommendations. Monitoring is undertaken by appropriately trained and qualified individuals to ensure quality of monitoring procedures.

Figure 25: Groundwater Monitoring Locations



3.8.3 Groundwater Performance Criteria

The groundwater monitoring program is in the early stages of collecting data towards which longer term trends for establishing site specific trigger values (SSTV's). At present, water quality parameters are being compared to ANZECC (2000)³ guidelines to which exceedances of several parameters is apparent. However, the exceedances are likely to be representative of background hydrogeology and not quarry activities. The implementation of SSTV's will enable a more realistic indication of quarry impacts on local groundwater conditions.

³ ANZECC, 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

3.8.4 Groundwater Monitoring Results

Tables 17 and 18 present the groundwater field sampling parameters and standing water levels respectively measured during the reporting period. Table 19 comprises of the laboratory analytical results from the first sampling event in October 2015 and quarterly groundwater sampling completed during the reporting period.

Figures 26, 27, 28 and 29 show trends for field measure parameters pH, electrical conductivity, dissolved oxygen and standing water levels respectively. PQ5 is identified as the sentinel water for the early identification fluctuation (refer to Figure 30).

Table 17: Groundwater Field Parameters

Bore ID	Field Parameters											
	pH				EC (µs/cm)				DO (ppm)			
	Feb	May	Jul	Oct	Feb	May	Jul	Oct	Feb	May	Jul	Oct
PQ01D	11.8	11.3	9.1	9.6	4160	3560	4135	4318	0.6	2.0	1.7	1.2
PQ01S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
PQ03D	12.7	12.9	12.6	12.5	5770	4358	4208	4380	2.7	1.6	1.5	0.9
PQ04D	NS	NS	6.2	7.6	NS	NS	1040	4535	NS	6.0	5.1	2.8
PQ04S	7.7	7.0	7.0	7.0	2520	2685	2571	4535	4.1	1.7	2.2	1.96
PQ5D	7.7	8.0	7.1	7.9	1917	1678	1795	1655	0.3	0.7	1.8	0.6
PQ6D	12.4	12.6	12.3	12.4	3380	3257	3349	3730	0.6	1.5	1.5	0.9
PQ7D	12.5	12.4	11.9	11.9	4070	2266	2204	1777	0.8	2.3	2.8	1.5
PQ8D	7.4	7.2	7.1	7.6	2720	2797	2970	3718	6.0	3.4	1.2	0.8
PQ8S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
PQ9D	7.4	7.2	7.4	8.4	1698	1587	1734	1473	0.8	1.4	1.5	1.0
PQ9s	7.3	7.0	7.2	8.0	1902	2663	2715	3596	4.8	2.8	3.6	1.7

NS: Not Sampled

Table 18: Groundwater Standing Water Levels

Bore ID	Standing Water Levels (mbgl)			
	Feb-16	May-16	Jul-16	Oct-16
PQ01D	35	37	35	34
PQ01S	Dry	Dry	Dry	Dry
PQ03D	23	27	28	29
PQ04D	17	18	18	19
PQ04S	12	13	12	12

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PQ5D	13	14	14	14
PQ6D	30	22	19	19
PQ7D	15	16	16	16
PQ8D	31	31	31	31
PQ8S	Dry	Dry	Dry	Dry
PQ9D	27	28	28	27
PQ9s	27	27	27	27

Table 19: Groundwater - Laboratory Analysis Results (2015 - 2016)

Bore ID	Date	TDS (mg/L)	Suspended Solids (mg/L)	Turbidity (mg/L)	Total Alkalinity (mg/L)	SO ₄ (mg/L)	Cl (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	F (mg/L)	Total N (mg/L)	Total P (mg/L)	Oil & Grease (mg/L)	PAH (µg/L)	TRH C6-C10 / BTEX-N (µg/L)	TRH C10 - C40 (µg/L)
PQ01D	10/10/2015	2710	5130	3700	242	100	897	142	175	310	25	-	1.6	2.55	<5	ND	ND	<100
	11/02/2016	2040	383	120	301	83	1010	320	<1	363	124	<0.1	1.1	<0.01	<5	ND	ND	<100
	26/05/2016	2890	32900	28200	104	79	1100	87	214	342	31	<0.1	0.5	0.04	<5	ND	ND	<100
	27/07/2016	2350	11900	6820	459	78	1290	217	300	330	9	0.2	4.7	0.08	<5	ND	ND	<100
	20/10/2016	3180	72	50.9	392	70	1220	239	323	19	19	0.2	0.7	0.27	10	ND	ND	<100
PQ03D	10/10/2015	1410	19700	7740	251	60	486	86	96	177	23	-	1.8	10.4	<5	ND	ND	<100
	12/02/2016	1740	20	8	1230	15	179	216	<1	201	404	0.3	1.5	<0.01	<5	ND	ND	<100
	26/05/2016	1460	116	58.2	895	15	196	152	<1	197	311	0.4	1.0	0.22	<5	ND	ND	<100
	27/07/2016	1140	82	38.3	871	14	204	146	<1	197	316	0.4	1.4	0.02	<5	ND	ND	490
	20/10/2016	1190	118	74.4	719	4	214	83	<1	201	239	0.4	1.5	0.02	<5	NA	ND	NA
PQ04S	9/10/2015	1980	10000	7230	381	77	596	60	56	437	7	-	3.0	6.58	28	ND	ND	330
	11/02/2016	1250	1150	681	438	66	598	72	60	398	3	1.0	2.4	0.6	17	ND	ND	1380
	26/05/2016	1560	473	258	522	32	596	86	67	449	4	0.8	1.8	0.18	<5	ND	ND	150
	27/07/2016	1620	480	224	568	5	603	86	57	434	4	0.6	0.6	0.33	<5	ND	ND	260
	20/10/2016	2320	108	70.6	490	42	968	90	92	640	5	0.8	0.6	0.04	<5	ND	ND	<100
PQ04D	9/10/2015	611	618	266	71	31	302	40	12	164	1	-	<0.2	0.27	<5	ND	ND	<100
	11/02/2016	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	15/06/2016	672	72	7.4	80	30	312	36	18	165	2	1.7	<0.1	0.01	<5	ND	ND	<100
	27/07/2016	551	8	5	95	30	335	39	18	185	7	1.5	0.3	0.02	<5	ND	ND	<100
	20/10/2016	694	10	8.4	97	29	334	36	20	191	8	1.7	0.2	<0.01	<5	ND	ND	<100
PQ05D	9/10/2015	1310	3880	1340	292	69	346	128	49	135	5	-	<0.5	0.54	<5	ND	ND	210
	12/02/2016	1080	614	232	518	<10	377	133	45	237	7	0.3	0.3	0.11	<5	ND	ND	<100
	26/05/2016	1190	1140	430	582	<1	348	142	48	245	9	0.2	0.7	0.19	<5	ND	ND	<100
	27/07/2016	1260	2330	1320	596	<1	381	145	42	253	7	0.2	1.5	1	<5	1.2	ND	100
	20/10/2016	1180	4310	1060	650	<1	370	134	46	260	7	0.3	0.4	0.03	<5	1.3	ND	<100
PQ06D	9/10/2015	1400	488	82.4	341	18	452	85	91	182	23	-	2	0.32	<5	ND	ND	180

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1st January 2016 to 31st December 2016

Bore ID	Date	TDS (mg/L)	Suspended Solids (mg/L)	Turbidity (mg/L)	Total Alkalinity (mg/L)	SO ₄ (mg/L)	Cl (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	F (mg/L)	Total N (mg/L)	Total P (mg/L)	Oil & Grease (mg/L)	PAH (µg/L)	TRH C6-C10 / BTEX-N (µg/L)	TRH C10 - C40 (µg/L)
	12/02/2016	1340	40	12.7	547	228	210	53	<1	253	246	0.6	1.5	0.02	<5	ND	ND	<100
	26/05/2016	1590	49	19.6	480	204	190	62	<1	260	231	0.6	1.1	0.03	<5	ND	ND	<100
	27/07/2016	1030	724	295	484	190	205	69	<1	254	232	0.5	1.6	0.11	<5	ND	ND	120
	20/10/2016	1280	74	32.2	494	182	199	28	<1	260	224	0.6	1.7	0.05	<5	ND	ND	<100
PQ07D	9/10/2015	1490	801	301	29	453	390	192	13	126	200	-	1.6	0.7	<5	ND	ND	210
	11/02/2016	1480	43	11.1	641	236	308	287	<1	142	137	0.2	0.6	0.06	<5	ND	ND	<100
	26/05/2016	1280	628	201	270	173	302	152	<1	158	105	0.1	0.4	<0.01	<5	ND	ND	<100
	27/07/2016	845	459	241	267	156	326	164	<1	155	92	0.2	0.6	0.06	5	ND	ND	130
	20/10/2016	894	1700	799	204	134	324	110	<1	168	98	0.2	0.6	<0.01	<5	ND	ND	<100
PQ08D	10/10/2015	2510	88	37.7	325	59	698	203	147	123	3	-	<0.1	0.02	<5	ND	ND	<100
	12/02/2016	2010	71	43.4	404	60	794	235	152	134	6	0.2	<0.1	0.08	<5	ND	ND	<100
	26/05/2016	2100	59	52.9	409	59	719	247	160	140	4	0.2	<0.1	0.15	<5	ND	ND	<100
	27/07/2016	2080	54	77.6	421	47	798	258	177	144	3	0.2	<0.1	0.06	<5	ND	ND	<100
	20/10/2016	2160	20	53.7	428	52	769	228	171	145	3	0.2	<0.1	0.01	<5	ND	ND	<100
PQ09S	10/10/2015	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	N/A
	11/02/2016	1640	821	418	466	21	727	173	178	155	7	0.2	2.5	0.22	7	ND	ND	<100
	26/05/2016	1930	2560	1850	506	16	663	183	180	151	6	0.2	1.9	0.96	<5	ND	ND	<100
	27/07/2016	1950	973	495	489	19	716	194	196	154	6	0.2	4.5	<0.01	<5	ND	ND	<100
	20/10/2016	1860	1100	444	509	7	693	168	187	151	7	0.3	2.5	0.08	<5	ND	ND	<100
PQ09D	10/10/2015	1040	874	537	391	35	297	93	95	96	7	-	0.3	0.25	27	ND	ND	1300
	11/02/2016	944	180	75.7	496	9	328	120	97	97	4	0.3	0.1	0.08	<5	ND	ND	300
	26/05/2016	1010	155	50	508	20	309	127	104	103	4	0.2	0.2	0.15	<5	ND	ND	180
	27/07/2016	1190	941	435	489	21	334	133	96	103	3	0.2	2.4	0.03	<5	ND	ND	6590
	20/10/2016	1060	226	85.7	514	20	334	113	110	104	4	0.3	1.6	2.23	<5	ND	ND	<100

Table reproduced from RPS Groundwater Monitoring Results (Oct 2016)

NOTES:

1. Shaded Cells: Exceedances of ANZECC (2000) threshold values
2. NA: Not Analysed
3. ND: Non-Detect

Figure 26: Groundwater pH Trend (2016)

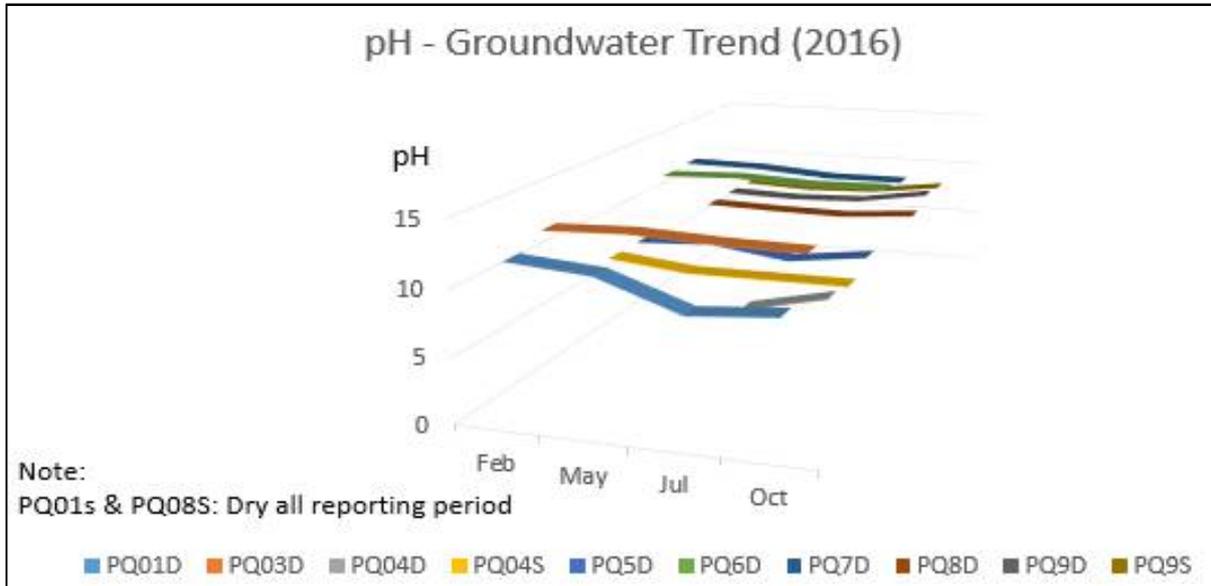


Figure 27: Groundwater Electrical Conductivity Trend (2016)

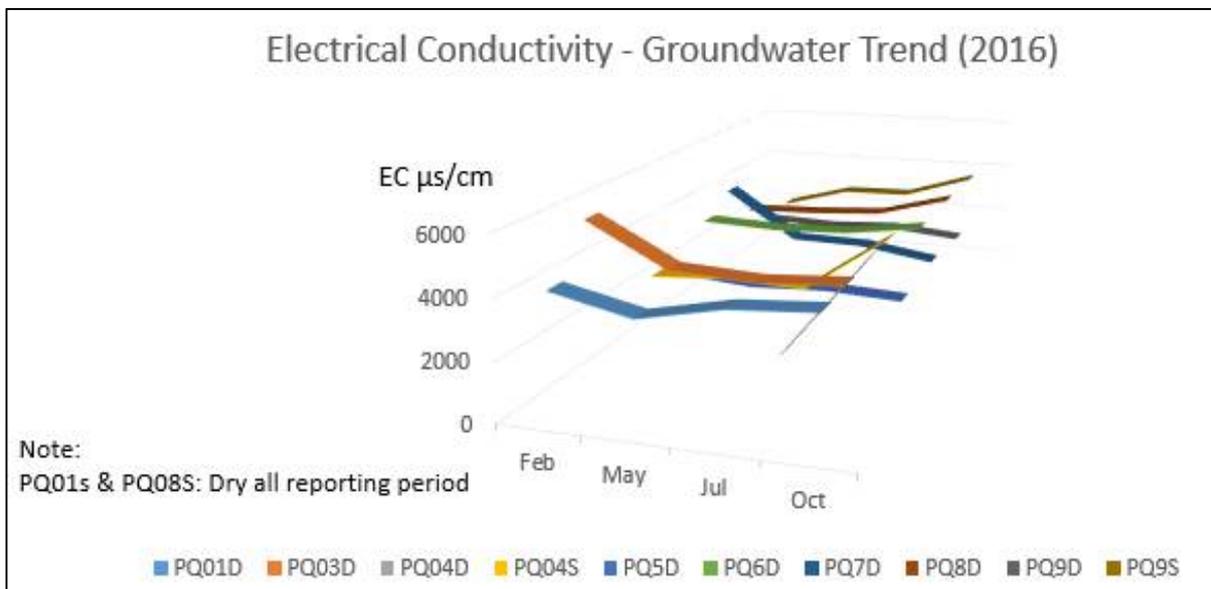


Figure 28: Groundwater Dissolved Oxygen Trend (2016)

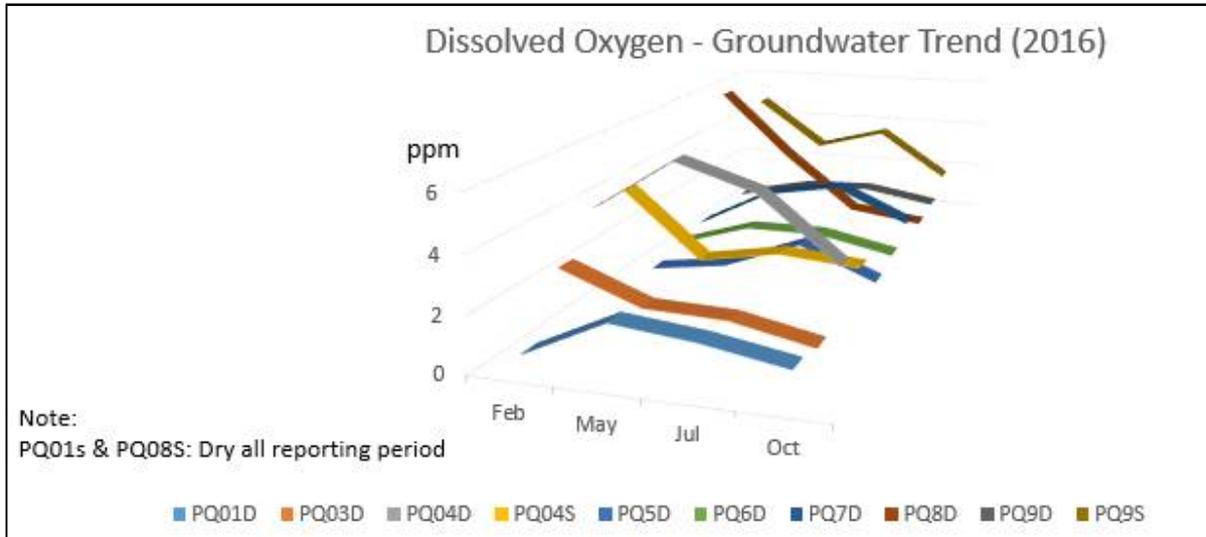


Figure 29: Groundwater Standing Water Levels

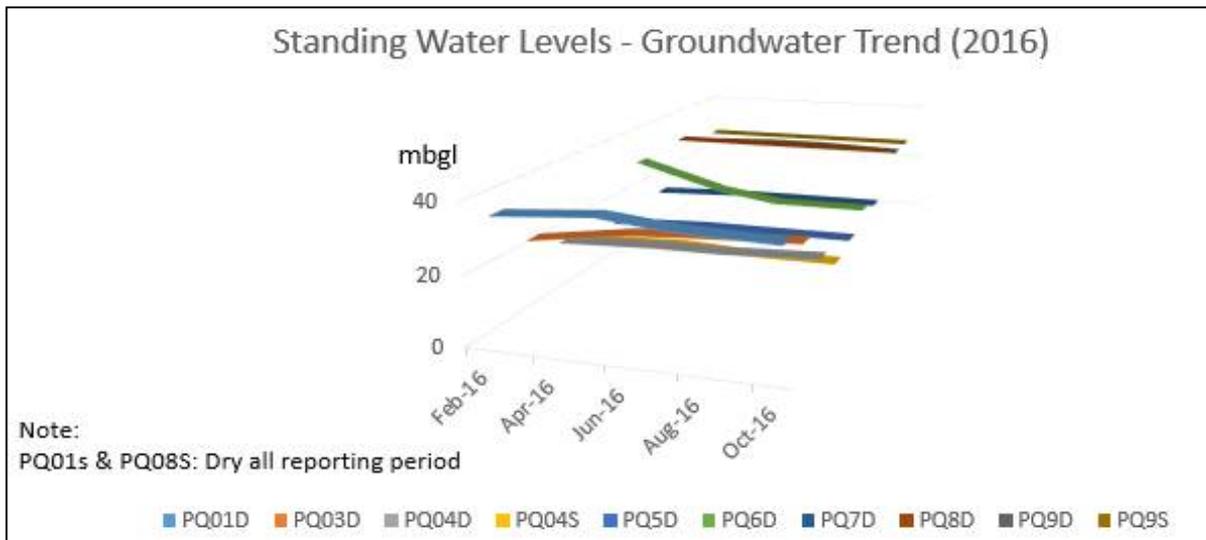
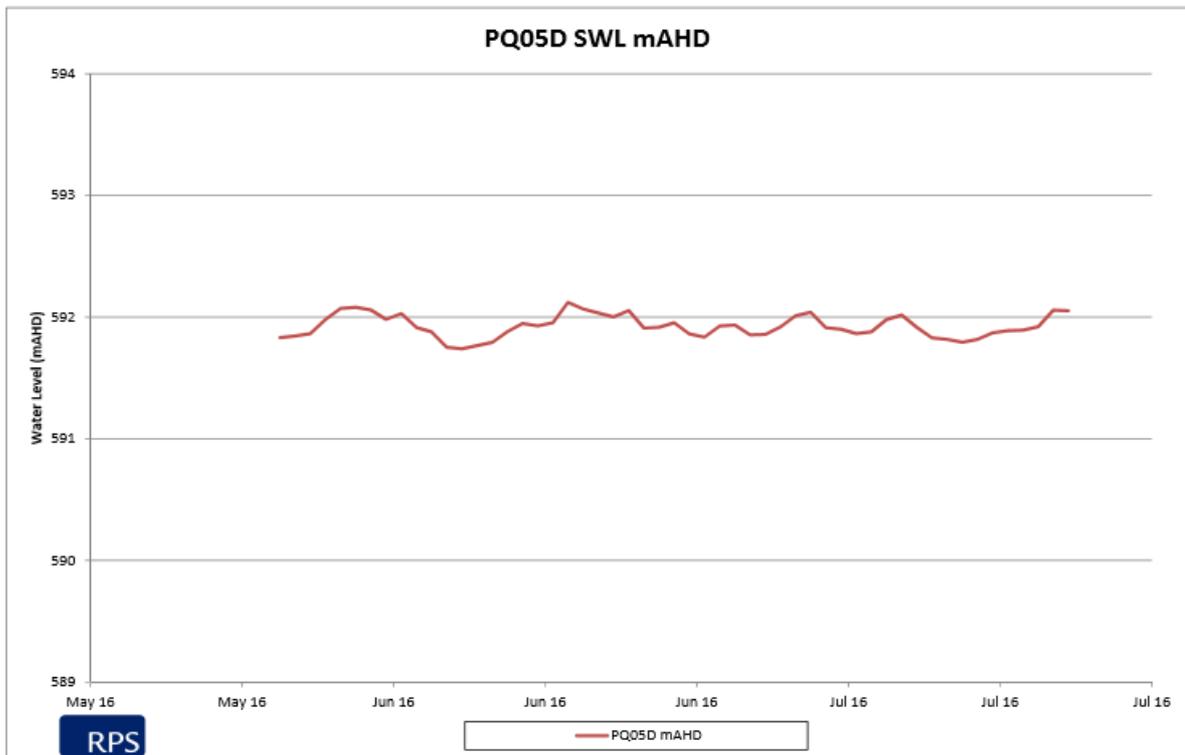


Figure 30: Standing Water Level - Sentinel Well (PQD5)



3.8.5 Groundwater Management Performance Review

It should be noted that the groundwater monitoring first commenced in October 2015 and to the end of the reporting period five sampling events had therefore been completed. Groundwater results and trends presented in Section 3.8.4 above and discussed below are in the early stages of a long-term monitoring program which will generate a greater data set from which more detailed and accurate interpretation of any potential or actual impacts on groundwater may be occurring through quarry activities.

Figure 26 shows that pH trends have remained relatively stable in each piezometer. However, Table 17 provides a summary of pH levels that varied considerably between the respective piezometers with a range of 6.2 (neutral) to 12.7 (alkaline). These levels occur in both in pit groundwater bores as well as those outside of any influence from quarry activities.

Table 17 presents a summary of field measured Electrical Conductivity (EC) during the reporting period which ranged from 1.4 to 4.5 mS/cm, indicative of fresh to brackish water quality. Figure 27 shows the early EC trends are relatively stable and consistent between each of the piezometers. Laboratory analysed TDS was commensurate with the field EC values.

Figure 28 shows dissolved oxygen (DO) trends showed a high degree of variability in individual and between respective piezometers throughout the reporting period. For example, the DO in PQ8D was measured at 6.0 ppm in February and down to 0.8 ppm in October (refer to Table 17).

Figure 29 shows that standing water levels remained stable in each of the piezometers. The greatest variation was measured in PQ6D which ranged from 30 mbgl (February) to 19 mbgl (October) during the reporting period (refer to Table 18). PQ5 is identified as the sentinel water bore and shows no fluctuation of water level (refer to Figure 30).

Key findings from the analytical result were:

- Concentrations of nutrients (total nitrogen and total phosphorous) exceeded ANZECC (2000) threshold values in most of the piezometers throughout the reporting period, and as such it is believed that these levels are representative of background levels
- Organic analyses (oil & grease, polycyclic aromatic hydrocarbons, volatile and semi-volatile total recoverable hydrocarbons and benzene, toluene, ethyl benzene, xylenes and naphthalene) were not detected at the majority of the piezometers aside from:
 - Oil and Grease at PQ01D (10 mg/L) and PQ05 (6 mg/L). Both detections were near the laboratories limit of reporting of 5 mg/L.
 - Naphthalene in PQ05D (1.3 µg/L) along with total PAH (1.3 µg/L). The results were marginally above the laboratories limit of reporting of 1.0 µg/L.
- The elevated concentrations of semi volatile total recoverable hydrocarbons (TRH C10 to C40) at Piezometer PQ09D (6,590 µg/L) noted in July 2016 were not observed again in October. The TRH was inferred to have resulted from drilling and poor development due to low yields, the decreasing concentrations of all organic analyses indicated natural attenuation has, and continues to occur.

Boral will continue with the quarterly groundwater monitoring program throughout 2017 with the objective of generating a comprehensive and long-term data set for ongoing guidance in the management groundwater and quarry activities.

3.9 EROSION AND SEDIMENT

3.9.1 Erosion and Sediment Management

The Quarry operates in accordance with a Water Management Plan which includes erosion and sedimentation controls that:

- Implement the requirements set out in the publication "Managing Urban Stormwater: Soils and Construction Volume 1, 4th Edition, 2004 (Landcom, 2004)", referred to as the '*Blue Book*' and Volume 2E Mines and Quarries (DECC, 2008);
- Identify practices that have potential to cause erosion and generate sediment and what control measures to minimise the impact of these practices; and
- Detail the location function and capacity of erosion and sediment control structures and how they will be maintained.

The Quarry utilises a number of diversion bunds, sediment traps and settling ponds to capture and contain dirty water. This water is then managed back into the pit operations for reuse.

Other drains and structures are in place as part of the clean water system which passes outside of the Quarry in order to reduce erosion and flooding from high intensity storms.

Sediment fencing is installed around any disturbed areas, where necessary, to contain sediment at the source and minimise the potential for off-site migration. Prior to any land being disturbed, the specific area is clearly marked and no works are permitted to extend beyond the prescribed boundaries.

Modification No. 4 - Southern Overburden Emplacement

The WMP was revised during the reporting period and included specific water management system proposed for the Southern Overburden Emplacement approved under Modification 4, including:

- Constructing sediment basins at the locations on the eastern side of the emplacement where runoff would drain to Barbers Creek. These basins would be sized to comply with the requirements for basins that discharge to 'sensitive' receiving environments in accordance with Table 6.1 in *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries* (DECC, 2008);
- Operation of the sediment basins to restore the 'capture capacity' of each basin within 5 days of the end of a storm event either by re-use of the water for dust suppression or irrigation, or transfer of the water to the quarry pit, from where water would be managed in accordance with the WMP; and
- Sediment control fencing on the western side of the emplacement where runoff will drain to the northern pit of the adjacent Limestone Mine.

Extreme Rainfall Event Management

An extreme rainfall event procedure, based on a commercially available weather forecasting dashboard, is used to predict meteorological conditions that may reduce the effectiveness of sediment and erosion controls.

The implementation of the procedure enables Boral to proactively prepare for and manage extreme weather events. Based on the level of an alert, controls and contingencies for stormwater management are effectively and efficiently implemented. Boral has trained staff and developed procedures to take appropriate levels of action based on the dashboard predictions.

3.9.2 Erosion and Sediment Monitoring Program

Monitoring and inspections of land disturbance activities involve:

- Regular surface water monitoring in accordance with the Quarry WMP;
- Planning, preparation and inspections for predicated heavy rainfall events;
- Routine environmental inspections and audits on the Quarry's regulatory compliance and operational performance against the following Boral HSEQMS Standards:
 - Environmental Aspects and Impacts;
 - Water Management;
 - Land Management; and
 - Ecosystem and Biodiversity Conservation.

3.9.3 Erosion and Sediment Monitoring Criteria

The WMP monitoring program comprises of quarterly monitoring of water quality parameters representative of potential adverse impacts on receiving waters resulting from poor erosion and sediment management practices. The results of the monitoring provide an indication of the effectiveness of controls implemented to minimise environmental impacts from Quarry extractive and land disturbance activities.

Internal environmental audits and inspections are routinely conducted on erosion and sediment management and any inadequacies in controls are entered into the Boral Incident Management System with corrective actions that are tracked to completion. Any registered corrective action not completed within dedicated timelines is escalated to senior management for review and prioritisation.

3.9.4 Erosion and Sediment Monitoring Results

Quarterly water quality monitoring results are presented in Section 3.7.4. The results for water quality parameters representative of erosion and sediment impacts such as TSS and Turbidity generally remained within guideline values for eastern Australian river systems, with elevated results during heavy rain events largely representative of catchment influences rather than Quarry activities.

3.9.5 Erosion and Sediment Management Performance Review

There were no erosion or sediment related incidents at the Quarry during the reporting period. No performance concerns on the management of erosion and sediment were identified during internal audits and inspections during the reporting period.

The Quarry was also subject to two external audits by the Department of Environment and Planning and an Independent Audit as part of Project Approval requirements. Neither of the respective Audit findings raised concerns in relation to erosion and sediment controls. However, the Independent Audit provided recommendations for administrative improvements to relevant management plans and Quarry maps.

3.10 WASTE MANAGEMENT

A Waste Management Plan was finalised during the reporting period that outlines the procedures for the monitoring, minimisation, classification and disposal of waste generated at the Quarry.

The Waste Management Plan outlines the roles and responsibilities for the:

- Development and maintenance of a waste register;
- Training of employees and contractors on waste objectives and requirements;
- Storage, segregation and classification of waste;
- Reuse and recycling of suitable waste materials; and
- Off-site disposal with all necessary documentation on the type/classification of waste, volume, method of transport, waste company details and receiving facility.

3.11 HERITAGE CONSERVATION

The Quarry's Aboriginal Heritage Management Plan (AHMP) was revised during the reporting period as part of Modification No. 4 approval.

During the reporting period members of the Aboriginal Management Committee (AMC) have continued to undertake topsoil monitoring across a large area of the site. Salvaging of artefacts during topsoil spreading has to the end of the reporting period identified and catalogued over 90,000 artefacts from various locations.

During the reporting period 24 quadrants were salvaged with over 8000 artefacts being collected.

In discussion with the AMC, the artefacts will be "returned to country" unless determined and agreed otherwise.

During the reporting period, artifact recovery operations were concentrated in Areas 1, 2 and 3 (Refer to Figure 6).

AMC representatives alongside consultants also identified a scar tree in association with the review of the site for the Modification 4 proposal. Appropriate management of the site will be arranged to ensure the area is protected.

3.12 INCIDENT MANAGEMENT AND RESPONSE

In accordance with NSW EPA requirements, a Pollution Incident Response Management Plan (PIRMP) has been developed and implemented which details the:

- Risks and hazards associated with quarry operations, equipment and materials;
- Controls in place to reduce the risk in the occurrence of potential incidents;
- Inventory of pollutants and respective volumes stored on-site;
- Safety and incident response equipment;
- Communication strategy for the immediate notification of an incident to relevant government agencies and neighbours;
- Actions to be taken during or immediately after an incident; and
- Training and responsibilities of response staff.

The PIRMP was last reviewed and revised in October 2016 and a copy can be accessed on the Boral website at:

http://www.boral.com.au/Article/nsw_poela_environmental_reporting.asp

3.13 SUMMARY OF REGULATORY NOTIFICATIONS

The following sections are a summary of notifications provided to Depart of Planning and Environment and EPA during the reporting period. It should be noted that the some of the notifications were made against performance criteria detailed within Quarry Management Plans and not regulatory compliance conditions. A number of the notifications were as a result of circumstances beyond Quarry management controls, such as groundwater quality being representative of natural occurring background levels and dust from off-site activities.

3.13.1 Groundwater

On 16th December, the Depart of Planning and Environment were notified through email that groundwater monitoring conducted during the reporting period had identified occasional exceedances of criteria outlined in the Quarry Water Management Plan. Advice from the Senior Hydrogeologist (RPS) engaged to conduct the monitoring program, has been to continue monitoring, as it would appear the exceedances are in relation to natural background levels and from the recent development of the bores. Investigations have not been able to identify any possible sources of groundwater impacts from the Quarry operations.

There are currently no groundwater related criteria associated directly with the DA or EPL. However, as the groundwater monitoring program generates a larger data set on which individual results and trends may be more accurately interpreted, site specific trigger values will be developed for comparison to ANZECC (2000) and other relevant water quality guidelines. As discussed above in Section 3.8 above, this may involve a number years of ongoing monitoring until such a data set can be established.

3.13.2 Dust

Dust Deposition Result

As required by DA Condition 6 (Schedule 5), the Department of Planning and Environment were notified through email on 3rd January 2017, that the dust deposition gauge D2 had a measured insoluble dust concentration of 4.8 g/m²/month for November 2016 which was marginally over the approval guideline criteria of 4g/m²/month.

Dust deposition gauge D2 is located to the south west of the Quarry and a review of weather station data indicated there were no significant winds from the north east which would have resulted in the measured concentration levels being attributed to the Quarry.

PM₁₀ - High Volume Result

On 21st December 2016, the Department of Planning and Environment were notified through email that a PM₁₀ concentration of 50.7 µg/m³ from the Quarry high volume sampler had marginally exceeded the 24hour criteria of 50 µg/m³ prescribe in DA Condition 17 (Schedule 3)

On investigation, the max temperature of the day was around 31 degrees, the average wind speed was 7.47 m/ ec and there was no rain. Wind direction fluctuated over the day being northwest before shifting about 10 am to South west with a further movement at 7 pm to south easterly.

The high volume air sampler is located to the south west of the Quarry and therefore up wind of quarry activities. Therefore, the exceedance is not considered representative of the previous 24 hours of quarry activities

3.13.3 Surface Water Quality

On 3rd of January 2017, Department of Planning and Environment and EPA were notified through email that quarterly monitoring of surface waters reported an exceedance of the ANZECC (2000) guideline trigger values for Total Nitrogen in samples taken at the Quarry Dam and Tangarang Creek. The levels were 3 mg/l and 0.3 mg/l respectively against the ANZECC guideline concentration of 0.25mg/l for south eastern Australian aquatic ecosystems.

Faecal coliforms were also above the NHMRC (1990) guideline criteria of 150 with a measurement of 300, in Tangarang Creek. On investigation, it was found that there had been no inflow to the Quarry Dam from upstream catchments due to prolonged dry period. During the dry period, there were also no flows of water to the Quarry Dam from the site operations as all water is being fully utilised for mainly dust suppression.

It is believed that the Total Nitrogen concentrations and Faecal coliform count levels were not representative of Quarry activities.

3.13.4 Show Cause Notice

On 7th October 2016, the Department of Planning and Environment had issued Boral with a Show Cause Notice for the following matters:

- AEMRs for the reporting periods 2013, 2014 and 2015 were not submitted with regulatory specified timelines; and
- An Independent Audit report had not been submitted within one month of its completion.

A letter response to the Show Cause Notice was provided on 24th October 2016 from the Quarry Manager, which detailed the circumstances and corrective actions being undertaken to address the above matters and to ensure future regulatory timelines for submission of necessary documents are complied with. The matter remains under review by the Department of Planning and Environment.

4.0 COMMUNITY RELATIONS

4.1 ENVIRONMENTAL COMPLAINTS MANAGEMENT

The Quarry maintains an environmental complaint's register that identifies actions required to resolve issues and concerns raised by the community. A 24-hour telephone complaints line has been established and advertised through signage at the Quarry access point on Marulan South Road. The complaints register is also published on the Boral website and records the following information:

- Complainant name and contact details;
- Nature of the complaint (noise, dust, traffic etc);
- Date of the complaint;
- Specifics of the complaint;
- Outcome of the investigation of the complaint; and
- Actions implemented to resolve the complaint.

4.1.1 Complaints Summary - 2016

The Quarry experienced an increase from 2 complaints in 2015 to 3 during the reporting period. All complaints were investigated and where Quarry activities were identified to be the cause, corrective actions were implemented in a timely manner.

As part of a noise assessment program managed during the reporting period, fourteen notifications had been received from a local resident regarding noise. Boral are assessing the potential for the impact of noise at this residential premises and have requested that the owner provide notification when noise is audible. These notifications are currently being investigated and will be assessed in line with noise monitoring (refer to Table 20).

Boral will continue to develop and maintain relationships with the community and ensure their concerns are addressed to an acceptable outcome wherever possible. Complaints received during the reporting period are summarised in Table 21.

Table 20: Noise Assessment Program Notifications

Date - 2016	Nature of Notification	Outcome of investigation
15 th June	Public Noise and lighting	Lights of concern have been identified and appropriate controls are being reviewed. At time of inspection, noise was no longer audible so monitoring will be undertaken during July.
29 th June	Public Noise	Operations normal, however strong winds in the direction of the residence making the operations audible.
5 th August	Public Noise Assessment Program	Operations normal, however noise exacerbated by weather conditions making the operations audible.
23 August	Public Noise Assessment Program	Operations normal, however noise exacerbated by weather conditions making the operations audible.
29 August	Public Noise Assessment Program	Very loud train noise, early evening exacerbated by weather conditions.
13 th September	Public Noise Assessment Program	Very loud train noise, early evening exacerbated by weather conditions, as well as rock falling onto surge stockpile
7 th September	Public Noise Assessment Program	Very loud train noise, early evening exacerbated by weather conditions.
7 th September	Public Noise Assessment Program	Audible reversing beepers. Equipment was identified and arrangements made for alternative beepers to be installed.
23 rd September	Public Noise Assessment Program	Very loud crusher and train noise, exacerbated by weather conditions.
30 th September	Public Noise Assessment Program: Query as to whether the site had been blasting as house shook	No blasting had been conducted at the Boral quarries and all operations were normal.
8 th October	Public Noise Assessment Program	Very loud crusher and train noise, exacerbated by weather conditions.
9 th October	Public Noise Assessment Program	Very loud crusher noise, exacerbated by weather conditions.
11 th October	Public as part of the Noise Assessment Program: Query as to whether the site had been blasting as house shook	No blasting had been conducted at the Boral quarries and all operations were normal.
13 th October	Public Noise Assessment Program	Noisy operations sounding like rock falling on the surge pile. Night was still with a very light breeze.

Table 21: Community Complaints Received in 2016

Date - 2016	Nature of Complaint	Outcome of investigation
6 th January	Public Noise between 9pm - 10pm audible at the residence	Excavator was being used to load feeders at crushing / screening plant due to maintenance works being undertaken on the normal system. Use of the excavator was finalised in the next 24 hours
21 st January	EPA General concern from public that the quarry was ramping up of operations overnight and no water being used for dust suppression.	Out of pit operations occur at night, however this is not a change but rather due to the need for maintenance and supply of rock during the day light hours. Dust suppression was in place and used at night as well as day.
21 st April	Public Dust and noise of concern.	Operations were found to be normal. However, strong winds in the direction of the residence were likely making the operations audible. Additional water suppression employed. Ongoing assessment of possible noise source at this residence.

4.2 COMMUNITY CONSULTATION

The Quarry has actively engaged with the local community since the commencement of the 2006 Environmental Assessment for the project. The program has included:

- The establishment of a Community Consultation Committee;
- Regular community newsletters;
- Active participation in local events;
- Arranging site inspections and one on one consultation;
- Active engagement with key government and non-government organisations; and
- Maintenance of an environmental and community complaints register and actively managing and resolving community issues as they arise.

4.2.1 Community Engagement Plan (2015 – 2017)

During the reporting period, the Quarry and Marulan South Limestone Community Engagement Plan (2015 – 2017) continued to be implemented, which provides the following commitments to ongoing stakeholder engagement and communication:

- Inform and educate stakeholders about the purpose and activities of each operation and how they contribute to the local area, wider region and the community as a whole;
- To identify potential matters of concern to stakeholders and propose ways in which those matters can be discussed and, where possible, resolved to mutual benefit;

- To create opportunities for stakeholders to freely comment on their observation and experience of each operation, and for that feedback to be used as part of continuous improvement;
- To address any compliance obligations each operation may have in regard to community information and engagement; and
- Where appropriate, to identify opportunities for value to be created for the community as a result of Boral's presence as a corporate citizen.

4.2.2 Community Consultative Committee

A Community Consultative Committee (CCC) has been established since 2011 in accordance with Condition 8 of Schedule 5 of the Project Approval. The CCC comprises of:

- Two representatives from Peppertree Quarry including the Environment and Community Adviser;
- One representative from Goulburn Malwaree Council (the Mayor); and
- Three Local Community Representatives

Independently chaired, the role of the CCC is to offer the Quarry input from the community perspective on matters of environmental performance and stakeholder relations. Meetings include the review of environmental data and any feedback provided to the site from local community members. Issues of concern can be raised with the site by the CCC representatives.

The timing of the meetings is determined by the CCC and generally undertaken at least 6 monthly.

4.2.3 Community Newsletters

Community Newsletters are produced on a regular basis in order to inform local residents of the Quarry operations and activities as well as detailing Boral's involvement in local community events. These are distributed via the "Discover Marulan" newsletter issued to the local community. These can be found at:

<http://discovermarulan.com.au/newsletters/>

The newsletter is also posted on the Boral website. The first newsletter was circulated in 2011 and continued to be frequently issued during the reporting period (issued in February, March, May, June, July, September and December).

4.2.4 Community Events

The Quarry staff are actively engaged with community events in the Marulan and Goulburn area. Community and stakeholder activities during the reporting period included:

- Charity Golf Day – Financial sponsorship, Quarry team representation and promotional goods giveaway;
- Tallong Apple Festival – Financial sponsorship;

- Marulan Kite festival – Financial sponsorship and committee involvement;
- Heritage and sustainability project (HSP) – Meeting and program support;
- Boral Youth Leadership program in partnership with Outward Bound; and
- CVA partnership with work at Marulan Public School, Tudor Boys and Tallong Memorial Park.

4.2.5 Blast Liaison

In accordance with the Development Consent, Condition 15 (Schedule 3), landowners and occupiers of residences within 2 kilometres of the Quarry pit are encouraged to register interest in order to be advised of any future blasts at the pit. Four landowners are occupied by email with 2 notified by phone.

4.2.6 Access to Information

Boral has a number of websites for each corporate division. Peppertree Quarry has its own site at:

http://www.boral.com.au/article/marulan_operations_homepage.asp

The site contains all public information in relation to Statutory approvals and development including:

- About the Boral Peppertree Quarry;
- Planning and Approvals;
- NSW EPA Licence and Monitoring publications;
- Resource and Products;
- Operations;
- Work Health and Safety;
- Our Environment;
- Our Community (includes Latest News);
- Employment Opportunities at the Boral Peppertree Quarry; and
- Contact Details.

5.0 REHABILITATION

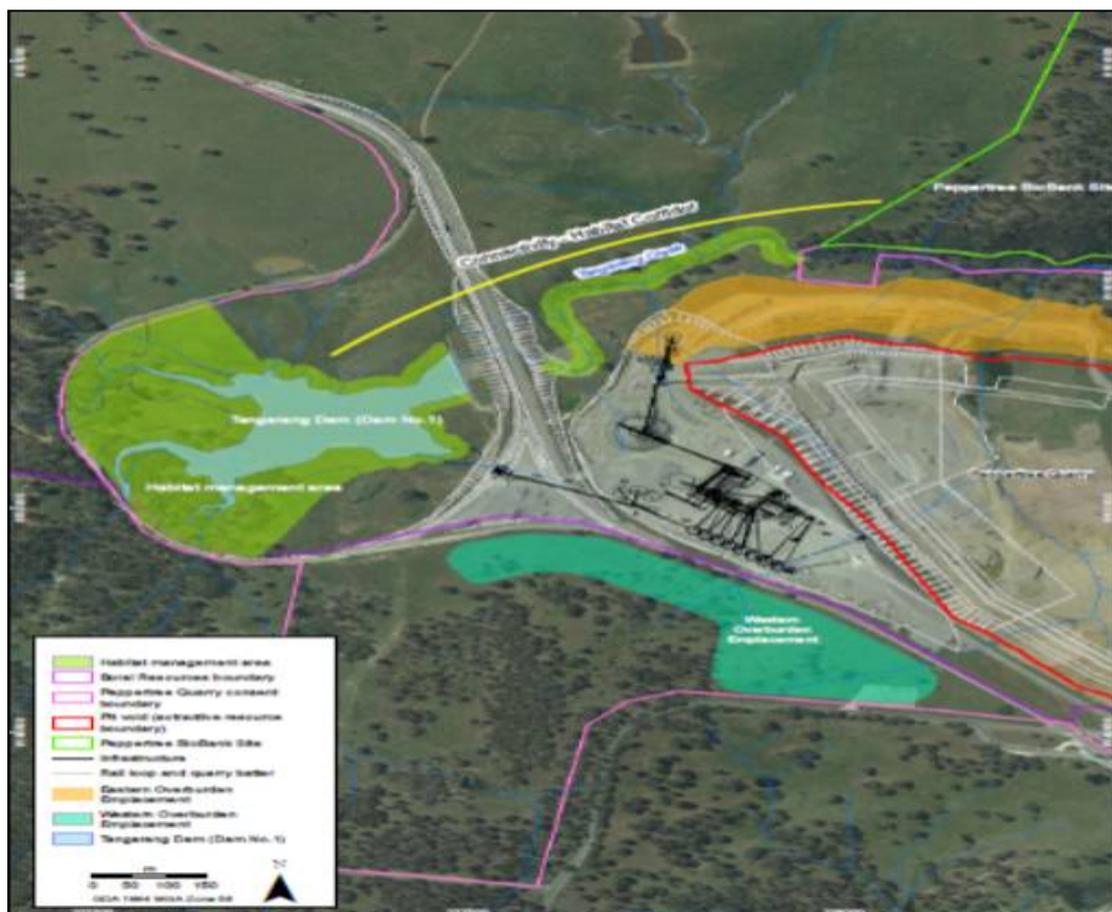
Operational and extraction areas are now established and there were no further disturbances of vegetation during the reporting period (refer to Figure 31).

However, the Quarry continued to conduct the rehabilitation program in accordance with the Landscape and Rehabilitation Plan prepared in accordance with Development Consent Condition 33, Schedule 3.

The rehabilitation and maintenance program is being undertaken on a weekly basis by experienced vegetation contractors. The rehabilitation program includes weed management for the control of serrated tussock, blackberries and thistles to ensure the Quarry does not impact on the surrounding rural pastures.

As part of the Modification 4 approval, studies identified the need for a bio banking offset area to be established 12 months after the commencement of the southern emplacement construction. Details are contained in Condition 34 and 34a, schedule 3 of the Approval.

Figure 31: Habitat Management Areas



6.0 ACTIVITIES PROPOSED IN NEXT AEMR PERIOD

The activities proposed to be undertaken during the 2017 AEMR reporting period are presented in Table 22. The activities have been selected and prioritised based on:

- Internal and Independent Audit findings and recommendations;
- Operational requirements; and
- Continual improvement objectives in accordance with Boral's Environmental Policy and integrated HSEQ management System.

Table 22: Proposed Activities in 2017 AEMR Period

Proposed Activities in 2017	Objectives
Undertaken Dust Extraction trial at crusher building	<ul style="list-style-type: none"> • Mitigation of dust
Undertake progressive Overburden stabilization and rehabilitation	<ul style="list-style-type: none"> • Minimise erosion and sediment runoff • Move towards achieving biodiversity management plan goals of establishing vegetation corridors
Update Oil storage systems	<ul style="list-style-type: none"> • Minimise risk of land contamination
Establish site water balance	<ul style="list-style-type: none"> • Understand water usage to better ensure water availability in times of drought
Heritage & overburden campaign – construct Western bund & start Southern emplacement	<ul style="list-style-type: none"> • Management of overburden and construction of noise bunds
Ongoing annual External review of weather data	<ul style="list-style-type: none"> • Ensure reliability of the weather station data
Waste accountancy	<ul style="list-style-type: none"> • Identify opportunities for waste minimization practices
Resolution of noise complaint	<ul style="list-style-type: none"> • Minimisation of noise in the community
Install additional Sediment control at the Train loadout facility	<ul style="list-style-type: none"> • Minimise erosion and sediment runoff
Install Stormwater management system at the eastern end of the pit– (turkeys nest)	<ul style="list-style-type: none"> • Divert clean storm water from entering pit operations.
Implement Stakeholder Engagement plan for 2017 including assistance with Kite festival	<ul style="list-style-type: none"> • Ongoing community engagement
Establish Bio bank area	<ul style="list-style-type: none"> • Management of vegetation and habitat to create corridors
Pit expansion to the East	<ul style="list-style-type: none"> • Ongoing operations
Review aspects and impacts register post 1 st year operating under Mod 4	<ul style="list-style-type: none"> • Ensure management of identified potential risks to the environment

Apply for variation of the EPL	<ul style="list-style-type: none">• To bring in line with the Modification 4 approval conditions in regards to Noise receivers
investigate the other "industrial" noise emission identified during October 2016 quarterly noise monitoring,	To confirm the sources origin and confirming that it is not associated with quarry operations.

6.1 Independent Audit

In accordance with Project Approval Condition 5 (Schedule 5) an Independent Audit was conducted at the end of 2016. The scope of the Audit was to:

- Assess the environmental performance of the project, and its effects on the surrounding environment;
- Assess whether the project is complying with the relevant standards, performance measures and statutory requirements;
- Review the adequacy of any strategy / plan / program required under the Project Approval; and
- Provide recommended measures or actions to improve the environmental performance of the project, and/or strategy/plan/program required under the Project Approval.

The Independent Audit found that the Quarry was in substantial compliance with the 60 applicable Project Approval conditions. The only non-compliance was in relation to a historic uncontrolled discharge event that occurred in the previous reporting period (2015). The Audit found no non-compliances to Project Approval conditions during the current reporting period.

However, the Audit Report included a number of recommendations towards further improvement opportunities (mainly administrative in nature) were subject to subject to an internal review. A response to the Audit recommendations was provided by the Quarry Manager to the Department of Planning and Environment on the 26th October 2016. The majority of the recommendations had been addressed by the end of the reporting period with the remainder to be actioned during the early months of the 2017 AEMR reporting period (refer to Table 3).

2015 DP&E Audit

The Independent Audit also assessed the status of actions addressing non-compliances identified by the Department of Planning and Environment in 2015 Audit conducted at the Quarry. The Audit found that corrective actions on 10 of the 13 non-compliances had been satisfactorily completed.

At the end of the reporting period corrective actions on the final outstanding three non-compliances had been completed.

6.2 DEPARTMENT OF PLANNING AND ENVIRONMENT AUDIT

In December 2016, the Quarry was the subject of a compliance audit undertaken by DP&E. The Audit found the Quarry was compliant with 133 applicable Project Approval conditions. There were 8 non-compliances identified. Seven of the non-compliance were against administrative conditions and the other was a low-risk concern with particulate dust concentrations which on two occasions marginally exceeded the short-term 24-hour average criteria of 50 µg/m³ during the reporting period (refer to Section 3.4.4 and Figure 12).

6.3 SITE ENVIRONMENT ASSESSMENT TOOL

The performance of the Quarry in key environmental aspects is annually assessed and scored for general compliance and continual improvement opportunities using a Site Environmental Assessment Tool (SEAT). The Quarry's environmental performance was assessed through the SEAT during the reporting period and Figure 32 presents the scores from the reporting period in comparison to the 2015 assessment.

The 2015 SEAT scores and assessment findings for each environmental aspect are provided below:

Water Management (2016 Score 10 – 2015 Score 9)

The management of water across the Quarry has continued to be key priority. This is represented by the SEAT scores of 10 and 9 for the reporting period and in 2015 respectively. The commencement of quarterly monitoring during the reporting period has enabled detection and interpretation of any potential impacts to groundwater from quarry operations.

The Quarry Water Management Plan was reviewed and revised during the reporting period and now reflects the current activities and management of quarry activities (i.e. groundwater monitoring program).

Blast Management (2016 Score 10 – 2015 Score 9)

A total of 50 blasts were conducted during the reporting period. All blasts were conducted within regulatory permitted times and in compliance with EPL limits for overpressure and ground vibration. The Noise and Blast Monitoring Program was reviewed and revised during the reporting period.

Noise Management (2016 Score 8.5 – 2015 Score 10)

As discussed in Section 4.1.1 above, the decrease in the SEAT assessment score was due to an increase in noise related notifications from a member of the community who took part in a noise assessment program during the reporting period. The notifications, quarterly noise monitoring results and quarry operations are currently being investigated and appropriate corrective action will be implemented if required

Air Dust Management (2016 Score 10 – 2015 Score 9)

The improved SEAT assessment score is due continued implementation of dust minimisation initiatives during the reporting period (refer to Section 3.4.1). The improvements have contributed to reduced levels of dust emissions measured through deposition gauges and HVAS (refer to Section 3.4.4)

Stakeholder Relations (2016 Score 10 – 2015 Score 10)

The Quarry Managers and personnel have continued their excellent relationships with the local community through sponsorship and participation in a number of events during the reporting period (refer to Section 4).

Waste Management (2016 Score 8.5 – 2015 Score 5.8)

A Waste Management Plan was developed during the reporting period which formalises record keeping, tracking of wastes and reduction programs. Although undertaken in previous years, recycling of wastes is now being tracked. Office wastes are now being recycled with resource recovery certificates issued on a quarterly basis that will document the total weight of this type of waste diverted from landfill (refer to Appendix 2).

Hydrocarbon and Spill Management (2016 Score 9 – 2015 Score 9)

All chemicals are stored in appropriate bunded and secure areas that are subject to regular inspection and maintenance. However, further work is still required as additional storage areas are identified.

Due Diligence (2016 Score 8 – 2015 Score 5)

A number of administrative of non-compliances were identified in 2015. In addition, an uncontrolled discharge event also occurred in 2015. All Quarry Management Plans were revised during the reporting period to reflect Modification No. 4 approval with increased planning and inspection requirements.

Reporting (2016 Score 8.5 – 2015 Score 8.5)

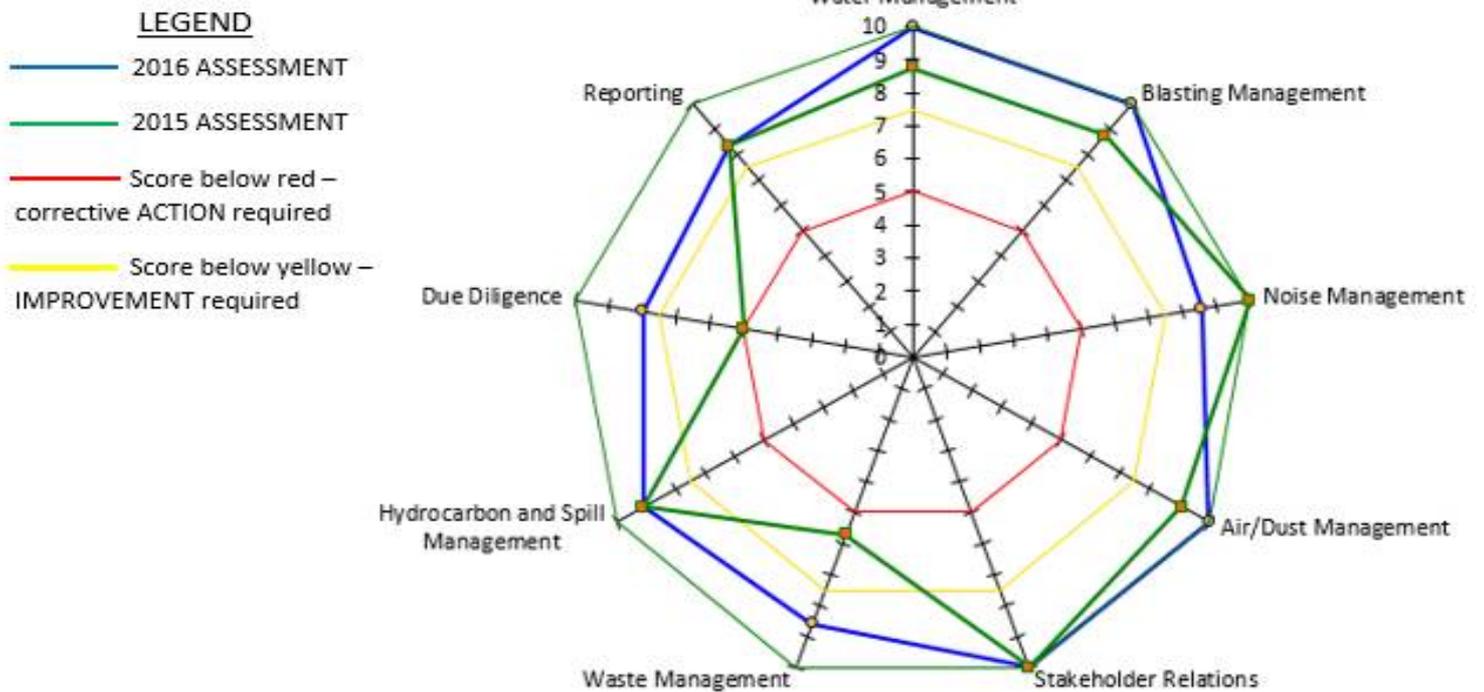
The Quarry Manager and personnel have continued their transparent and proactive approach to reporting incidents and performance issues during the reporting period (refer to Section 3.1.2).

SEAT Summary

Figure 32 shows improved assessment scores on most of Quarry environmental elements. However, there remain elements such as Reporting, Due Diligence and Waste Management to which improvements are being prioritised for action during the 2017 AEMR period (refer to Table 22).

Figure 32: Site Environmental Assessment Tool Scores

Building something great™ Boral Production System Environmental Site Assessment		
BCM:: Assessment Team: Sharon makin, ,	Score Date of Assessment: Date of Previous Assessment:	91.7% 11/11/2016 11/11/2015



7.0 CONCLUSION

Project Approval Modification No. 4

The Boral owned and operated Peppertree Quarry (the Quarry) operates under a Project Approval 06_0074 which was subject to a fourth Modification (Modification No. 4) during the 2016 AEMR period (reporting period). Modification No. 4 approved an extension of in-pit operating hours in order to meet increased quarry product volumes required by the recent upturn in the building and construction industry in NSW, and particularly in Sydney. The increased productions will remain within approved annual limits and the extended hours will only be operated when required to meet customer demands.

During the reporting period, a review and update was undertaken on all existing Quarry environmental management plans for the control and monitoring of:

- Air and water quality;
- Noise and blasting;
- Erosion and sedimentation;
- Heritage conservation;
- Vegetation management and rehabilitation; and
- Community and Stakeholder engagement.

These documents provide the framework and objectives for statutory compliance and continual improvement objectives to ensure the environment and neighbouring community are not adversely impacted by the Quarry activities.

Environmental Management and Monitoring

The original Project Approval for the Quarry was granted in 2009 and full production only commenced in 2014. As such the Quarry benefits from modern design, technology and equipment - all of which combine in minimising environmental impacts associated with site operations.

The Quarry conducts comprehensive monitoring of environmental performance in relation to the management and effectiveness of controls aimed at minimising environmental impacts from site activities.

The Quarry conducted 50 blasts during the reporting period. Each of the blasts were monitored and results verified full compliance with Project Approval criteria.

The management of dust generated from quarrying operations is measured through a combination of deposition gauges and high-volume air samplers. On two occasions throughout the reporting period, dust was measured to be marginally above project approval criteria. Investigations into the two

exceedances could not identify Quarry activities as the source and there is a strong likelihood the results were representative of off-site influences. During the reporting period, there were a number of dust reduction initiatives implemented and monitoring data has shown an improvement in comparison to 2015 results.

Noise levels at sensitive receivers around the Quarry boundaries were monitored by independent specialists on a quarterly basis during the reporting period. All results of the monitoring were within project approval compliance limits. However, as part of a 2016 noise assessment program, a number of notifications were received from a resident which are currently being investigated. If Quarry activities are identified as the source of noise, appropriate corrective actions will be implemented.

The Quarry's main dam provides environmental flows into Tangarang Creek which is an ephemeral creek that otherwise would only experience flows during high and prolonged rain events. The environmental flows provide water essential for the health of aquatic ecosystems downstream of the Quarry.

A groundwater monitoring program commenced late in 2015 and was continued to be implemented during the reporting period. Groundwater bores were measured for standing water levels and sampled for analysis of water quality. The groundwater monitoring program will continue to provide longer term data sets on which ongoing management of quarry activities will be guided to ensure preservation of groundwater levels and quality.

Community Engagement and Cultural Appreciation

Boral continued to positively engage with the local community through sponsorship and attendance of a number of local events. Community newsletters are periodically released to inform local residents of the Quarry operations and activities, as well as detailing Boral's involvement in local community events. During the reporting period, Information in relation to Quarry operations and the Project Approval Modification No. 4 remained readily available through the Boral website.

Aboriginal artefacts continue to be located with the assistance of members of the Aboriginal Management Committee (AMC). Over 90,000 artefacts have been recovered to the end of the reporting period the majority of which either have or will be returned to country under the guidance and supervision the AMC. A small proportion of artefacts will be placed on display at the Quarry to create awareness, knowledge and appreciation of Aboriginal cultural presence in the area.

Compliance

The Quarry was the subject of two environmental compliance audits during the reporting period. In accordance with Project Approval requirements, Boral had engaged an independent auditor to assess regulatory compliance and environmental performance at the Quarry over the previous five years. In addition, the Department of Planning and Environment had also conducted a regulatory compliance audit in December 2016. Both audits found that the Quarry activities were being conducted in substantial compliance with Project Approval conditions. A small number of administrative and low risk

non-compliances identified during the audits were addressed through corrective actions implemented during the reporting period.

The Quarry also operates under Boral's integrated Health, Safety, Environment and Quality Management System (HSEQMS), which comprises of a number of environmental standards that have a high-level focus on continual improvement. Internal audits and reviews as part of the HSEQMS found the Quarry continued to improve its environmental performance in the management of dust, blasting, waste, water and regulatory reporting. A key focus in 2017 will be around investigating community noise concerns and where required implementation of appropriate corrective actions.

Commitment to Continued Improvement

A number of actions provided in the previous AEMR (2015) for ongoing improvements to the Quarry's environmental management were largely completed during the reporting period. Within this AEMR, further initiatives and actions for improved environmental performance have been proposed to be implemented throughout 2017. Key areas improvement will focus on:

- Waste management – particularly in accounting for volumes generated in comparison to reuse/recycling and off-site disposal rates;
- Further dust minimisation controls;
- Completion of noise investigations as part of the 2016 noise assessment program;
- Establishing a Bio-bank area;
- Additional stormwater diversion controls;
- Update of oil storage systems; and
- Continued stabilisation and rehabilitation of overburden areas.

APPENDIX 1: ANNUAL RETURN FOR EXTRACTIVE MATERIALS - 2016



**Department
of Industry**
Resources & Energy

Form S 1

RETURN FOR EXTRACTIVE MATERIALS: YEAR ENDED 30 JUNE 2016

Quote RIMS ID in all correspondence

Quarry Id: Rims ID: 400960

Operators Name: BORAL RESOURCES (NSW) PTY LTD
 Address: PO BOX 42
 WENTWORTHVILLE
 NSW 2145

Email: vanessa.lindsay@boral.com.au,

Quarry Name: PEPPERTREE QUARRY
 Quarry Location: MARULAN SOUTH RD

The return should be completed and forwarded to the **STATISTICAL OFFICER, NSW DEPARTMENT OF INDUSTRY RESOURCES AND ENERGY, PO BOX 344, HUNTER REGION MAIL CENTRE NSW 2310** on or before **30 November, 2016**. If completion of the return is unavoidably delayed, an application for extension of time should be requested before the due date. If no work was done during the year, a **NIL** return must be forwarded. The return should relate to the **above quarrying establishment**, and should cover the operations of quarrying and treatment (such as crushing, screening, washing etc.) carried out at or near the quarry. A return is required even if the operations are solely of a developmental nature, and whether the area being worked is held under a mining title or otherwise.

Zane West, Royalties and Advisory Services Manager

Inquiries please telephone:
(02) 4931 6435
Completed or Nil Returns
Email –
mineral.royalty@industry.nsw.gov.au

Please amend name, postal address and location of mine or quarry if incorrect or incomplete

Please complete the following information to assist in identifying the location of the Quarry

Typical Geology _____
 Nearest Town to Quarry ___ Marulan _____
 Local Council Name _____ Goulburn ~~Mulwaree~~ Council _____
 Deposited Plan and Lot Number/s of Quarry _____
 Email Address of Operator _____
 Name of Owner or Licensee ___ Boral Resources (NSW) Pty Ltd _____
 Postal Address of Licensee ___ PO Box 42, Wentworthville NSW 2145 _____
 Licence/Lease Number/s (if any)
 From Mineral Resources NSW (Industry & Investment NSW) _____
 From Department of Lands or other Department _____
 If any output was obtained from land NOT held under licence from the above Departments, state the Name/s and Address/es of the Owners of the land _____

- To the best of my knowledge, the particulars which have been entered in this return are correct and no blank spaces have been left where figures should have been inserted.
- SIGNATURE of PROPRIETOR or MANAGER ___ Vanessa Lindsay _____ DATE 14/11/2016 _____
- PERSON to be contacted if queries arise regarding this return ___ Vanessa Lindsay _____
- NAME (Block letters) ___ Vanessa Lindsay _____ Telephone 03 9033 5425 _____

Boral Peppertree Quarry
 Annual Environmental Management Report
 1st January 2016 to 31st December 2016

SALES During 2015-2016

Production information may be published in aggregated form for statistical reporting. However, production data for individual operations is kept strictly confidential.

Product	Description	Quantity Tonnes
Virgin Materials		
• Crushed Coarse Aggregates		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		1,154,639
Under 5mm		
Natural Sand		
Manufactured Sand		
Prepared Road Base & Sub Base		
Other Unprocessed Materials		
Recycled Materials		
• Crushed Coarse Aggregates		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand		
Manufactured Sand		871,662
Prepared Road Base & Sub Base		63,556
Other Unprocessed Materials		
• River Gravel		
Over 30mm		
5mm to 30mm		
Under 5mm		
• Construction Sand	Excluding Industrial	
• Industrial Sand		
Foundry, Moulding		
Glass		
Other (Specify)		
• Dimension Stone		
	Building, Ornamental, Monumental	
Quarried in Blocks		
Quarried in Slabs		
• Decorative Aggregate		
	Including Terrazzo	
• Loam		
	Soil for Topdressing, Garden soil, Horticultural purposes)	
• TOTAL SITE PRODUCTION		2,089,857
Gross Value (\$) of all Sales		
• Type of Material		
• Number of Full-Time Equivalent	Employees:	Contractors

APPENDIX 2: RESOURCE RECOVERY CERTIFICATE



Resource Recovery Certificate

This certificate is issued to

Boral Peppertree Quarry

Address : 843 Marulan south Rd,
 MARULAN, NSW 2579

Period : 1/10/2016 - 31/12/2016

This certificate confirms the collection and recycling of the following items:

Bottles & Waste Collectors	5.58 kgs
Other	2.74 kgs
Your company has diverted the following from landfill	
	8.32 kgs

Signed on 02 January, 2017

Robert E.W. Parry-Jones (CEO)



Congratulations! You have contributed to diverting the equivalent of



133.61



3.73

from landfill and laying



62.11km

of road since
 1 July 2016!

Close the Loop warrants that all items issued under this certificate have been received at its Somerton facility for recycling. Close the Loop is committed to zero waste to landfill for all products processed on site.



